



# EARTH SYSTEM MONITOR

## NOAA's National Weather Service: Building on Successes for Our Future

*A guide to  
NOAA's data and  
information  
services*

*Jack Hayes, NOAA Assistant Administrator for  
Weather Services*

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This is an exciting time for NOAA's National Weather Service. Advancements in science, technology, and our ability to apply these advances to operations have led to significant accomplishments in fulfilling our mission to protect the lives and property of this Nation. This is never an easy task, as America is increasingly vulnerable to severe weather and climate. Nearly one-third of our Nation's economy—some \$4 trillion—is sensitive to weather, climate, and water events. This year has been no exception. With the three-year average for tornadoes during January – April totaling 368, it is clear from this year's preliminary total thus far of nearly 700 tornadoes across the country that we are well above average when it comes to severe weather for 2008.

It is during times of severe weather that we continually demonstrate our value to the Nation. In the case of the February 5-6 "Super Tuesday" tornado outbreak, which killed 59 people and injured more than 350 in five states, we had remarkable lead times in our outlooks—up to six days in advance in some cases—that something major was going to happen. We issued warnings in time for schools to close early and send students home. We were able to do this because the Nation has invested in science and technology to improve our forecasting capabilities.

Over the past year, we implemented several improvements in our products and services that will greatly enhance our ability to provide timely and accurate weather, water, and climate information to those who rely on it. Last October we began issuing new "storm-based warnings," which allow forecasters to pinpoint areas where severe weather threats are highest, thereby

reducing the total area warned by as much as 70 percent when compared to the previously-used county-by-county warning system. Decreasing our "false alarm" rate during severe weather events is important in ensuring effective warnings.

We added 16 broadcast stations to the NOAA Weather Radio All Hazards (NWR) network in 2007. In addition to achieving 100 percent coverage of high-risk areas, NOAA refurbished 62 broadcast stations with technology upgrades that significantly improved reliability and availability, while decreasing maintenance costs. We also partnered with the Department of Homeland Security and the Department of Energy to distribute NWRs to every public school in America. This proved especially valuable for students and teachers in Caledonia, Mississippi, on January 10, 2008, when an EF-3 tornado, with estimated maximum winds of 155 mph, struck their school. Amazingly, although there were more than 2,000 students and staff inside at the time, no one was injured. The school received notification of the tornado warning—which was issued 41 minutes ahead of the tornado—through NWR, a siren located at a fire station very close to the school, and local television.

While we are proud of these accomplishments, there remains a lot of work ahead of us. Foremost in my mind is our initiative with the Federal Aviation Administration (FAA) to improve the Nation's aviation weather service. This is vital, due to FAA projections of a three-fold increase in air traffic, passengers, and cargo by 2025.

We are also working to include new probabilistic information in our suite of products to convey our level of confidence in a forecast. Decision makers will benefit by knowing all of the possible weather, water, and climate scenarios, not just the most likely outcome. This will improve the value of our forecast and warning

*(continued on page 4)*



▲ Jack Hayes



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

## Letter from the NODC Director



▲ Dr. Margarita Conkright Gregg

I would like to use this forum as an opportunity to highlight some of the activities at the National Oceanographic Data Center (NODC) and our efforts to improve our services for the oceanographic community.

As the newly appointed NODC director, I held a town hall at the Ocean Sciences meeting on March 3-7, 2008, in Orlando, Florida. The purpose was to provide an overview of our products and services and to get input on what ocean data and information are required by the community we serve. We also discussed how to facilitate the exchange of ocean data and information. This is a critical topic since the issues we are dealing with are global and regional, such as the response of marine ecosystems to climate change. Understanding the oceans in a changing climate requires historical as well as real-time ocean data and information. NODC, in its role as the national stewards for ocean data and information, is working with the national and international community to provide the essential products needed to address climate change issues.

Janice Beattie, Director of NOAA's Central Library, retired in March. Janice devoted 23 years toward creating a national nexus for historical oceanic and atmospheric information at NOAA. She will be missed. Neal Kaske, Acting Director of NOAA's Central Library, has agreed to help guide the library and our information services until we advertise this position. Neal previously held positions at the U.S. National Commission on Libraries and Information Science and the University of Maryland Libraries, where he is also an adjunct professor in the College of Information Studies. In other news, I have appointed Ken Casey as the Acting NODC Technical Director. Ken will help develop a technical strategy to prepare NODC for future data center operations; provide a focal point for technical coordination within NOAA; and represent the center in international, interagency, and NOAA programs and policies as they relate to Data Center operations and responsibilities.

This *Earth System Monitor* issue focuses on NOAA's National Weather Service (NWS) and NOAA's Weather and Water (W&W) Goal. Jack Hayes, Assistant Administrator for NWS, highlights some of the life-saving activities routinely carried out by NWS. This theme is developed through various articles on our W&W modeling, research, and outreach activities. The *ESM* articles illustrate how weather and water activities span across NOAA, including all three NOAA data centers.

Below are pictures illustrating some of NODC's social and work events. You are cordially invited to visit us and join our celebrations. ■

Margarita



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Under Secretary and Administrator

# The Importance of NOAA's Weather and Water Goal Program

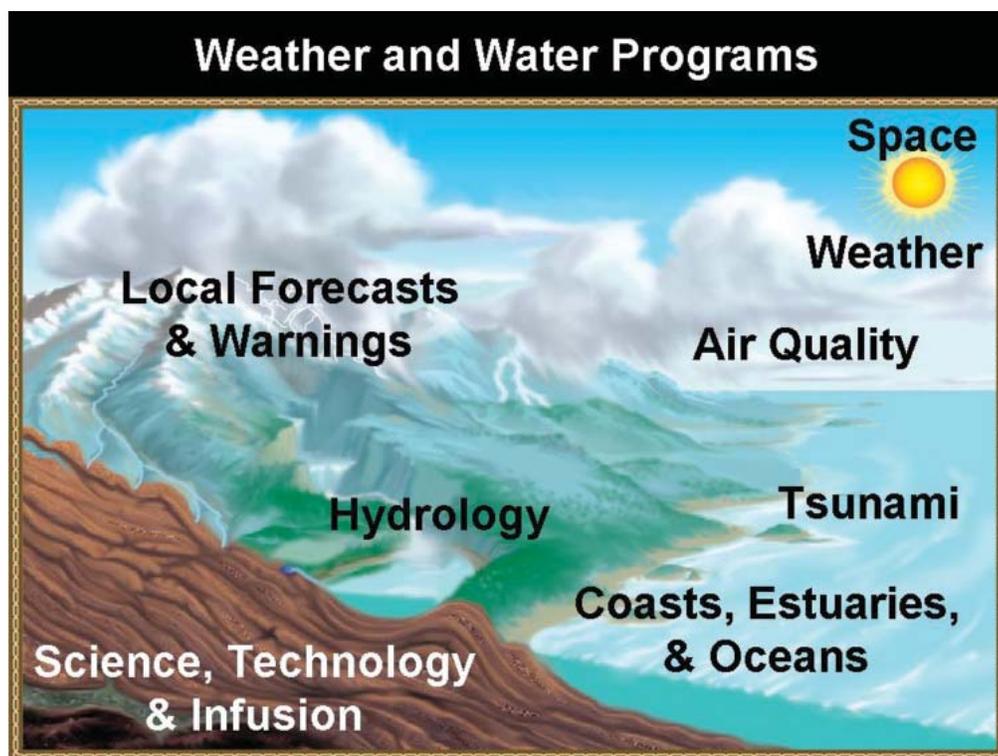
*George Smith, Weather and Water Goal Team Lead, Ward Seguin, Weather and Water Deputy Goal Team Lead, and Kirsten Gurka, Local Forecasts and Warnings Program Analyst*

The United States is one of the most hazard prone areas on the globe with its population threatened by a spectrum of high-impact weather and water events. Because of this, almost every major endeavor in this Nation depends on weather and water information. Industries directly impacted by weather such as agriculture, construction, energy distribution, and outdoor recreation account for nearly 10 percent of the Gross Domestic Product.<sup>1</sup> Damage caused directly by tornadoes, hurricanes, and floods costs \$11.4 billion annually. As a result, from hurricanes to droughts, extreme heat to winter storms, tornadoes to tsunamis, and poor air quality to solar storms, America needs timely, detailed, accurate, and reliable weather and water information.

Weather and water data and forecasts help individuals, industries, and first responders, among others, make many safety related decisions. To support these decision makers, NOAA's Weather and Water Goal mission is to monitor, enhance, and deliver environmental information, science, and services to save lives, protect property, and support environmental stewardship. This Goal provides decision makers with key observations, analyses, predictions, and warnings of weather and water conditions, including water supply, air quality, and space weather. The seven Weather and Water Goal programs described in the following paragraphs contribute to these objectives.

## Local Forecasts and Warnings

The fast pace of today's society demands sophisticated, relevant, and timely delivery of weather and water information and forecasts. The Local Forecasts and Warnings (LFW) program delivers essential NOAA services, especially those related to high-impact events, to local communities through its field offices and national centers. This year, National Weather Service (NWS) employees will work together



to save lives and protect property by issuing over: 1,000 tornado warnings; 2,500 flash flood warnings; 5,000 winter storm warnings; 900,000 airport forecasts; 200,000 coastal and lakeshore marine forecasts; and 700 tropical cyclone forecast/warning packages. By providing these warnings and forecasts, the LFW program provides essential environmental services and a cornerstone for hazard resilience in communities across the Nation.

## Air Quality

Air pollutants lead to significant public health and economic consequences, including tens of thousands of deaths and more than \$100 billion in costs annually. The Air Quality program goals are: to provide sound science that supports effective environmental policies and regulations and to provide air quality forecasts with enough accuracy and advance notice to allow people to limit harmful effects of poor air quality. This program's ultimate aim is to save lives and reduce the number of air quality-related asthma attacks; eye, nose, and throat irritations; heart attacks; and other respiratory and cardiovascular problems. NOAA is

working to identify the underlying causes of poor air quality through a series of regional assessments (most recently in East Texas) and laboratory studies. These investigations will support the development of predictive models used by air quality decision makers to craft management strategies to improve air quality. In 2007, NOAA extended its daily air quality predictions to cover the lower 48 states and implemented new guidance for forecasting the transport of smoke from agricultural and forest fires.

### Hydrology

Water is a finite and stressed resource linked to human health, population growth, development, and climate change. Locations where water was once plentiful are now experiencing competing demands and shortages. NOAA's Hydrology program provides water forecasts and warnings in support of safety, river commerce, water supply, power production, and recreation for the public and private sectors. For three decades, NOAA's scientific products and services for the Great Lakes have provided water managers and policy makers with critical information to make informed, cost-effective decisions. NOAA also contributes to the health of several waterways through the partnership for migratory fish survival.

### Tsunamis

Tsunamis are a low frequency but very high-impact hazard. High-impact tsunamis cause considerable numbers of fatalities and inflict major damage on infrastructure along coastlines. NOAA's Tsunami program works with a myriad of Federal agencies to detect tsunamis and to warn and educate the public about these phenomena. NWS operates two tsunami warning centers that continuously monitor data from seismological and tidal stations, evaluate earthquakes that have the potential to generate tsunamis, and disseminate tsunami information and warning bulletins to government authorities and the public.

### Space Weather

Our Nation is extremely dependent on space technologies, such as the Global Positioning System. As a result, we are particularly vulnerable to space weather solar storms, as we move into the solar maximum in 2011. Space weather can disrupt virtually every major public infrastructure system, including transportation systems, without timely and accurate alerts and warnings. NOAA's Space Weather program is the Nation's source for official space weather information. This program issues forecasts, warnings, and alerts to those most affected by space weather, such as power grid operators, airlines, the National Aeronautics and Space Administration, and communications companies. It also provides archive, data access, and research services.

### Coasts, Estuaries, and Oceans

The coasts, estuaries, and oceans are critical to the economic, social, and ecological vitality and security of our Nation. This area of land and offshore water also contains sensitive ecological habitats and natural resources, which are vulnerable to weather and water changes. Decision makers and others in these regions require sufficient observations and predictions to plan for and respond to hazardous weather, water, and related environmental events. Even seemingly minor weather and water changes, when coupled with human-induced effects, can create serious water quality and environmental risks. The Coasts, Estuaries, and Oceans program connects our national coastal community, maritime users, and decision makers with national, state, and local information about the land-sea-ocean interface.

### Science, Technology, and Infusion

NOAA and the Nation depend on the cutting-edge science provided by NOAA's research programs. These programs, including those under the Science, Technology, and Infusion (ST&I) program, are the driving force behind NOAA's environmental products and services. ST&I research enables improvements in key weather and water services by addressing the needs for both incremental improvements in existing forecast systems and breakthrough advances that can revolutionize how predictions are made. ST&I state-of-the-art research focuses on enhancing our understanding, observation, and prediction of environmental phenomena such as tornadoes, hurricanes, heavy rainfall, blizzards, thunderstorms, coastal weather, and windstorms. ■

<sup>1</sup> U.S. Department of Commerce, National Oceanic and Atmospheric Administration, *The Economic Implications of an El Niño*, NOAA Magazine Online, March 6, 2002, available only at <http://www.noaa.gov/magazine/stories/mag24.htm>.

*(NOAA's National Weather Service continued from page 1)*

information for the public in virtually every sector of the economy.

As we focus on these near-term goals, we are also looking ahead at ways to dramatically improve our warning services and lead times for severe weather, tropical cyclones, and winter weather, as well as finding ways to improve our climate, aviation, space weather, and water resource services. By working closely with other NOAA elements as well as with our partners across the weather, water, and climate enterprise, we can more effectively move research into operations through advancements in observations, computer modeling, forecast generation, service delivery, training, and customer education. Together we can better deliver on our shared mission to protect the lives and property of the American people. ■

# National Centers for Environmental Prediction's Ocean Prediction Center

*Ming Ji, Director, and David Feit, Chief, Ocean Forecast Branch, Ocean Prediction Center*

The Ocean Prediction Center (OPC), established in 1995, was one of the National Centers for Environmental Prediction's (NCEP's) original six service centers. However, the basis for OPC's mission can be traced back to the sinking of the Titanic in April 1912. In response to that tragedy, an international commission was formed to determine requirements for safer ocean voyages. In 1914, the commission's work resulted in the Safety of Life at Sea Convention; the United States is one of the original signatories. The National Weather Service (NWS), through OPC, assumed the U.S. obligation to issue warnings and forecasts for portions of the North Atlantic and North Pacific Oceans.

OPC's Ocean Forecast Branch issues warnings and forecasts in print (bulletins) and graphical formats, on a 24×7 basis up to five days in advance. Over 100 of these products are issued daily. They cover the North Atlantic Ocean from the west coast of Europe to the U.S. and Canadian east coast and the North Pacific Ocean from the U.S. and Canadian west coast to the east coast of Asia. OPC weather forecasts and warnings for these areas primarily ensure the safety of ocean-crossing commercial ships and other vessels on the high seas. Imbedded in these high seas areas are smaller offshore zones off the Atlantic and Pacific coasts. These zones extend from near the coast seaward to just beyond the U.S. Exclusive Economic Zones, out to about 250 nautical miles. OPC services ensure the safety of the extensive commercial and recreational fishing, boating, and shipping activities in these offshore waters.

In 1994, OPC began to quality control global surface marine observations. Using an automated algorithm and interactive system, forecasters examine the latest observations from Voluntary Observing Ships and drifting and moored platforms and compare them against short projection model runs. Worldwide surface marine observations come to OPC via the World Meteorological Organization's global telecommunications system in real-time. These quality control measures remove spurious data before the data are ingested into models to initialize forecasts. Several hundred of these observations are interactively examined daily. In addition,

the quality controlled data are used by OPC forecasters to determine if gale, storm, or hurricane force wind warnings are warranted.

OPC's Ocean Applications Branch plays a critical role in transitioning science and technological advancements into enhanced OPC operations and services. One example is the adaptation of ocean surface vector wind observed from the QuikSCAT satellite in early 2000. Prior to the QuikSCAT launch, NWS did not have the ability to observe, verify, and warn of hurricane force (HF) wind conditions, areas where wind speed exceeds 64 knots, associated with strong winter ocean storms. With QuikSCAT data routinely available in 2000, OPC began to issue HF wind warnings. In the 2006-2007 winter storm season, over 100 HF warnings were issued for North Pacific and North Atlantic oceans to warn ships of these most severe weather hazard conditions over major shipping routes. Preliminary results from a recent study estimates that in the absence of good information about extratropical ocean storms, the annual loss to container and dry bulk shipping would be on the order of more than \$500 million. Operational marine warnings and forecasts reduce the above estimated annual loss by nearly a half.

Advancements in science and technology continue to drive OPC's service improvements. OPC began to produce experimental gridded significant wave height forecasts in 2006, a first step toward digital marine service for high seas and offshore areas. Additional gridded products such as surface pressure and winds are under development. Recently, OPC began to use the NWS operational extratropical storm surge model output to provide experimental extratropical storm surge guidance for coastal weather forecast offices to assist them in coastal flood warning and forecast operations. OPC has a number of ongoing research-to-operations transition efforts that will lead to a suite of new oceanographic analysis and forecast products such as ocean temperatures and currents based on real-time observations and advanced global and basin scale ocean forecasting models. The first of these products will be coming online in late 2008. ■



# Getting a Handle on the World's Wildest Weather

*Susan Cobb, Meteorologist and Outreach Content Specialist, National Severe Storms Laboratory*

The world's wildest and most varied weather occurs in the United States. Hurricanes, blizzards, ice storms, thunderstorms, tornadoes, floods, and drought batter our country each year. In fact, no other nation endures the wide range of weather we see here. In this arena, the National Severe Storms Laboratory (NSSL) is doing its best to observe and predict the unpredictable and protect lives and property. Located in Norman, Oklahoma, the heart of tornado alley, NSSL is a leader in studying all aspects of severe weather. NSSL focuses on three main areas of research to improve severe weather forecasts and warnings.

## Radar Research: Spies of the Sky

Radar is one of the most valuable tools in a forecaster's arsenal; NSSL continues to use ingenuity and creativity to push radar technology to the edge. The National Weather Radar Testbed (NWRT) is a phased array radar and is available to the research community on a full-time basis. NSSL researchers have shown that phased array radar technology has the ability to rapidly scan severe weather on time scales of seconds instead of several minutes. This high temporal sampling provides an unprecedented opportunity to study rapidly evolving weather phenomena and explore the potential to extend warning lead times for severe weather. NSSL scientists also proved phased array radar can detect rotation, hail, microbursts, and gust fronts well ahead of other radars because of its rapid scan capability. Phased array technology will help forecasters provide longer lead times for tornado warnings—beyond the current average of 14 minutes—and other hazards. Using the NWRT, NSSL scientists are also exploring using phased array radar for aircraft tracking and wind profiling simultaneously with weather surveillance. This concept of a multifunction phased array radar has the

potential to meet the Nation's weather, aviation, and homeland security needs.

NSSL continues to develop techniques with dual-polarized Doppler radar, providing significant improvements in rainfall estimation, precipitation classification (for example, rain, hail, snow, and sleet), and weather hazard detection. The entire National NEXRAD (WSR-88D) radar network will be upgraded in 2010-2011 with dual-polarization capability, improving echo classification, precipitation rate estimation, and data quality.

NSSL scientists also use shared mobile radars to rapidly scan the atmosphere at low levels, below the beam of NEXRAD radars, to collect data on the structure of the storms. In areas where mountains block the beams of the regular radars, mobile radars provide extra rainfall data that help scientists determine the threat of flash floods and debris flows.

## Hazardous Weather Research: Predicting the Unpredictable

NSSL researchers are exploring new ways to improve our understanding of severe weather causes and new ways to use that weather information more efficiently in forecasts and warnings. A cornerstone of this effort is the NOAA Hazardous Weather Testbed (HWT) facility, which is strategically located between operational forecast areas of the NOAA Storm Prediction Center

and the NOAA National Weather Service (NWS) Norman Forecast Office. HWT allows forecasters and researchers to collaborate and share knowledge that will improve severe weather forecasts and vital forecasting tools. Every spring, NSSL scientists co-sponsor the annual Hazardous Weather Testbed Spring Experiment. During this focused collaboration period, researchers immerse themselves in the frontline operational and scientific challenges of forecasting hazardous

*(continued on page 9)*



# NOAAWatch – NOAA's All Hazard Monitor

Andrew Allegra, Oceanographer, National Oceanographic Data Center

The National Oceanic and Atmospheric Administration (NOAA) keeps the public informed about the changing environment and climate and protects life and property from natural disasters where possible. NOAA's scientists work with sophisticated instrumentation to provide timely and reliable forecasts of weather and climate as well as to monitor a variety of natural hazards. Most of this information is available online. However, since this data comes from various offices and centers throughout NOAA, our Web presence had become a bit scattered. For example, during a landfalling hurricane, you can go to the National Hurricane Center for forecasts and tracking charts, NOAA's Satellite Services Division for tropical satellite imagery, NOAA's National Weather Service for regional radars and rainfall data, and NOAA's Ocean Service for tide data and storm surge data. All of these data and information products are used to support forecasting, tracking, and recovery after a tropical storm. This will not change. But now the public can go to one place to find all of this information: NOAAWatch.

NOAAWatch is the direct result of the post-Hurricane Isabel assessment, which found a need for all information related to a storm or event to be available on one webpage. Advisories and hazard statements are not issued by NOAAWatch itself, as that is already being done elsewhere in NOAA. NOAAWatch provides that "central Web presence," where all the information from one natural hazard event can be pulled in, displayed, and updated as needed.

NOAAWatch enables public access to information on a number of environmental threats, ranging from oil spills, to hurricanes, to tsunamis, to space weather. The way the information is pulled into NOAAWatch is simple. In fact, it's really simple. We use Really Simple Syndication, known as RSS feeds. RSS is an XML-based format that allows the syndication of lists of hyperlinks and small images, along with other information or metadata that helps users decide whether they want to follow the link. We use this same technology to pull subscribed feeds into NOAAWatch webpages. We've pursued different offices and centers within NOAA and other government agencies to publish RSS feeds with their regular information postings, so we can take advantage of the technology and automatically present the feeds on our website. In addition to NOAA RSS feeds, we currently have relationships with the U.S. Geological Survey, Environmental Protection Agency, Department of Health and Human

▲ A snapshot of NOAAWatch.gov showing hazard information, as well as daily weather forecasts and warnings.

Services, Census Bureau, and Federal Emergency Management Agency to pull in their hazard information, and we can easily set up new relationships as needed.

NOAAWatch consists of a few permanent features, such as current weather outlook and warnings, satellite image of the day, drought outlook, El Niño gauge, and a link to the NOAA Weather Radio. The website's main feature is a list of detailed information on high-risk hazards as they occur. Overview pages describing NOAA's roles in environmental hazards are also available for Tropical Weather (hurricanes), Fire Weather, Tsunamis, Severe Weather, Flooding, Droughts, Volcanoes, Earthquakes, Harmful Algal Blooms, Coral Bleaching, Oil/Chemical Spills, Rip Currents, Air Quality, Excessive Heat, Winter Weather, and Space Weather. ■

For more information on NOAAWatch, visit  
[www.noaawatch.gov](http://www.noaawatch.gov).

Special thanks to Ronald Jones, NOAAWatch Team Leader, Carol Baldwin, NOAA Marine and Aviation Operations representative, and Nancy Merckle, Satellites representative, for reviewing this article.

## News Briefs

### NOAA Launches Final Two Buoys to Complete U.S. Tsunami Warning System

NOAA deployed the final two tsunami detection buoys in the South Pacific on March 10, 2008, completing the buoy network and bolstering the U.S. Tsunami Warning System. This vast network of 39 stations provides coastal communities in the Pacific, Atlantic, Caribbean, and the Gulf of Mexico with faster and more accurate tsunami warnings.

These final two deep-ocean assessment and reporting of tsunamis (DART) stations will give NOAA forecasters real-time data about tsunamis that could potentially impact the U.S. Pacific Coast, Hawaii, and U.S. Pacific territories. Tsunami sensors are now positioned between Hawaii and every seismic zone that could generate a tsunami that would impact the state and beyond, including the U.S. West Coast. Buoys already in the western Atlantic, Gulf of Mexico, and Caribbean have been keeping watch over the U.S. East and Gulf Coasts.

DART stations consist of a bottom pressure sensor anchored to the seafloor and a companion moored surface buoy. An acoustic link transmits data from the bottom pressure sensor to the surface buoy, and then satellite links relay the data to NOAA tsunami warning centers. The DART network serves as the cornerstone to the U.S. Tsunami Warning System.

Other components of the tsunami warning system include NOAA's tsunami warning centers, a network of tide and seismic stations, forecast models for at-risk communities, and TsunamiReady™, a public preparedness and education program.

### A More Timely World Ocean Database

The National Oceanographic Data Center (NODC) develops a product called the World Ocean Database, which is a global, comprehensive, quality-controlled compilation of oceanographic vertical profile data. Datasets are submitted to NODC from ocean researchers and programs from around the world. These data are used in developing ocean climatologies, and in studies of interdecadal variability,

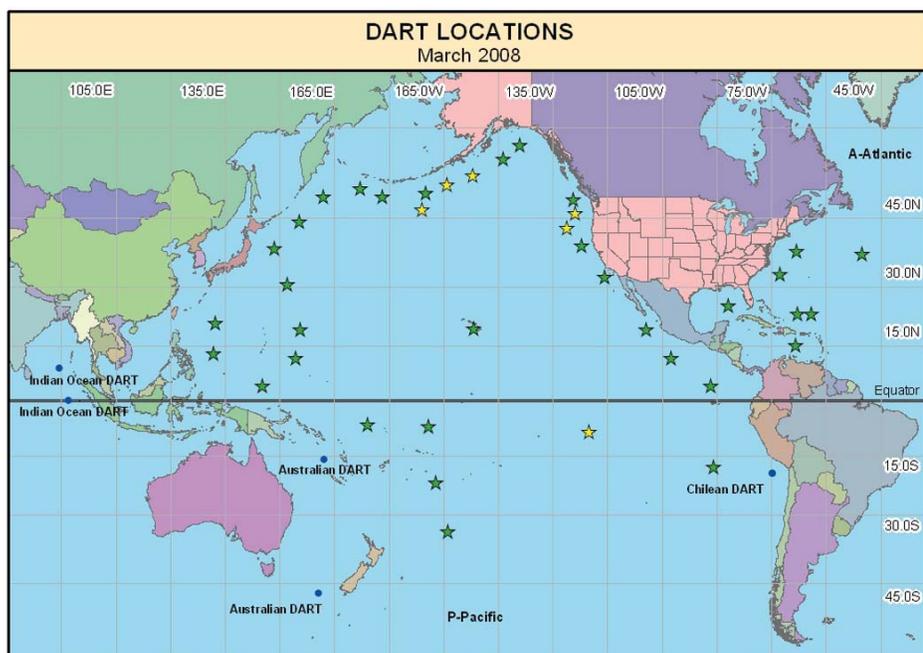
which is very important for studying global climate change. Examples of oceanographic variables included in this product are temperature, salinity, nutrients, oxygen, and pH data as a function of depth. In the past, this dataset was scheduled for periodic releases (sometimes 4 years apart) when the entire quality control processing was completed. However, since data is continually being added to NODC's global ocean database, a more timely quarterly release of this product will be important for scientists in this rapidly changing world. It should be noted that the quality control of this data is preliminary until the release of the next fully quality controlled version, World Ocean Database 2009.

For more details, visit [www.nodc.noaa.gov/OC5/indprod.html](http://www.nodc.noaa.gov/OC5/indprod.html).

### Science Expedition to Coral Reefs in Caribbean Helps Launch International Year of the Reef

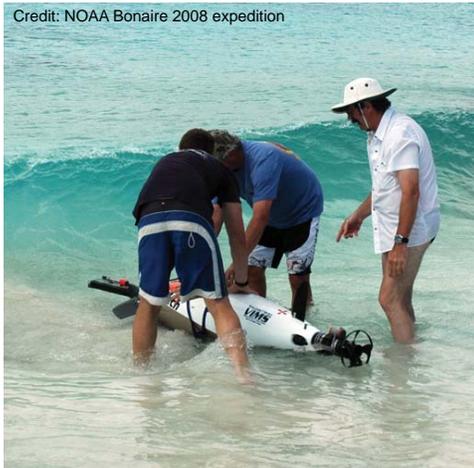
In January 2008, a NOAA-sponsored expedition investigated shallow and deep coral ecosystems off the Caribbean island of Bonaire, part of the Netherland Antilles. Multiple underwater robots and divers surveyed some of the most pristine coral reefs in the Caribbean to learn why they remain relatively healthy while many others in the Caribbean and around the world are threatened. The mission was one of the first in the International Year of the Reef 2008.

"The International Year of the Reef is a year-long, worldwide campaign to highlight the importance of coral reef ecosystems, and to motivate people to protect them," said Vice Admiral Conrad C. Lautenbacher, Jr., Under Secretary of Commerce for Oceans and Atmosphere and NOAA Administrator. "NOAA supports this campaign with leadership and coordination, and



▲ NOAA DART buoy locations.

Credit: NOAA Bonaire 2008 expedition



▲ AUV launch off the beach on Bonaire.

by sponsoring scientific study of reef systems such as those off Bonaire.”

In shallower waters, the team measured changes from limited surveys in the 1980s and 1990s. In deeper waters, three robots called Autonomous Underwater Vehicles (AUVs), surveyed the “Twilight Zone,” 65 to 150 meters deep, where sunlight is scarce and little is known about the reef systems.

“We believe this is the first science expedition using multiple AUVs to chart Bonaire’s reefs and likely the first to do so on coral reefs anywhere,” said expedition leader Dr. Mark Patterson of the Virginia Institute of Marine Science, College of William and Mary. “This is important because of scale. AUVs obtain wide-area data, allowing scientists to pinpoint further investigation.”

The expedition ran from January 7-30, 2008, and is chronicled online at [www.oceanexplorer.noaa.gov](http://www.oceanexplorer.noaa.gov).

### Texas A&M University Researcher Receives NOAA’s David Johnson Award

Peter J. Etnoyer, a graduate research associate at Texas A&M University, received the prestigious NOAA David S. Johnson Award, which is named after the first NOAA

Assistant Administrator for Satellite and Information Services. The award recognizes young scientists for their innovative use of environmental satellite data and for creating new uses for observational satellite data to better predict atmospheric, oceanic, and terrestrial conditions.

“I’m honored to receive this award, and want to emphasize my appreciation for the contributions of my co-authors and research partners, whose support has been instrumental,” Mr. Etnoyer said.

For the award, Mr. Etnoyer was cited for his use of Earth observation satellite applications to characterize and identify important pelagic (open ocean) habitats for endangered marine species in the North Pacific. He used two instruments aboard polar orbiting satellites to track blue whales and sea turtles and found prolonged residence times along subtle temperature gradients, or fronts, far offshore.

“We are proud to have an award like this to recognize the innovative work by scientists like Peter, who are using NOAA satellite data to improve our understanding of marine ecosystems and endangered species,” said Mary E. Kicza, Assistant Administrator for Satellite and Information Services. ■

*(World’s Wildest Weather continued from page 6)*

weather. This gives researchers the insight needed to enhance the operational relevance of their research efforts and accelerates the transfer of science and technology from research to operations.

A technique to “slice and dice” radar data from storms was recently developed by NSSL to help forecasters make better and faster warning decisions. This tool was successful in improving the warning process during operational testing and was implemented in Weather Forecast Offices

this past winter.

During the spring of 2009, NSSL researchers will undertake a major field study to continue their quest to understand how, when, and why tornadoes form; the structure of tornadoes; the relationship of tornadic winds to damage; and how to better forecast tornadoes. The VORTEX 2 project will use a large armada of mobile instruments to collect data on tornadic storms and provide clues into the tornado mystery.

### Hydrometeorology Research: Forecasting Floods

By investigating the meteorological causes of flash flooding and working on flash flood and river flood warning decision-making tools, NSSL is working to save more lives and property. Researchers are discovering ways to blend data from multiple sensors, including radar, satellite, lightning, and rain gauges, to improve flash flood monitoring and prediction. These ideas are being tested in projects around the U.S., including California and North Carolina. NSSL also created a national testbed, the National Mosaic and Multi-Sensor Quantitative Precipitation Estimation system, to provide a real-time, around-the-clock, hydrologic applications development and testing environment. Results of this research will improve flood and flash flood watches and warnings.

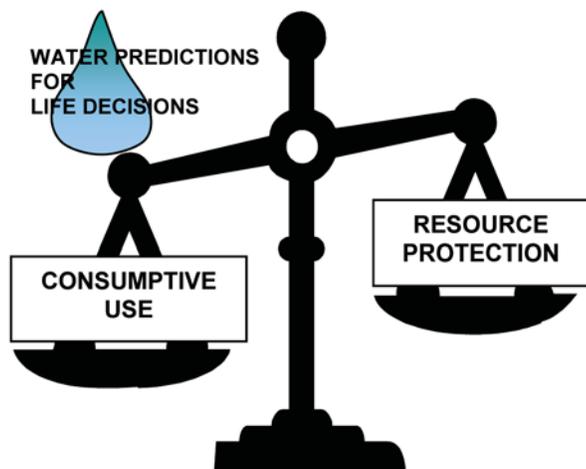
Severe weather research conducted at NSSL has led to valuable improvements in severe and hazardous weather forecasting, increasing warning lead times to the public. NSSL scientists are exploring new ways to improve our understanding of the causes of severe weather and ways to use weather information to assist NWS forecasters, emergency managers, and the public. ■

For more information on NSSL, visit <http://www.nssl.noaa.gov>.

## Water Availability: The Next Oil Crisis?

Gary Carter, NOAA Hydrology Program Manager and Director Office of Hydrologic Development, and Dr. John Ingram, NOAA Hydrology Program Coordinator and Lead Hydrologist, Office of Hydrologic Development

In January 2008, the United Nations Secretary General projected, “Half the nations of the world will face freshwater stress or shortages by 2025.” The newly crafted water resources policy of the American Meteorological Society states, “The provision of adequate fresh-water resources for humans and ecosystems will be one of the most critical and potentially contentious issues facing society and governments at all levels during the 21<sup>st</sup> century.” By 2030, the Energy Information Administration expects U.S. electricity demand to grow by 50 percent, placing an additional burden on freshwater supplies.



▲ NOAA's Integrated Water Services will enable decision makers to optimize decisions for often competing and conflicting fresh water demands.

Because water availability and utility are linked to population growth, development, and changing weather patterns, America is facing a water crisis. Locations where water was once plentiful are experiencing competing and conflicting demands on finite fresh water quantities for human health, ecosystem integrity, agriculture, aquaculture, hydropower generation, river commerce, recreation, tourism, and the economic vitality of communities and the Nation. Decision makers must now balance the allocation of fresh water among these often-competing and conflicting demands.

Increasing financial and regulatory pressures will require water managers to seek more complete (multiple-use) ways to:

- Optimize water availability allocations for growing communities
- Manage fish and wildlife habitats
- Support productive agriculture/aquaculture
- Expand industry and river commerce
- Maximize hydropower generation
- Mitigate the impacts of floods and droughts
- Build community resilience to weather event impacts and changing precipitation patterns
- Sustain water quality

The National Oceanic and Atmospheric Administration (NOAA) has the long-standing mandates and unique Federal role (based upon public law and/or executive orders, such as the National Weather Service Organic Act and the NOAA Inland Flood Forecasting and Warning Act) to deliver water forecasts and warnings in support of safety, river commerce, water allocation, power production, and recreation for the public and private sectors. NOAA scientific products and services for the Great Lakes provide water managers and policy makers with critical information to make informed, cost-effective decisions. Other NOAA operational forecast systems, such as those for the Chesapeake Bay and Galveston Bay, support the maritime community with improved short-term predictions of water levels and currents.

Hence, NOAA has the service delivery system, expertise, and legislative mandates to provide critical information for the protection and management of our Nation's water resources. And, NOAA offices have developed extensive partnerships with the Federal, state, and local water agencies that measure, monitor, and manage water. By integrating our extensive research, observational assets, modeling capabilities, and forecasting infrastructure, a new generation of water services can be designed, tested, and transitioned to operations. These integrated water services will support the widespread use of risk-based decision tools to proactively manage and limit devastating societal impacts to communities and the ecosystem. NOAA's integrated water services will provide well-coordinated information, resulting in more reliable information for decision makers to make critical decisions. ■

# Weather and Water

Droughts, Hurricanes, Tornadoes, Flooding, Wildland Fires



# The NODC Coastal Water Temperature Guide

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The Coastal Water Temperature Guide (CWTG), also known informally as the “beach temperature guide,” is a popular online National Oceanographic Data Center (NODC) product. This system includes data components such as real-time water observations from NOAA’s National Ocean Service (NOS) tidal stations and Physical Oceanographic Real-Time System (PORTS®) and moored buoy data from the NOAA National Data Buoy Center (NDBC). CWTG receives data from 120 NOS stations and 121 NDBC stations.

CWTG tables include near-real-time water temperatures and climatological averages based on NOS and NDBC data. Although ocean conditions vary from year-to-year, water temperatures are less variable than air temperatures, so the historical averages can provide useful information for planning beach activities such as swimming or fishing. For the Gulf Coast, only monthly averages are presented. Water temperatures vary more along the Atlantic and Pacific coasts of the United States, so stations in these locations present two-week averages from April through October. Maps that support interactive browsing of the real-time temperatures are also available on the website.

CWTG is accessed by a wide range of users, including scientists, scuba divers, fishermen, boaters, and radio and TV stations. CWTG can also serve as an educational tool. For instance, many people assume coastal waters are warmer than offshore waters. However, various factors such as river runoff, upwelling caused by wind, and coastal air temperatures can cause “beach” temperatures to be cooler. ■

For more information on CWTG, visit [www.nodc.noaa.gov/dsdt/cwtg/](http://www.nodc.noaa.gov/dsdt/cwtg/).