



The August 2006 issue of the *Bulletin of the American Meteorological Society* featured NOAA's P-3 aircraft on its cover to highlight an article written by scientists with AOML's Hurricane Research Division. The P-3 hurricane hunter aircraft recently celebrated 30 years of serving as an airborne meteorological research platform. The first flight occurred on June 27, 1976 with Hurricane Bonny in the eastern Pacific. The article documents the depth and breadth of instrumentation aboard the P-3s which have enabled scientists to study numerous aspects of hurricane structure and dynamics over the years.

Aberson, S.D., M.L. Black, R.A. Black, R.W. Burpee, J.J. Cione, C.W. Landsea, and F.D. Marks, 2006: Thirty years of tropical cyclone research with the NOAA P-3 aircraft. *Bulletin of the American Meteorological Society*, 87(8):1039-1055.

FACE Program Begins Sampling Efforts Along Florida Coast

In early October, scientists with AOML's Ocean Chemistry Division boarded the NOAA Ship *Nancy Foster* for the first research cruise of the Florida Area Coastal Environment (FACE) program. They were joined aboard ship by investigators with the University of Miami's Rosenstiel School for 11 days of intensive near-shore, water-quality sampling along Florida's southeastern coast. Additionally, through the cooperative efforts of a multi-county Utility Work Group, scuba divers from several local diver associations also participated in the water sampling efforts.

The main sampling regions included the "boil" and down-current plume areas at six treated-wastewater outfall sites. These sites are located from one to three miles offshore of Miami-Dade, Broward, and Palm Beach Counties. Analysis of the data gathered at the outfall sites and surrounding areas will enable FACE scientists to better assess water quality at the outfalls. These data will also assist local, state, and Federal agencies in formulating management and regulatory actions to protect public health and sensitive coastal ecosystems such as coral reefs.

The coral reefs of southeast Florida represent a unique ecosystem of significant economic and ecological value. Over the past 20 years, however, the reefs have undergone several changes including the appearance of various forms of algae that have contributed to their decline. The appearance of algae on the reefs may be due to many possible natural and/or anthropogenic factors. A part of the FACE research effort will be to distinguish natural changes occurring on the reefs from those that can be attributed to anthropogenic causes.

The FACE program is primarily concerned with anthropogenic discharges in Florida's coastal ocean, including treated wastewater releases that flow into the coastal ocean and adjacent water bodies. A key research area targeted by the program is the study of nutrients. While there are many prospective sources of nutrients (*continued on page 2*)



FACE scientists aboard the NOAA Ship *Nancy Foster* gather around a CTD rosette used for analyzing the chemical and physical characteristics of the water column. From left to right: Charles Featherstone, Jack Stamates, Thomas Carsey, Joseph Bishop, Charles Fischer, Christopher Sinigalliano (all with AOML's Ocean Chemistry Division), and Amel Saied from the University of Miami's Rosenstiel School.

(continued from page 1)



The 187-foot long NOAA Ship *Nancy Foster* served as a floating research platform during the first water-quality sampling cruise of the FACE program along Florida's southeastern coast offshore of Miami-Dade, Broward, and Palm Beach Counties.

in the coastal ocean (e.g., oceanic upwelling, groundwater, septic discharges, atmospheric deposition, wastewater outfalls), very little quantitative information is currently available to assess their impact.

FACE seeks to obtain the long-term data needed to develop an overall understanding of the near-shore environment of the eastern Florida coast. Field activities in support of FACE include the collection of a wide range of biological, chemical, and physical oceanographic measurements. Acoustic remote sensing of outfall plumes, microbiological monitoring, and coral reef health monitoring are all part of the effort.

The program began in 2002 as a NOAA response to the needs of government agencies and water and sewer authorities in south Florida besieged by ecosystem management problems. Under the leadership of Dr. John Proni of AOML's Coastal Environment Group, FACE is a multi-year collaboration of Federal, state, and county ecosystem management agencies, county governments, municipal water and sewer authorities, and public environmentally-concerned citizen groups. FACE is guided by a Steering Committee comprised of representatives from NOAA, the U.S. Environmental Protection Agency, U.S. Army Corps of Engineers, and the U.S. Geological Survey, as well as the Florida Department of Environmental Protection and the Florida Fish and Wildlife Conservation Commission.

Several future water-quality sampling cruises for the FACE program are currently scheduled, including tracer studies of both the Boynton Inlet and South Central outfall plumes in February 2007.

Monitoring of Western Boundary Currents Continues

Scientists with AOML's Physical Oceanography Division joined with Dr. William Johns and colleagues from the University of Miami on a very successful research cruise that extends the long time-series of observations of the western boundary currents in the subtropical Atlantic. NOAA has funded important observations of the Florida Current and the Deep Western Boundary Current in the subtropical Atlantic since the mid-1980s; this program is currently called the Western Boundary Time Series (WBTS) project. Beginning in 2004, an international effort funded jointly by the U.S. National Science Foundation and the United Kingdom's Rapid Climate Change program has joined with the continuing NOAA WBTS program to measure the complete transport across the Atlantic Ocean basin from Florida to the coast of Africa near 26°N.

Four AOML scientists, Dr. Christopher Meinen, Mr. Carlos Fonseca, Mr. Pedro Pena, and Mr. Andrew Stefanick joined University of Miami colleagues aboard the R/V *Seward Johnson* from September 25-October 12, 2006 in support of these programs. Together they completed 42 conductivity-temperature-depth (CTD) profiles to obtain water temperature, salinity, and density samples. They also recovered two pressure inverted echo sounder (PIES) moorings and four tall moorings, as well as deployed two inverted echo sounders (IES), five PIES, and four tall moorings. Data downloaded acoustically from three additional PIES moorings were brought back to AOML for processing.

The success of this cruise has lengthened an already impressive long time-series of observations that is unique in its ability to aid in the study of climate time-scale ocean processes. It has also ensured that the program will continue into the future with the recovery and redeployment of the many moorings that are deployed near the western boundary.



Deployment of an inverted echo sounder (IES) mooring to obtain profiles of temperature, salinity, and specific volume anomaly.



The team works in the rain to deploy a mooring at 26°30'N, 72°00'W.



Tests that combine molecular biology with electrochemical detection have been developed at AOML's Environmental Microbiology Laboratory for a red-tide dinoflagellate (*Karenina brevis*), fecal-indicating bacteria (*Enterococcus* spp.), source-tracking markers indicative of human fecal pollution, and a viral pathogen (adenovirus). Preliminary field testing of *K. brevis* has demonstrated a sensitivity sufficient to detect the organism in water without yielding false positive results and the ability to distinguish between the broad classification of "present" and "medium" concentrations (100,000 to 10^6 cells/L).

These methods can be used to rapidly (3-5 hours) screen environmental water samples for the presence of microbial contaminants, and work is underway to integrate them into semi-automated detection platforms. This tool could assist beach and resource managers in making improved decisions regarding human health and safety.

Atlantic Hurricane Activity Linked to Saharan Dust

A study published in the October 10th issue of *Geophysical Research Letters* suggests that a strong correlation exists between Atlantic hurricane activity and atmospheric dust transported across the Atlantic Ocean from the Saharan Desert of northwest Africa.

Amato Evan and co-authors discovered the correlation after analyzing 25 years of satellite data (1982-2005). They compared tropical storm activity with levels of Saharan dust present in the atmosphere. In the years with larger, denser clouds of Saharan dust drifting in the Atlantic there were fewer storms. In the years with only meager amounts of Saharan dust, a greater number of storms developed.

Evan, A.T., J.P. Dunion, J.A. Foley, A.K. Heidinger, and C.S. Velden, 2006: New evidence for a relationship between Atlantic tropical cyclone activity and African dust outbreaks. *Geophysical Research Letters*, 33(19):L19813, doi:10.1029/2006GL026408.

The role of atmospheric dust as a possible factor affecting Atlantic hurricane activity was first hypothesized by AOML meteorologist Jason Dunion and co-author Christopher Velden in a 2004 research article in the *Bulletin of the American Meteorological Society*. Dunion and Velden demonstrated that hurricane activity may be influenced by the presence of the Saharan Air Layer, which forms when a warm, dry, and dusty layer over west Africa is advected over the low-level moist air of the tropical North Atlantic.

Although the current study does not establish a direct causal relationship, the strong link between hurricane activity and atmospheric dust warrants further research and should be considered as another possible reason for fluctuating storm levels.

El Niño conditions developing in the tropical Pacific Ocean this past September have put a damper on the 2006 Atlantic hurricane season, resulting in a less active year than previously predicted. El Niño conditions typically act to suppress hurricane activity by increasing the vertical wind shear over the Caribbean Sea. El Niño conditions are expected to continue through the end of 2006 and into early 2007.

Hurricane Intensity Studies Focus on Early Storm Formation

The mechanisms that enable some African easterly waves to intensify into hurricanes while others do not are still largely unknown. This early stage of intensity change is one aspect that scientists with the AOML's Hurricane Research Division (HRD) have been studying this summer as part of the Intensity Forecast Experiment (IFEX). IFEX is a major component of the Division's 2006 hurricane field research program.

As part of HRD's hurricane intensity research efforts, investigators observed Tropical Storm Debby in the eastern Atlantic Ocean in late August from aboard NOAA's Gulfstream-IV jet. In particular, they were interested in studying the role that dry, dusty air plays on the intensification of storms in their early stages of development.

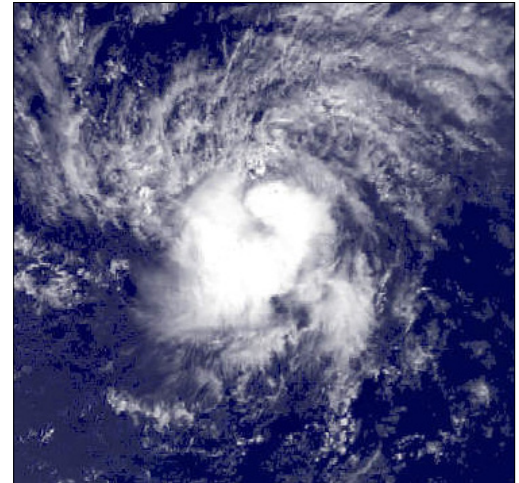
Tropical Storm Debby was one of the first easterly waves of the 2006 hurricane season. It originated off the coast of Africa on August 21st and almost immediately showed signs of strengthening. Debby became a tropical depression on August 22nd and a tropical storm the following day on August 23rd. Easterly waves in the atmospheric flow, named for the geographic location where they form, are known as Cape Verde storms and are the seedlings for more than half of the systems that eventually become tropical storms and earn a name from NOAA's National Hurricane Center. Oftentimes, they trek thousands of miles across the Atlantic Ocean before making landfall.

Debby was of particular interest because of its association with a large mass of dry air, the Saharan Air Layer (SAL), that forms annually over the northwest African continent between early spring and late fall. During the summer months, the SAL is transported by prevailing winds off the African coast and travels westward across the Atlantic Ocean. HRD researchers and their colleagues are studying the interactions of this regularly-occurring SAL phenomena and its apparent ability to temporarily suppress hurricane development and/or intensification.

"The SAL may be yet be another piece of the puzzle in advancing our understanding of tropical cyclone genesis and intensity change in the North Atlantic and Caribbean Sea," according to Jason Dunion, HRD meteorologist and director of the 2006 hurricane field research program. Hurricanes thrive in environments of moist warm ocean air and appear to struggle when surrounded by large SAL outbreaks and their associated dry air.

Although Tropical Storm Debby was forecast to become a hurricane, its top winds only reached 50 mph. Shortly after attaining its highest intensity on August 23rd, an encounter with the SAL weakened the storm. A subsequent encounter with wind shear also took its toll. Debby gradually lost strength, becoming a minimal tropical storm on August 25th, a tropical depression on August 26th, and then completely dissipated on August 27th.

During the two Gulfstream-IV missions, HRD scientists deployed numerous GPS (global positioning system) dropsondes into the region surrounding Debby's convection to gather data about the storm's environment. The wind speed, pressure, temperature, and moisture samples obtained provide a depiction of the storm that can be compared with satellite estimates of the SAL, as well as the storm's correlated intensity. This information was sent to the National Hurricane Center, NOAA's National Centers for Environmental Prediction, and other locations where models were able to incorporate and interpret this new data set.



Tropical Storm Debby in the Atlantic Ocean as observed by the GOES-12 satellite on August 23rd.



"Spring Forward—Fall Back"

Daylight Saving Time Ends on October 29, 2006 at 2 a.m.

Congratulations

Rik Wanninkhof, Robert Castle, Betty Huss, Esa Peltola, and Tsung-Hung Peng, all with AOML's Ocean Chemistry Division, are the recipients of a 2006 Department of Commerce Gold Medal. The group, along with scientists from NOAA's Pacific Marine Environmental Laboratory, was recognized for its painstaking observations and groundbreaking research over the past 15 years which has shown that the uptake and storage of anthropogenic carbon dioxide by the oceans is causing pH levels in the oceans to drop. Ocean acidification adversely affects corals and other marine life forms, which could have significant impacts on fisheries, tourism, and a variety of ocean-related economies.

Shailer Cummings, an oceanographer with AOML's Ocean Chemistry Division, is the recipient of a 2006 Department of Commerce Silver Medal. Cummings was recognized, along with scientists from NOAA's Northwest Fisheries Science Center and the Office of Marine and Aviation Operations, for participating in field operations immediately following the passage of Hurricane Katrina in August 2005 that were vital for ensuring seafood was safe for public consumption.

John Gamache, Joseph Griffin, Nancy Griffin, Paul Leighton, and Peter Dodge, all with AOML's Hurricane Research Division, are the recipients of a 2006 NOAA Administrator's Award. The group was recognized for developing algorithms and software to enable real-time analysis and transmission of wind field and airborne Doppler radar data. These data, collected in hurricanes, will improve the initialization of a new generation of hurricane forecast models.

Moving on Up

NOAA Corps officer Lieutenant Nancy Ash, AOML's Associate Director, was recently promoted to the rank of Lieutenant Commander.

NOAA Corps officer Lieutenant Junior Grade Hector Casanova, working with the Ocean Chemistry Division's Coastal Environmental Group, was recently promoted to the rank of Lieutenant.

Farewell

Jeffrey Absten, a CIMAS research associate, resigned in early September after three years with the Ocean Chemistry Division's Integrated Coral Observing Network (ICON) program. During Absten's years at AOML, he enhanced the overall design of the coral observing network stations, as well as participated in their deployment. He has accepted a position with Florida International University's Southeast Environmental Research Center.

Dr. Michael LaGier, a CIMAS assistant scientist, departed AOML in late August after three years with the Ocean Chemistry Division's Environmental Microbiology Laboratory. While at AOML, LaGier worked with Dr. Kelly Goodwin to develop electrochemical assays to detect the DNA of problem organisms in coastal waters such as *Karenia brevis* (a red-tide dinoflagellate), bacteria associated with sewage contamination, bacterial and viral pathogens, and markers that indicate the source of fecal contamination. LaGier and his wife have both accepted research positions with Duke University.

Dr. Heike Luegar, a CIMAS post-doctoral associate, completed a two-year appointment in September with the Ocean Chemistry Division's Ocean Carbon Group. While at AOML, Luegar developed an innovative method for utilizing remote sensing to create high resolution air-sea CO₂ flux maps for the North Atlantic. She is planning to pursue a degree at the University of Plymouth in the United Kingdom on sustainable environmental development.

Welcome Aboard

Guy Cascella joined the staff of AOML's Hurricane Research Division in August to work with Dr. Joseph Cione on the Aerosonde project. The Aerosonde is a remote-controlled aircraft that's being investigated for its ability to obtain observations just above the ocean surface in the tropical cyclone environment. Cascella is currently a graduate student at the University of Miami's Rosenstiel School in the Department of Meteorology and Physical Oceanography.

Christopher Kinner joined the staff of NOAA's Miami Regional Library located at AOML in September as a librarian. Kinner will provide assistance with reference and bibliographic searches, inter-library loans, e-journal management, and web page support. He holds a B.A. degree in English from Appalachian State University and will soon complete an M.S. degree in Information Science from Florida State University.

Dr. Christopher Sinigalliano joined the staff of AOML's Ocean Chemistry Division in September to work with Dr. Kelly Goodwin in the Environmental Microbiology Laboratory. Dr. Sinigalliano's research will involve the molecular analysis of microbial water quality in coastal systems. Prior to his employment at AOML, he served as an environmental microbiologist/molecular biologist at Florida International University's Southeast Environmental Research Center. He holds a doctoral degree in biology from Florida International University.

Stork Scores Baby Trifecta

Rigoberto Garcia, a CIMAS research associate with AOML's Physical Oceanography Division, along with his wife Maripaz Ortiz, are the proud parents of their second child, a daughter. Lucia Fernanda Garcia was born in Miami on September 2, 2006 and weighed in at 7 lbs. 12 oz.



Erica Rule, AOML's education and outreach coordinator, and her husband Lance, are the proud parents of their second child, a son. Mason Alexander Rule was born in Miami on September 15, 2006 and weighed in at 7 lbs. 6 oz.

Stanley Goldenberg, a meteorologist with AOML's Hurricane Research Division, and his wife Barbara, are the proud parents of their 11th child, a daughter. Kaylah Abigail Goldenberg was born in Miami on October 4, 2006 and weighed in a 8 lbs. 8 oz.

All babies, Moms, and Dads are healthy, happy, and doing well.

Travel

Rik Wanninkhof was an invited participant at the International Workshop on Transport at the Air-Sea Interface in Heidelberg, Germany on September 6-8, 2006.

Judith Gray attended the SEACOOS/SECOORA (Southeast Atlantic Coastal Ocean Observing System/Southeast Coastal Ocean Observing Regional Association) Fall Workshop in Jacksonville, Florida on September 12-13, 2006.

Silvia Garzoli was an invited guest and presenter for a series of seminars about distinguished female oceanographers at the University of Rhode Island's Graduate School of Oceanography in Narragansett, Rhode Island on September 18-22, 2006.

Robert Atlas attended an Office of Oceanic and Atmospheric Research (OAR) Senior Research Council meeting in Ann Arbor, Michigan on September 25-26, 2006. He also attended an OAR/National Ocean Service Workshop with Gustavo Goni in Laurel, Maryland on October 5, 2006.

Tsung-Hung Peng attended the Third GLEON/CREON (Global Lake Environmental Observatory Network/Coral Reef Environmental Observatory Networks) Joint Workshop in Taichung, Taiwan on October 3-4, 2006.

John Kaplan made an invited presentation at the 2006 RMS Hurricane Eyewall Symposium in New York City, New York on October 12, 2006.

Joseph Bishop, Hector Casanova, Thomas Carsey, Charles Featherstone, Charles Fischer, Kelly Goodwin, Christopher Sinigalliano, and Jack Stamates participated in the Florida Area Coastal Environment (FACE) research cruise aboard the NOAA R/V *Nancy Foster* on October 8-19, 2006.

Carlisle Thacker attended the GODAE (Global Ocean Data Assimilation Experiment) Symposium on Ocean Data Assimilation and Prediction in Asia-Oceania in Beijing, China on October 16-18, 2006.

Molly Baringer and Christopher Meinen attended the Rapid Climate Change International Science Conference in Birmingham, United Kingdom on October 24-27, 2006.

Recent Publications*

ABERSON, S.D., M.L. BLACK, R.A. BLACK, R.W. BURPEE, J.J. CIONE, C.W. LANDSEA, and F.D. MARKS, 2006: Thirty years of tropical cyclone research with the NOAA P-3 aircraft. *Bulletin of the American Meteorological Society*, 87(8):1039-1055.

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*Names of AOML authors appear in capital letters.

Keynotes is published bi-monthly by the Atlantic Oceanographic and Meteorological Laboratory. Contributions and/or comments are welcome and may be submitted via email (Gail.Derr@noaa.gov), fax (305) 361-4449, or mailing address: NOAA/AOML, *Keynotes*, 4301 Rickenbacker Causeway, Miami, FL 33149.

Editor – Robert Atlas
Publishing Editor/Writer – Gail Derr

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