July-August 2010
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AOML Keynotes

ATLANTIC OCEANOGRAPHIC AND METEOROLOGICAL LABORATORY

AOML is an environmental laboratory of NOAA's Office of Oceanic and Atmospheric Research on Virginia Key in Miami, Florida

EMC/AOML Collaborative Effort Results in Experimental Hurricane Forecast System

AOML's Hurricane Research Division (HRD) is working closely with NOAA's Environmental Modeling Center (EMC) to run NOAA's high resolution real-time experimental forecast system as part of the Hurricane Forecast Improvement Project (HFIP) 2010 demo. HRD has been running the experimental version of the Hurricane Weather Forecast (HWRF) model, HWRFX, as well as a new version of HWRF, Version 3.2, at higher resolution (9 and 3 km). Called HWRFV3.2-HRD, this experimental model is an atmospheric-oceanic coupled hurricane prediction system operating at the highest resolution possible at this time for real-time predictions. This system is a merger effort between the research version of HWRFX and the operational HWRF system.

As a result of the successful collaborative effort between EMC and HRD, the HWRFV3.2-HRD model will be working in real-time on NOAA's Gulfstream-IV hurricane hunter aircraft starting the week of August 29th. The advanced hurricane vortex assimilation technique developed for HWRF at EMC is being adopted for operating the 3 km research version, and the hurricane specific post-processing package originally developed for HWRFX will also be readily extended to this system. All experimental products at 9 and 3 km resolution are available on the web at https://storm.aoml.noaa.gov/hwrfx/.

AOML Welcomes Dr. Alan Leonardi

AOML welcomed Dr. Alan Leonardi in August as the Laboratory's new Deputy Director. "I'm excited to join the talented and devoted AOML family," said Leonardi "and hope my science and management background can further AOML's important role in NOAA's science and service mission."

Leonardi made the move to AOML from Silver Spring, Maryland where he had served as Deputy Director of the NOAA Research Office of Policy, Planning and Evaluation and Program Manager for NOAA's Environmental Modeling Program.

Prior to joining NOAA in October 2003, Leonardi was a post-doctoral fellow at the University of Maryland's Earth System Science Interdisciplinary Center. As a post-doctoral fellow, his research focused on coupling satellite-based and in situ ocean observations with numerical models to gain a better understanding of ocean dynamics and air-sea processes.

A native of Wisconsin, Leonardi earned a B.S. degree in meteorology from the University of Wisconsin in 1995, followed by M.S. and Ph.D. degrees in physical oceanography from Florida State University in 1998 and 2000, respectively. During his academic tenure, he investigated the annual and interannual variability in the North Pacific Ocean and the oceanic circulation surrounding the Hawaiian Islands as a NASA Mission to Planet Earth research fellow and a Naval Research Laboratory graduate research fellow.

Leonardi is an ardent supporter of mathematics and science education, having served as a member of the Board of Trustees for the Washington Mathematics Science Technology Public Charter High School in Washington, D.C.

He inherits the Deputy Director position at AOML from Judith Gray, who departed the Laboratory in April to become the Acting Deputy Assistant Administrator of NOAA's Office of Oceanic and Atmospheric Research.

AOML hosted a welcome aboard party for Alan Leonardi on August 10th. Before formally welcoming Leonardi to the Laboratory, however, AOML Director Bob Atlas first acknowledged Molly Baringer. Baringer served as AOML's acting Deputy Director during the interim between the departure of former Deputy Director Judith Gray in April and the arrival of Leonardi in August. Atlas thanked Baringer for her service during a busy time at the Laboratory and for her leadership skills that enabled AOML to successfully support NOAA's Deepwater Horizon oil spill response activities. Pictured are Drs. Molly Baringer and Bob Atlas after Baringer was presented with an autographed token of appreciation from AOML staff.

AOML Surveys Connectivity in Gulf of Mexico "Far Field"

As part of NOAA's response to the Deepwater Horizon oil spill, interdisciplinary measurements were conducted in the Gulf of Mexico aboard the NOAA Ship *Nancy Foster* between June 30 and July 18, 2010. The primary objectives of this survey were to assess the connectivity between mesoscale features in the Gulf of Mexico such as the Loop Current (LC), "Eddy Franklin" (the main LC ring), and smaller associated frontal eddies, and to determine the potential of these features to transport oil to the downstream coastal ecosystems of south Florida, northern Cuba, and the Bahamas.

Combined with an examination of the physical surface and subsurface pathways connecting the northern Gulf of Mexico to the southern Gulf and the Florida Straits, phyto-, zoo-, and ichthyoplankton samples were collected across the region to determine species present in the water column, as well as their physiological condition (where possible), abundance, and diversity. Throughout the survey, water quality was monitored and sampled for hydrocarbons to determine areas affected by the oil spill.

Personnel and existing assets from NOAA's Atlantic Oceanographic and Meteorological Laboratory (AOML), Southeast Fisheries Science Center (SEFSC), and Subsurface Monitoring Unit (SMU) participated in support of this endeavor.

Connectivity between waters in the northern Gulf of Mexico and downstream areas such as northern Cuba, south Florida, and the Florida Keys via the LC is well documented. For example, waters from the Mississippi River have been shown to reach the Florida Keys through pathways that may or may not include the LC. If discharge from the Deepwater Horizon wellhead were to be entrained directly by the strongest part of the LC, significant quantities of oil could reach the downstream areas relatively quickly (on the order of days to weeks; a direct pathway).

Neuston nets were towed to sample surface waters for ichthyoplankton and tar balls.

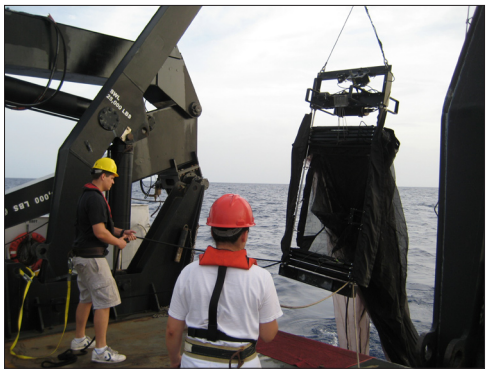
However, if this discharge were mostly contained in an LC eddy, not connected to the LC, or in Gulf of Mexico "common waters" (waters not associated with the LC or anticyclonic eddies shed by the LC), most of the oil would remain in the Gulf of Mexico and reach the far field through more indirect pathways with the potential to ultimately affect the coasts of Texas and Mexico, the southwest Florida shelf, the Florida Keys, the Florida Straits, the northern coast of Cuba, and the Bahamas.

Although remote sensing observations (sea surface temperature, ocean color, sea height/ocean currents) provide very useful tools to monitor surface conditions, they have limitations (for example, they measure surface parameters only) that need to be complemented by in situ targeted or sustained observations and by numerical model outputs. Since the complex surface circulation is not directly translated to the subsurface, direct measurements are needed to determine subsurface features. Satellite observations were used to guide the cruise on a daily basis. The two main features of the surface and subsurface circulation that were under particular scrutiny during this cruise were the LC and Eddy Franklin, which was being shed from the LC in June and July 2010.

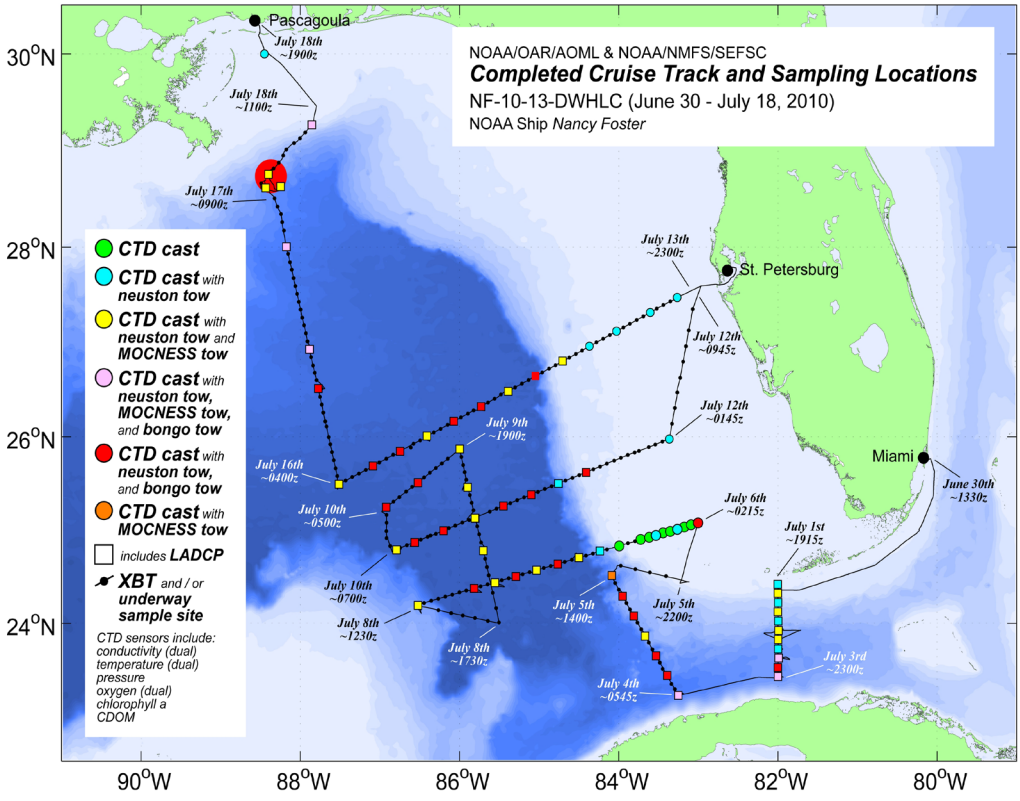
While processing of the physical data, and chemical and biological samples, collected during the 19-day cruise is ongoing, preliminary analysis of the physical data suggests that the northern Gulf of Mexico and, in particular the near field area of the oil spill, did not show a direct pathway towards the Loop Current. However, indirect pathways did exist through the cyclonic and anticyclonic eddies in the region. Additionally, no oil was observed in the far field, including Eddy Franklin. However, this cruise only partially surveyed this eddy. Oil and tar balls were observed in near field areas around the wellhead as forecast by NOAA's Office of Response and Restoration.

For a more complete synopsis of cruise motivation and objectives, measurements and samples collected, and initial findings, a mission summary report is now publicly available and can be accessed at ftp://ftp.aoml.noaa.gov/pub/DHI_Response/NF1013_reports/.

Ryan Smith
Physical Oceanography Division



Kyle Seaton of AOML and Laura Bendernagel, a NOAA Hollings Scholar working with AOML's Physical Oceanography Division over the summer, deploy a MOCNESS to gather ichthyoplankton from multiple depths



The completed cruise track and sampling methods/locations for the NF-10-13 Deepwater Horizon Loop Current cruise aboard the NOAA Ship *Nancy Foster.*

Bimonthly Cruise Activities Modified to Hunt for Oil

One of AOML's regular bimonthly interdisciplinary surveys of the south Florida coastal waters was recently conducted aboard the Skidaway Institute of Oceanography's RV *Savannah*. These cruises have been used to monitor the salinity, water quality, and circulation of the south Florida coastal waters since 1995. They are designed to quantify the mean and varying conditions before, during, and after the planned changes in fresh water deliveries to the coastal marine ecosystems due to the ongoing Comprehensive Everglades Restoration Plan (CERP). The cruise activities for this latest survey were enhanced to assist with NOAA's Deepwater Horizon oil spill response, as described below.

The scientific party for this particular cruise consisted of Nelson Melo (Chief Scientist) and Grant Rawson of AOML's Physical Oceanography Division, Cheryl Brown and Lloyd Moore of AOML's Ocean Chemistry Division, and two NOAA Hollings scholars working at AOML during the summer. The cruise departed from the Port of Miami on June 29th and arrived back at the University of Miami Rosenstiel School dock on July 3rd.

A total of 36 full water column Conductivity-Temperature-Depth-Oxygen (CTD-O_2) stations were occupied, and 39 underway surface samples (temperature, salinity, nutrients, chlorophyll fluorometry, and color dissolved organic matter) were collected along the cruise track. In addition, three satellite-tracked surface drifters provided by NOAA's Northeast Fisheries Science Center were deployed near the mouth of the Shark River and Charlotte Harbor on the southwest Florida shelf.

Neuston net tows enabled researchers to gather icthyoplankton samples and tar balls along the western Florida shelf.

New observations directly targeted to the Deepwater Horizon oil spill included neuston surface net tows to collect icthyoplankton and tar balls, and water samples for laboratory "fingerprinting" of oil source. The most noteworthy result of the cruise was the observation of a deep, high-fluorescence signal at about 20 m depth, with associated anomalies in temperature, dissolved oxygen, and color dissolved organic matter at the western end of the Charlotte Harbor section (north of the Caloosahatchie River on the southwest Florida shelf).

Three satellite-tracked surface drifting buoys were deployed to monitor ocean currents and provide sea surface temperature data.

An apparent oil sheen was also observed on the neuston net tow taken near the bottom at that station. Water samples were collected within the anomaly and at the bottom. Laboratory analysis of the anomalous water indicated that, although oil was indeed present, its source was not the Deepwater Horizon spill. The samples contained refined oil, rather than crude oil, highlighting the wide range of oil sources in the region.

Libby Johns and Nelson Melo
Physical Oceanography Division

AOML Co-Hosts Oil Spill Response Workshop

Researchers with AOML and NOAA's Southeast Fisheries Science Center jointly organized and hosted a workshop to discuss Deepwater Horizon oil spill monitoring efforts on July 1st-2nd in Miami, Florida. Participants included members of the scientific and operational communities from private industry and from government and university laboratories currently gathering observations, creating products, and/or performing analyses that may help advise the NOAA oil spill response, restoration, and damage assessment activities.

A total of 81 participants from 38 institutions met to exchange knowledge and strategies, discuss monitoring of ocean conditions in the Gulf of Mexico/Straits of Florida, and provide recommendations in support of NOAA's Deepwater Horizon oil spill monitoring and mitigation efforts.

Presentations showed how oil and dispersants are being monitored in real-time at the surface and subsurface using different platforms and methodologies; highlighted the importance of sustained and targeted interdisciplinary in situ observations at the surface and in the water column; emphasized the key role of integrated satellite observations for detection of oil and to monitor a suite of parameters such as ocean currents and water masses; stressed the unique contributions of numerical models to monitor currents and oil pathways in combination with observations; and presented scenarios on the impact of the oil on ecosystems.

Researchers from 38 institutions met on Virginia Key in Miami to discuss Deepwater Horizon oil spill response activities.

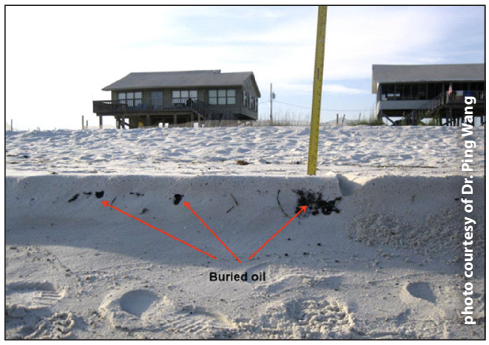
The need to identify and address current gaps in observations and on analyses that will better help with impact and recovery work was emphasized during workshop discussions.

Plenary discussions during the NOAA-sponsored workshop focused on Deepwater Horizon oil spill monitoring activities produced six main recommendations for NOAA to consider in meeting its short-, mid-, and long-term oil spill response goals:

1) *Creation of five working groups—surface oil monitoring; subsurface oil monitoring; fluorometer data; oceanographic monitoring and analysis; and pelagic ecosystems.*
2) *Coordination of modeling and analysis efforts.*
3) *Support of highly accurate oxygen measurements.*
4) *Creation and/or enhancement of interdisciplinary monitoring systems.*
5) *Centralization and coordination of the distribution of data and products.*
6) *Improvement in the prediction of storm surge and nearshore processes during hurricane events.*

AOML Staff Support NOAA's Oil Spill Activities

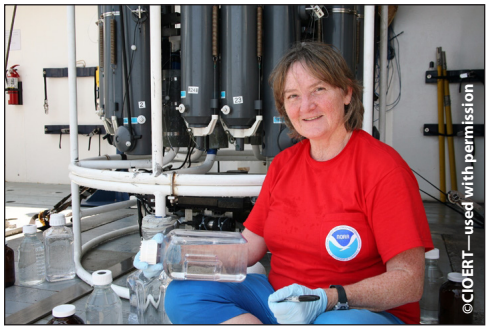
In addition to the two research cruises detailed by Ryan Smith and Libby Johns (on pages 2 and 3), AOML staff have also participated in a number of other field activities associated with the Deepwater Horizon oil spill over the past few months. For example, Chuck Featherstone of AOML's Ocean Chemistry Division has been investigating oil-beach interactions with Dr. Ping Wang of the University of South Florida on beaches in northern Florida and Alabama. Featherstone has collaborated with Dr. Wang by providing the technical expertise needed to operate AOML's profiling fluorometer for detecting oil in sediment cores.



Buried and subsequently exposed oil from the Deepwater Horizon oil spill is visible within the active berm on a beach in the Gulf Shores, Alabama region.

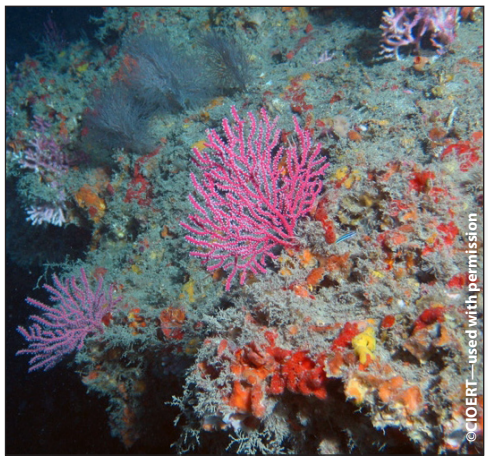
AOML has also provided support for high quality oxygen analyses on the ships monitoring the subsurface oil plume near the Deepwater Horizon well by utilizing the expertise and resources gained from the many hydrography and biogeochemistry cruises that the Laboratory has performed over the past 30 years. This effort was mandated by the National Incident Command after concerns were raised that data from in situ oxygen sensors were not validated and that the sensors might not be providing accurate data in the presence of oil.

George Berberian, Robert Castle, Dennis Pierrot and Ulises Rivero of AOML travelled to Key West, Florida, Port Fourchon, Louisiana, and Pascagoula, Mississippi to deliver equipment and train technicians to perform shipboard sampling and analyses. The ships serviced include the NOAA fisheries vessels *Henry G. Bigelow* and *Pisces* and the BP charter vessels *Ocean Veritas* and *Brooks McCall*. George Berberian participated in three short cruises aboard the *Ocean Veritas* and the *Brooks McCall* over the last month. Rumor has it that one of the contract personnel threatened not to go to sea without George on board as a mentor!



Michelle Wood of AOML aboard the RV *Seward Johnson* collects samples for a study of bacterial diversity and genomics in oil-spill influenced regions.

Michelle Wood, Director of AOML's Ocean Chemistry Division, joined scientists with the Cooperative Institute for Ocean Exploration, Research, and Technology (CIOERT) from the University of Florida and the Harbor Branch Oceanographic Institution at Florida Atlantic University for an eight-day cruise aboard the RV *Seward Johnson*. Wood was responsible for interpreting and managing a range of water column measurements including the detection of subsurface oil by fluorescence, collection of samples for processing hazard analysis, "fingerprinting" of oil-related material if encountered, collection of picoplankton samples, and collection of bacterial samples for isolation of petroleum-utilizing bacteria. The research on petroleum-utilizing bacteria is a project that AOML microbiologist Kelly Goodwin has proposed for the NOAA DWH Science Box.

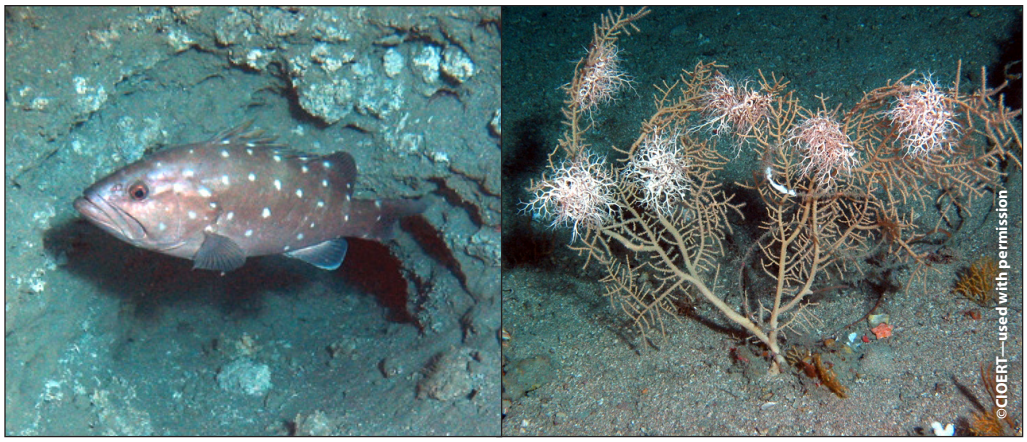


Corals and sponges were common in the mesophotic reef habitats visited during the FloSEE expedition of the RV *Seward Johnson*.

Wood also had a chance to participate in a *Johnson Sea Link* manned submersible dive at the Madison Swanson region of the Florida continental shelf, about 70 nautical miles south of Pensacola, Florida. She describes numerous, large red grouper and amberjack as being constant companions to the submersible while on her dive.

The cruise was one leg of a month-long expedition called FloSEE (Florida Shelf Edge Exploration), a multi-disciplinary science expedition to study deep coral and live bottom reefs along the shelf edge of Florida, from Cape Canaveral to the Alabama border. The mission was originally scheduled as part of CIOERT's FY-2011 science plan but, in response to the oil spill event, was moved up to begin on July 9th. Daily blogs, including Wood's, and other information about the cruise are available at http://cioert.org/flosee/. NOAA Administrator, Dr. Jane Lubchenco, joined the expedition on the final days before it returned to Harbor Branch in Ft. Pierce, Florida, and made two dives in the *Johnson Sea Link* submersible.

AOML researchers installed oxygen titration equipment aboard the NOAA Ship *Henry B. Bigelow* at dock in Key West, Florida and provided training in performing shipboard oxygen sampling and analyses.



Snowy grouper (left) and Gorgonian with basket stars (right) were both collected off the northwest Florida shelf in regions of concern about submerged oil occurring in very low concentrations during the FloSEE research cruise of the RV *Seward Johnson*.

AOML's SEAS AutoIMET System Increases NOAA's Ocean Weather Observations

Over the past few years, NOAA's Office of Marine and Aviation Operations (OMAO) has been outfitting its research vessels with 24/7 email and Internet capabilities. With these upgrades, the ability to transmit fully automated weather observations in real time is now possible. This feat, accomplished through the use of the SEAS AutoIMET system, has strengthened NOAA's ability to obtain a greater number of quality marine weather observations. These observations are critical to NOAA's ability to monitor and predict weather and climate changes.

The Shipboard Environmental data Acquisition System, or SEAS, software was developed and is currently maintained by AOML. It gathers oceanographic and atmospheric data from the global network of research and merchant vessels participating in the Ship of Opportunity and Volunteer Observing Ship programs.

In 2007, the NOAA Ship *Gordon Gunter* was used as a test-bed site for the SEAS AutoIMET data collection platform. After a year of testing with the AutoIMET system interfaced with the *Gordon Gunter's* Scientific Computer System, it was determined that this system provided the ideal shipboard automated weather data collection platform. A benefit of this automated platform is that the SEAS AutoIMET system can be augmented, which means that marine weather observations can be quality controlled at their point of origin.

The NOAA Ship *Gordon Gunter* was the first vessel in the NOAA fleet to use the SEAS AutoIMET system for gathering oceanographic and meteorological data.

Chief electronics technician Brian Thomas aboard the NOAA Ship *Oregon II* during installation of the SEAS AutoIMET system.

The impact on the performance of NOAA's research vessels is an expected 200-500% increase in the quantity of marine weather observations.

In addition to the *Gordon Gunter,* the NOAA Ships *Ronald H. Brown, Pisces, Bell M. Shimada,* and *Oregon II* have also been outfitted with the SEAS AutoIMET system. Over the next several months, all NOAA ships with a Scientific Computer System and 24/7 email-Internet capabilities will implement the SEAS AutoIMET data collection platform. This will provide the National Centers for Environmental Prediction and other specialized centers with approximately 175,000 additional marine weather observations per year.

The NOAA Ship *Oregon II* is the latest research vessel in the NOAA fleet to acquire the SEAS AutoIMET system that will be used to enhance both the quality and quantity of NOAA's ocean observations.

With the use of the SEAS program developed at AOML, the number of quality marine weather observations obtained by NOAA research vessels will increase, enhancing NOAA's ability to predict, adapt, and respond to weather and climate changes. Other benefits of the increased number of weather observations include optimized marine operations; timely and more accurate weather predictions; ground truth for buoys, satellites, and other observing vessels; and verification of issued forecasts, watches, and warnings. The development of the SEAS AutoIMET system, along with continued reliable customer support of this software, will enable NOAA to remain a forerunner in furthering research and science, nationally as well as globally.

Paula Rychtar
(Port Meteorological Officer, National Weather Service) and the NOAA-AOML SEAS Team

NOAA Honors Valued Contributions of Partners

Dr. Gustavo Goni, Director of AOML's Physical Oceanography Division (center), presented a 2010 NOAA Environmental Hero award to the crew of the MV *Oleander* in Bermuda on July 12th. The *Oleander* has gathered oceanographic and meteorological data along a transect from Bermuda to New Jersey since 1972. AOML researchers with the Ship of Opportunity Program nominated the *Oleander* for the award in recognition of the vessel's long-term volunteer ocean-observing efforts.

Drs. Gustavo Goni and Silvia Garzoli of AOML presented a plaque to the Naval Hydrographic Service in Buenos Aires, Argentina on August 17th in recognition of their outstanding collaboration with AOML in support of NOAA's ocean observing system in the South Atlantic. Pictured from left to right are Gustavo Goni, Commander Ariel Troisi, Silvia Garzoli, Alberto Piola, and Rear Admiral Andres Di Vincenzo, Director of the Hydrographic Service.

NOAA Reiterates Forecast for Active Hurricane Season

NOAA's hurricane specialists updated their outlook for the 2010 Atlantic hurricane season in early August, reiterating their initial outlook issued in May. An active year is still expected, although the number of potential storms and hurricanes predicted to form has been slightly reduced (see table at right).

As the Atlantic hurricane season enters the peak period for tropical cyclone activity (August through October), forecasters predict with 70% confidence that between 14-20 named storms will develop, with 8-12 storms becoming hurricanes with winds above 74 mph. Four to six of the hurricanes that form are expected to strengthen into major hurricanes with winds above 110 mph (categories 3, 4, and 5 on the Saffir-Simpson hurricane scale). A predicted accumulated cyclone energy (ACE) index of 170-260% (with 100% being the median for an average amount of activity) also points to the likelihood of an active season.

Key environmental factors driving the forecast include the ongoing active phase of the multi-decadal signal, which is believed to have contributed to greater levels of storm activity since it began in 1995, and above-average sea surface temperatures across the Caribbean and tropical Atlantic Ocean that fuel tropical cyclone development. La Niña conditions in the tropical Pacific Ocean are also expected to impact tropical cyclone activity in the Atlantic basin. The La Niña phenomena causes lower wind shear in the Atlantic, enabling a greater number of storms to develop and intensify.

Eleven named storms have developed since the June 1st start of hurricane season, including major hurricanes Danielle, Earl, Igor, and Julia. Danielle, Igor, and Julia all remained at sea, while Earl skirted the U.S. eastern seaboard as it trekked northward. Earl brought flooding, blustery weather, and dangerous rip currents to coastal communities from the Carolinas to Canada before making landfall in Nova Scotia as a tropical storm on September 4th.

An additional 3-9 named storms are anticipated to form before the six-month long season ends on November 30th. If the upper range of the number of predicted storms is reached, 2010 will be noted as one of the more active seasons on record.

Coastal communities are urged to remain vigilant in monitoring the tropics and to have hurricane preparedness plans in place and ready to activate if the need arises.

NOAA's 2010 Atlantic Hurricane Seasonal Outlooks

Type of Activity	NOAA August Outlook	NOAA May Outlook	Average Season
Tropical Storms	14-20	14-23	11
Hurricanes	8-12	8-14	6
Major Hurricanes	4-6	3-7	2

Hurricane Field Program Underway with NASA/ NSF Collaborators

With the start of summer and the Atlantic hurricane season comes AOML's hurricane field program. For more than 30 years, researchers with AOML's Hurricane Research Division (HRD) have annually gathered data from the inner core of tropical cyclones and their surrounding environment from aboard NOAA's hurricane hunter aircraft. This year, HRD investigators are collaborating with colleagues from the National Aeronautics and Space Administration (NASA) and National Science Foundation (NSF) to conduct experiments designed to improve understanding of hurricane formation and intensity.

Since 2005, a major component of HRD's field program has been the Intensity Forecasting Experiment (IFEX). IFEX seeks to improve operational forecasts of tropical cyclone intensity, structure, and rainfall by providing more accurate data to the operational numerical modeling system (HWRF) and by improving understanding of tropical cyclone physical processes. The goals of IFEX are threefold:

1. Collect observations that span the tropical cyclone life cycle in a variety of environments for model initialization and evaluation;

2. Develop and refine measurement technologies that provide improved real-time monitoring of tropical cyclone intensity, structure, and environment; and

3. Improve understanding of the physical processes important in intensity change for a tropical cyclone at all stages of its life cycle.

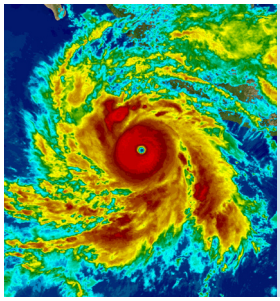
As many as seven planes, including NOAA's P3 and Gulfstream-IV hurricane hunter aircraft, will gather data to improve understanding of tropical cyclone development and intensification processes during the 2010 hurricane field program.

In addition to the HRD-led experiments related to IFEX, several other experiments will occur simultaneously and in partnership with IFEX during the 2010 hurricane field program:

• NASA collaborators will conduct the Genesis and Rapid Intensification Processes (GRIP) experiment to better understand the processes important in tropical cyclone genesis and rapid intensification. Two NASA jet aircraft (DC-8 and WB-57), plus a remotely-controlled Global Hawk unmanned aircraft, will gather the data for this effort.

• NSF collaborators will conduct the PRE-Depression Investigation of Cloud systems in the Tropics (PREDICT) experiment to better understand the processes governing the transition of easterly waves into tropical depressions, with a focus on the mesoscale and synoptic-scale environment supportive of tropical cyclogenesis. A Gulfstream-V high-altitude jet is tasked with gathering data for the PREDICT effort.

• Researchers with NOAA's National Environmental Satellite, Data, and Information Service will conduct the Ocean Winds Experiment using NOAA's WP-3D aircraft to gather ocean surface wind observations in high wind and rain conditions with the goal of improving marine forecasts and numerical weather prediction models.



Get the Facts... **In collaboration with NASA and NSF partners, AOML's Hurricane Research Division hosts daily tropical weather discussions at 12 noon in the AOML first-floor conference room. The discussions are between 20-30 minutes in length and are open to all interested individuals who wish to know more about tropical weather activity in the Atlantic basin. For audio access to the discussions, join the NASA conference call line at 866-647-3268, pass code 9181669.**

Exploring New Methods of Communicating Research

NOAA's hurricane research programs recently joined the world of social media with the establishment of a blog site accessible through a RSS feed, Facebook, or Twitter account. The Hurricane Research Division (HRD) of AOML joins the ranks of other notable NOAA entities that have started using social media to communicate not only major accomplishments but also the day-to-day planning and science that leads to their successes. HRD follows in the footsteps of NOAA Administrator Jane Lubchenco and the National Severe Storms Laboratory's VORTEX2 tornado project in using social media for communication with the public.

HRD began using social media to increase outreach to those interested in the science NOAA undertakes, with an additional goal of furthering its ability to attract the best and brightest young minds to NOAA and hurricane research. HRD's launch of the blog is just in time to begin highlighting the annual field program, whose focus is the Intensity Forecast EXperiment, or IFEX. IFEX will focus on hurricanes and developing tropical systems in the Atlantic basin, with special emphasis this year on tropical cyclogenesis and rapid intensification and the physical mechanisms that drive these processes. Look to the blog site for status updates on flights utilizing NOAA's hurricane hunter aircraft, the two P-3 Orions and the G-IV jet.

When flights are completed, you will likely see a blog entry written by Dr. Robert Rogers, the field program manager for IFEX, who may discuss various aspects of the observed storm. Other entries may be about collaborations with HRD's 2010 partners, the National Science Foundation-sponsored PRE-Depression Investigation of Cloud systems in the Tropics (PREDICT) and the National Aeronautics and Space Administration-sponsored Genesis and Rapid Intensification Processes (GRIP) field projects.

In addition to hurricane flights, HRD conveys many other types of information through its blog site. Have you ever wished you could sit in on many of the great seminars and discussions that take place in NOAA's research laboratories? Links to presentations by AOML scientists and visitors are commonly found on the blog, including some with recordings of the actual presentations complete with audio.

NOAA's hurricane researchers also often make time to communicate their science to members of the media, and links to coverage in the popular press are highlighted. References to recent publications, awards, and accolades for HRD research are also included.

Several methods can be used to access the HRD blog entries. The actual blog is located at http://noaahrd.wordpress.com/. For those with a Facebook account, search for HRD where blog entries are automatically posted. You can also follow the posts on Twitter using @HRD_AOML_NOAA. Posts can also be accessed via a RSS feed.

Most modern web browsers can read RSS feeds automatically (sometimes these feeds are referred to as "Live Bookmarks"). Alternatively, you can use a stand-alone feed reader or news aggregator. These are applications that can be set to read the feeds on a recurring basis, generally once an hour or so.

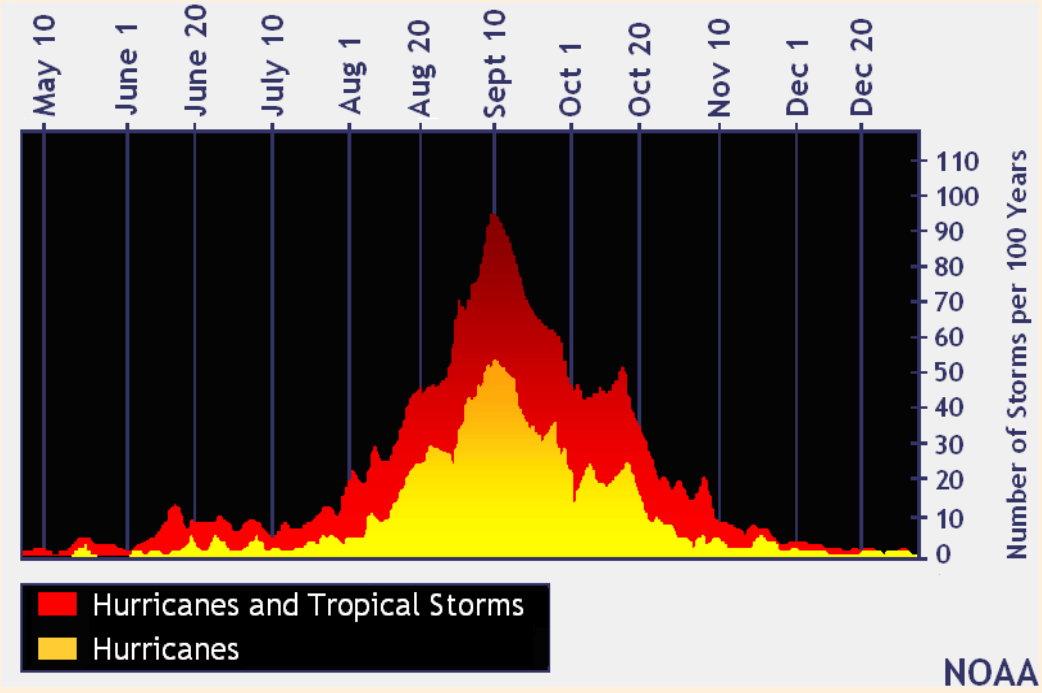
AOML's Hurricane Research Division now has a blog site accessible through a RSS feed, Facebook, or Twitter account, which enables HRD to reach a wider audience in communicating its science and annual hurricane field program activities.

Once you have installed a feed reader or news aggregator, you simply add the HRD feed address (http://noaahrd.wordpress. com/) to the list of feeds in the reader. The installation instructions for the readers will guide you through the set-up process. If your browser, newsreader, or aggregator uses "auto-discovery," simply enter the main HRD address (http://www.aoml.noaa.gov/hrd) and it will find all of the active feeds.

Erica Rule
Office of the Director

The Atlantic hurricane season is officially from 1 June to 30 November. There is nothing magical in these dates; hurricanes have occurred outside of these six months, but these dates were selected to encompass over 97% of tropical activity. June 1st has been the traditional start of the Atlantic hurricane season for decades. However, the end date has been slowly shifted outward, from October 31st to November 15th until its current date of November 30th. The Atlantic basin shows a very peaked season from August through October, with 78% of the tropical storm days, 87% of the minor hurricane days (Saffir-Simpson Scale categories 1 and 2), and 96% of the major hurricane days (Saffir-Simpson Scale categories 3, 4, and 5) occurring then (Landsea, 1993). Maximum activity is in early to mid September. Once in a few years there may be a tropical cyclone occurring "out of season," primarily in May or December.

Frequently Asked Questions About Hurricanes
www.aoml.noaa.gov/hrd/tcfaq/tcfaqHED.html



St. Croix CREWS/ICON Station Receives a "Makeover"

In early August a team from AOML—Mike Jankulak, Lecia Salerno, and Rachel Kotkowski—visited the Coral Reef Early Warning System (CREWS)/Integrated Coral Observing Network (ICON) station near Salt River Bay, St. Croix, U.S. Virgin Islands to replace equipment, upgrade electronics, and clean the station of biofouling. AOML researchers worked in collaboration with staff from the St. Croix East End Marine Park, who coordinated all of the logistics for the station's maintenance operations and provided boating services.

The St. Croix station's last annual visit by AOML was in July 2009, at which time several equipment problems were noted. The last scheduled cleaning for the station occurred in September 2009, after which its local maintenance contract expired.

As expected from having been unattended for 11 months, the station was found to be badly biofouled and in need of attention. AOML divers Lecia Salerno and Rachel Kotkowski conducted five dives of approximately 60-70 minutes to swap out underwater instruments, document the station's condition in photos, and complete an extensive cleaning of all surfaces, spectra lines, support chains, and lashings.

Barnacles and other marine growth are visible on the support chains that anchor the St. Croix station to the ocean floor, as well as on one of the subsurface instruments.

The station's shallow CTD (conductivity-temperature-depth) instrument was found to have lost its power feed from the main station. Although the CTD continued transmitting its data, on April 10, 2010 with its local battery power reserves completely drained the instrument went offline. The station's deep CTD also experienced a malfunction and stopped recording its data on January 4, 2010. These equipment failures were diagnosed and repaired, and both the shallow and deep CTDs are now functioning properly.

NOAA Corps officer LTJG Rachel Kotkowski of AOML works to clean away marine growth and other debris at the base of the St. Croix pylon.

All of the station's electronics were subsequently replaced, including the control electronics and antennae that have been operating at the site since September 2006. A new navigation light with high-intensity light-emitting diodes (LEDs), which increased the light's range from 3 to 4 nautical miles, was also installed. Additionally, the station's 64-MB flash memory card was replaced with a 1 GB card to increase the capacity for data storage, and nonfunctional instruments—an air temperature sensor, wind monitor, and electronic compass—were all replaced.

CREWS/ICON Stations Record Passage of Hurricane Earl

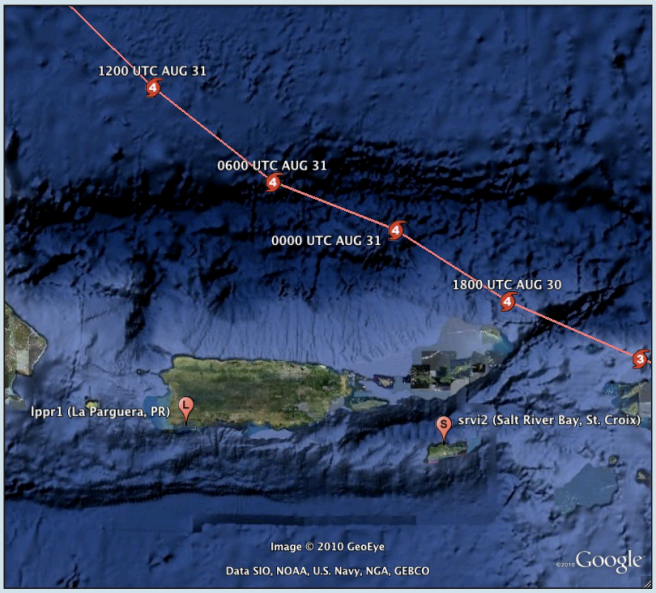
On August 30th-31st, Hurricane Earl, the 2010 Atlantic hurricane season's second major hurricane, passed quite close to two of the Coral Reef Early Warning System (CREWS) stations in the Caribbean that are part of the Integrated Coral Observing Network (ICON). Researchers at AOML manage the CREWS/ICON stations in support of the Coral Health and Monitoring Program.

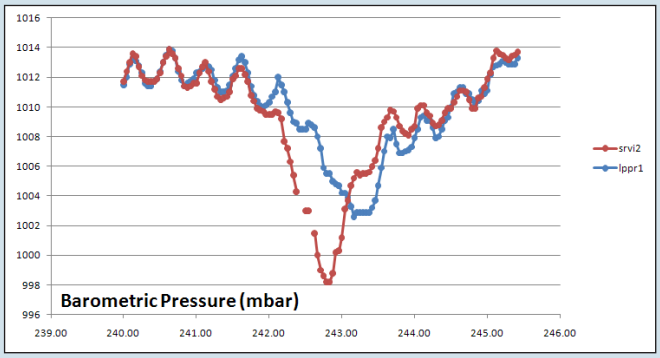
The first station impacted by Earl was the station designated as SRVI2 on the northern coast of St. Croix, U.S.Virgin Islands, while the second station impacted was LPPR1 on the southwest coast of Puerto Rico (see map at right).

Both CREWS/ICON stations appear to have survived the experience unharmed, and both of them recorded data including barometric pressure, air temperature, dew point, and winds that are of potential interest to hurricane scientists.

With winds of between 120-135 mph, Hurricane Earl passed within 90 miles of the St. Croix station at about 18 UTC on August 30th and within about 150 miles of the Puerto Rico station at about 6 UTC on August 31st. Both stations recorded gale-force winds during this period.

Except for 16 dropped transmissions from the St. Croix station and four dropped transmissions from the Puerto Rico station, all of the ICON data were transmitted in near-real time to the National Data Buoy Center in Mississippi where they became part of the National Weather Service's operational data stream and were assimilated into the models used by forecasters at the National Hurricane Center. Since the passage of Hurricane Earl, both the St. Croix and Puerto Rico CREWS/ICON stations have continued to operate normally.





Upper right: The location of the two CREWS/ICON stations in the Caribbean are denoted by red balloons, while the path of Hurricane Earl is denoted by a red line.

Lower right: Barometric pressure as recorded by the St. Croix (red line) and Puerto Rico (blue line) CREWS/ICON stations during the passage of Hurricane Earl.

AOML Intern to Pursue Career in Meteorology

AOML student intern Edumin Corrales developed a fascination for hurricanes at an early age. As an 11th grade student at William H. Turner Technical Arts High School in 2009, Edumin competed in the Miami-Dade County Science Fair with a presentation entitled "Which Atlantic factors have caused hurricane seasonal patterns to change in the last 50 years?" Judges Shirley Murillo, Bachir Annane, and Xuejin Zhang, all researchers with AOML's Hurricane Research Division (HRD), awarded Edumin first place for the best high-school level weather display.

Shirley Murillo, Sylvie Lorsolo, Edumin Corrales, and Michael Black on the last day of Edumin's internship with AOML's Hurricane Research Division.

Edumin subsequently applied to the Miami-Dade School Board for a student internship at a NOAA facility and spent the duration of his high school senior year working with HRD researchers. Under the tutelage of Michael Black, Edumin studied dropsonde data from Hurricane Bill (2009) to analyze whether the Saharan Air Layer was a factor in Bill's weakening. After graduating from high school this past June, Edumin continued working with HRD researchers as one of AOML's 2010 summer student interns. Alongside Drs. Sylvie Lorsolo and John Gamache, Edumin reprocessed NOAA tail Doppler radar data from Hurricanes Wilma, Rita, Jeanne, Bill, and other storms using new algorithms.

He is now preparing for his freshmen year at the University of Miami, attending on a half-scholarship to study meteorology. "I feel that working at AOML better prepared me for college. It gave me hands-on experience. I'm more confident, more organized. I've had to pay attention to details, so I think this will help make the transition easier," Edumin said in reflecting upon his time at AOML. "It's also helped me to define my goals for what I need to do to become the best meteorologist I can become."

Edumin's goals are to obtain a Ph.D. in meteorology and one day return to work for HRD as a meteorologist. "It's the perfect environment for me. I really enjoy research and look forward to flying into hurricanes. I hope to give back what's been given to me."

AOML's ranks were augmented in June by the arrival of summer interns, including five NOAA Hollings Scholars. Working with mentors in the Hurricane Research (HRD), Ocean Chemistry (OCD), and Physical Oceanography (PhOD) Divisions, AOML's hard-working interns assisted investigators with a wide assortment of science-related tasks in support of the Laboratory's research programs. Pictured above are some of AOML's summer interns with Dr. Jane Lubchenco, NOAA Administrator, during her visit to AOML this past June. From left to right are (first row) Sarah Larson, Dr. Jane Lubchenco, Hallee Meltzer, and Laura Bendernagel. Second row: Kimmaree Horvath, Kyle Gispert, Arthur Eiserloh, Shelby LaBuhn, and Rosimar Rios-Berrios. The names of AOML's 2010 interns and their mentors appear in the table below.

Laura Bendernagel, Columbia University (**Hollings Scholar**)	Elizabeth Johns (PhOD)
Heather Coit, Green River Community College	Christopher Sinigalliano/Maribeth Gidley (OCD)
Edumin Corrales, University of Miami	Sylvie Lorsolo/John Gamache (HRD)
Arthur Eiserloh, University of South Alabama (**Hollings Scholar**)	Sundararaman Gopalakrishnan (HRD)
Kyle Gispert, MAST Academy	Andrew Stefanick (PhOD)
Zachary Gruskin, University of Wisconsin	Jun Zhang/Robert Rogers (HRD)
Kimmaree Horvath, University of Akron (**Hollings Scholar**)	Derek Manzello/Jim Hendee (OCD)
Jessica Joyner, University of Georgia	Christopher Sinigalliano/Maribeth Gidley (OCD)
Olivia Kellner, Purdue University	Sundararaman Gopalakrishnan (HRD)
Shelby LaBuhn, Lake Superior State University (**Hollings Scholar**)	Thomas Carsey (OCD)
Sarah Larson, University of South Alabama (**Hollings Scholar**)	Chunzai Wang/David Enfield (PhOD)
Monica Laureano, Purdue University	Sundararaman Gopalakrishnan (HRD)
Hallee Meltzer, Palmetto Senior High School	Kathryn Sellwood (HRD)
Xavier Mendez, Academy of Arts and Minds	Ulises Rivero (PhOD)
Rosimar Rios-Berrios, University of Puerto Rico	Tomislava Vukicevic/Altug Aksoy (HRD)
Lily Zhang, Coral Reef Senior High School	Christopher Sinigalliano/Maribeth Gidley (OCD)

Summer Student Interns Win Top Honors

Kimmaree Horvath, a NOAA Hollings Scholar who spent the summer working at AOML, received first place at a recent science and education symposium hosted by NOAA for the 2009 class of Hollings and Educational Partnership Program (EPP) scholars. More than 100 Hollings and EPP scholars attended the symposium and made presentations about their summer research projects, which were classified according to the research themes of climate, weather and water, mission support, and ecosystems. Horvath garnered first place in the ecosystems category, the category which included the largest portion of the presentations.

While at AOML, Horvath worked with Drs. Derek Manzello and Jim Hendee of NOAA's Coral Health and Monitoring Program. Horvath's research focused on coral growth and reef framework persistence of the Florida Reef Tract in an era of accelerating ocean acidification. In learning of his intern's accomplishment, Derek Manzello stated, "It is very exciting to hear that Kimmaree gets to bask in the glory of being the best Holling's Scholar for stepping up to the degree and variety of hard work I subjected her to this summer!"

Two more NOAA Hollings Scholars that interned at AOML this summer—Laura Bendernagel and Sarah Larson—also received awards at the symposium, tying for third and second places in their respective categories.

Rosimar Rios-Berrios, an intern that worked with Drs. Tomislava Vukicevic and Altug Aksoy of the Hurricane Research Division's Modeling Group, has been selected as the recipient of the National Weather Association's 2010 David Sankey Minority Meteorology Scholarship.

Farewell

Dr. Tania Casal, a CIMAS post-doctoral scientist with AOML's Physical Oceanography Division, departed AOML in July to accept a program management position with the European Space Agency in the Netherlands. During her two years at AOML, Casal studied water mass transformations in the southeastern Pacific, specifically the ventilation of Antarctic Intermediate Water by Subantarctic Mode Water, and its decadal variability.

Dr. Robert Molinari, a longtime oceanographer with AOML's Physical Oceanography Division and former NOAA Senior Scientist, departed AOML in August to assume directorship of the International CLIVAR Project Office in Southampton, England. As director, Molinari will oversee the scientific and administrative aspects of the CLIVAR program, which seeks to improve skill in predicting climate variability on seasonal to centennial and longer time scales.

NOAA Corps officer LT Lecia Salerno departed AOML in August for her next duty assignment in Honolulu, Hawaii as the operations officer for the NOAA Ship *Ka'imimoana*. During her two years at AOML, Salerno served as the Laboratory's unit diving supervisor and assisted researchers with field activities related to the Coral Health and Monitoring and Florida Area Coastal Environment Programs.

It's a Boy!

David Wanless and his wife Shannon are the proud parents of their first child, a son. Winston Sullivan Wanless was born in Miami on June 28th and weighed in at 6 lbs., 1 oz. Winston and his parents are all fine and doing well.

Plastic Facts

— Americans buy an estimated 29.8 billion plastic water bottles every year.

— Nearly eight of every 10 plastic bottles ends up in a landfill.

— As many as a million sea creatures die annually due to plastic bags and other plastic garbage tossed into the ocean.

Congratulations

Chunzai Wang, an oceanographer with AOML's Physical Oceanography Division, has been elected as a 2010 Fellow of the United Kingdom's Royal Meteorological Society. Fellows are recognized for their long-term professional experience in either the field of meteorology or a field related to meteorology. Wang's research focuses on ocean-atmosphere interactions, climate variability, and the impacts of climate and global warming on hurricane activity.

AOML's top three peer-reviewed journal articles for fiscal year 2010 were recently selected. Congratulations to Francis Bringas, Gustavo Goni, George Halliwell, Frank Marks, Michael Montgomery, Mark Powell, and Eric Uhlhorn, all co-authors on these excellent research papers:

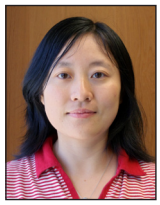
Goni, G.J., M. DeMaria, J. Knaff, C. Sampson, I. Ginis, F. Bringas, A. Mavume, C. Lauer, I.-I. Lin, M.M. Ali, P. Sandery, S. Ramos-Buarque, K. Kang, A. Mehra, E. Chassignet, and G.R. Halliwell, 2009: Applications of satellite-derived ocean measurements to tropical cyclone intensity forecasting. *Oceanography,* 22(3):191-197.

Marks, F.D., P.G. Black, M.T. Montgomery, and R.W. Burpee, 2008: Structure of the eye and eyewall of Hurricane Hugo (1989). *Monthly Weather Review,* 136(4):1237-1259.

Powell, M.D., E.W. Uhlhorn, and J.D. Kepert, 2009: Estimating maximum surface winds from hurricane reconnaissance measurements. *Weather and Forecasting,* 24(3):868-883.

Welcome Aboard

NOAA Corps officer LTJG Rachel Kotkowski joined AOML's Office of the Director in June to provide assistance to the Laboratory. Kotkowski has had extensive hazardous materials training and will work to promote safety and environmental compliance with NOAA policies at AOML. She will also provide small boat operation, diving (as AOML's unit diving supervisor), and logistical support for the Ocean Chemistry Division's coastal ecosystems and climate-related research programs. Kotkowski holds a B.S. degree in marine safety and environmental protection from the Massachusetts Maritime Academy and a 1600-Ton Mates License.



Dr. Yanyun Liu joined the staff of AOML's Physical Oceanography Division in August as a CIMAS post-doctoral scientist. Liu recently obtained her Ph.D. from the Department of Marine, Earth and Atmospheric Sciences of North Carolina State University. Her doctoral research focused on using a hybrid coordinate ocean model (HYCOM) to simulate the ocean circulation around the Galapagos Archipelago. During her time at AOML, Liu will work with Dr. Sang-Ki Lee and in collaboration with researchers at NOAA's Southeast Fisheries Science Center in Miami to perform a regional downscaling of the Intergovernmental Panel on Climate Change's future projection of circulation and property changes in the Gulf of Mexico and their impact on bluefin tuna habitat.

Jose Tossas joined the staff of the Administrative Office of AOML's Office of the Director in August. Tossas will be working part time to provide assistance with closing out AOML's 2010 fiscal year accounts and establishing files for AOML's 2011 fiscal year accounts. He will also ensure invoices are paid and undergo training on NOAA's accounting systems. After the start of the 2011 fiscal year in October 2010, Tossas will provide procurement assistance and assume responsibility for reconciling a portion of AOML's bankcards.

National Research Council post-doctoral scientist Dr. Ruben van Hooidonk joined the staff of AOML's Ocean Chemistry Division in August. van Hooidonk is a biologist from the Netherlands with a passion for diving and coral reefs. He earned a M.S. degree by studying coral reef ecology on the Caribbean Island of Curaçao and then completed a Ph.D. in earth and atmospheric sciences at Purdue University in Indiana as a Fullbright Scholar. van Hooidonk's doctoral research focused on the prediction of coral bleaching events and verification of these predictions. During his time at AOML, he will work to further refine coral bleaching prediction schemes and investigate the thermal tolerance of different coral species.

Travel

Bob Atlas attended the NOAA Climate Service Corporate Board Retreat in Asheville, North Carolina on July 7-9th; presented papers at the 2010 International Geoscience and Remote Sensing Symposium (IGARSS) in Honolulu, Hawaii on July 25-30th; presented an invited paper on the impact of satellite surface winds on numerical prediction at the SPIE Optical Engineering and Applications Conference in San Diego, California on July 31-August 5th; and attended OAR's Senior Research Council meeting in Knoxville, Tennessee on August 17-20, 2010.

Christopher Meinen attended the U.S. CLIVAR Summit in Denver, Colorado on July 7-9,2010. He also attended the annual meeting of the RAPID-WATCH program in Exeter, England on July 14-16, 2010.

Eric Ulhorn attended a HIRAD (Hurricane Intensity Radiometer) Technical Interchange meeting in Huntsville, Alabama on July 12-15, 2010.

Lloyd Moore attended a Hazardous/Toxic Waste Management Workshop in Orlando, Florida on July 22-23, 2010.

Rick Lumpkin attended and presented a paper at the 2010 International Geoscience and Remote Sensing Symposium (IGARSS) in Honolulu, Hawaii on July 25-30, 2010.

Rik Wanninkhof was an invited participant at the annual Climate Process Team meeting in Princeton, New Jersey on July 28-30, 2010.

Michael Jankulak, Rachel Kotkowski, and Lecia Salerno serviced the Integrated Coral Observing Network (ICON) station in St. Croix on August 2-6, 2010.

Kelly Goodwin and Christopher Sinigalliano attended the Gulf of Mexico Alliance (GOMA) Annual Implementation and Integration Workshop in Biloxi, Mississippi on August 4-5, 2010.

Michael Black participated in the pre-GRIP (Genesis and Rapid Intensification Processes) test flights of the Global Hawk dropsonde system in Palmdale, California on August 8-13, 2010.

Silvia Garzoli, Gustavo Goni, Chunzai Wang, and Jia-Zhong Zhang attended and made presentations at the 2010 Meeting of the Americas in Foz do Iguassu, Brazil on August 8-12, 2010.

Molly Baringer and Gustavo Goni attended the XBT Bias and Fall-Rate Workshop in Hamburg, Germany on August 25-27, 2010.

Recent Publications*

ABERSON, S.D., J. CIONE, C.-C. Wu, M.M. Bell, J. Halverson, C. Fogarty, and M. Weissmann, 2010: Aircraft observations of tropical cyclones. In *Global Perspectives on Tropical Cyclones: From Science to Mitigation,* J.C.L. Chan and J.D. Kepert (ed.). World Scientific Publishing Company, 2nd edition, 227-240.

AMORNTHAMMARONG, N., P.B. Ortner, and J.-Z. ZHANG, 2010: A simple, effective mixing chamber used in conjunction with a syringe pump for flow analysis. *Talanta,* 81(4-5), 1472-1476.

Braun, S.A., M.T. MONTGOMERY, K.J. Mallen, and P.D. Reasor, 2010: Simulation and interpretation of the genesis of Tropical Storm Gert (2005) as part of the NASA Tropical Cloud Systems and Processes Experiment. *Journal of the Atmospheric Sciences,* 67(4):999-1025.

Dietrich, J.C., S. Bunya, J.J. Westerink, B.A. Ebersole, J.M. Smith, J.H. Atkinson, R. Jensen, D.T. Resio, R.A. Luettich, C. Dawson, V.J. Cardone, A.T. Cox, M.D. POWELL, H.J. Westerink, and H.J. Roberts, 2010: A high-resolution coupled riverine flow, tide, wind, wind wave, and storm surge model for southern Louisiana and Mississippi, Part II: Synoptic description and analysis of Hurricanes Katrina and Rita. *Monthly Weather Review,* 138(2):378-404.

Haus, B.K., D. Jeong, M.A. Donelan, J.A. ZHANG, and I. Savelyev, 2010: Relative rates of sea-air heat transfer and frictional drag in very high winds. *Geophysical Research Letters,* 37(7): L07802, doi:10.1029/2009GL042206.

Ismail, S., R.A. Ferrare, E.V. Browell, S.A. Kooi, J.P. DUNION, G. Heymsfield, A. Notari, C.F. Butler, S. Burton, M. Fenn, T.N. Krishnamurti, M.K. Biswas, G. Chen, and B. Anderson, 2010: LASE measure-ments of water vapor, aerosol, and cloud distributions in Saharan air layers and tropical disturbances. *Journal of the Atmospheric Sciences,* 67(4):1026-1047.

MANZELLO, D.P., 2010: Coral growth with thermal stress and ocean acidification: Lessons from the eastern tropical Pacific. *Coral Reefs,* 29(3): 749-758.

POWELL, M.D., 2010: Near-surface based, airborne, and satellite observations of tropical cyclones. In *Global Perspectives on Tropical Cyclones: From Science to Mitigation,* J.C.L. Chan and J.D. Kepert (eds.). World Scientific Publishing Company, 2nd edition, 177-199.

Sereenonchai, K., S. Teerasong, S. Chan-Eam, P. Saetear, N. Choengchan, K. Uraisin, N. AMORNTHAMMARONG, S. Motomizu, and D. Nacapricha, 2010: A low-cost method for determination of calcium carbonate in cement by membraneless vaporization with capacitively coupled contactless conductivity detection. *Talanta,* 81(3):1040-144.

Shen, B.-W., W.-K. Tao, W.K. Lau, and R. ATLAS, 2010: Predicting tropical cyclogenesis with a global mesoscale model: Hierarchical multiscale interactions during the formation of Tropical Cyclone Nargis (2008). *Journal of Geophysical Research,* 115:D14102, doi:10.1029/2009JD013140, 15 pp.

Teerasong, S., S. Chan-Eam, K. Sereenonchai, N. AMORNTHAMMARONG, N. Ratanawimarnwong, and D. Nacapricha, 2010: A reagent-free SIA module for monitoring of sugar, color, and dissolved CO2 content in soft drinks. *Analytica Chimica Acta,* 668(1):47-53.

Teerasong, S., N. AMORNTHAMMARONG, K. Grudpan, N. Teshima, T. Sakai, D. Nacapricha, and N. Ratanawimarnwong, 2010: A multiple processing hybrid flow system for analysis of formaldehyde contamination in food. *Analytical Sciences,* 26(5):629-633.

Tweddle, J.F., P.G. Strutton, D.G. Foley, L. O'Higgins, A.M. WOOD, B. Scott, R.C. Everroad, W.T. Peterson, D. Cannon, M. Hunter, and Z. Forster, 2010: Relationships among upwelling, phytoplankton blooms, and phycotoxins in coastal Oregon shellfish. *Marine Ecology Progress Series,* 405:131-145.

WANG, C., and S. DONG, 2010: Is the basin-wide warming in the North Atlantic Ocean related to atmospheric carbon dioxide and global warming? *Geophysical Research Letters,* 37(8):L08707, doi:10.1029/2010GL042743.

*AOML authors are denoted by capital letters.

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AOML seeks to provide improved ocean and weather services for the nation by conducting research to understand the physical, chemical, and biological characteristics and processes of the ocean and the atmosphere, both separately and as a coupled system. The principal focus of these investigations is to advance knowledge that leads to more accurate forecasting of severe storms, better utilization and management of marine resources, and better understanding of the factors affecting both climate and environmental quality.