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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

NOAA Forecasts Another Active Hurricane Season

NOAA's annual Atlantic hurricane outlook, released on May 19th, forecasts an above-average year for the 2011 Atlantic basin hurricane season. Hurricane specialists are predicting a 70% probability that 12-18 named storms will develop during the six-month long season, which began on June 1st. Of these named storms, 6 to 10 are expected to strengthen into hurricanes, while 3 to 6 hurricanes are forecast to intensify into major hurricanes with winds above 110 mph (categories 3, 4, and 5 on the Saffir-Simpson hurricane scale). An average season typically produces 12 named storms, 6 hurricanes, and 3 major hurricanes.

A combination of climatic factors—the tropical multi-decadal signal, above-average sea surface temperatures across the tropical Atlantic Ocean and Caribbean Sea, and a weakening La Niña event in the equatorial Pacific Ocean—are all critical contributors to NOAA's seasonal outlook.

The active phase of the tropical multi-decadal signal is believed to have caused an increase in Atlantic hurricane activity since it began in 1995, while warmer than average sea surface temperatures will help fuel storm development. The 2010-2011 La Niña event, although dissipating, is still expected to impact weather patterns throughout the summer months by reducing wind shear over the Atlantic, thus creating a more favorable environment for tropical cyclogenesis to occur.

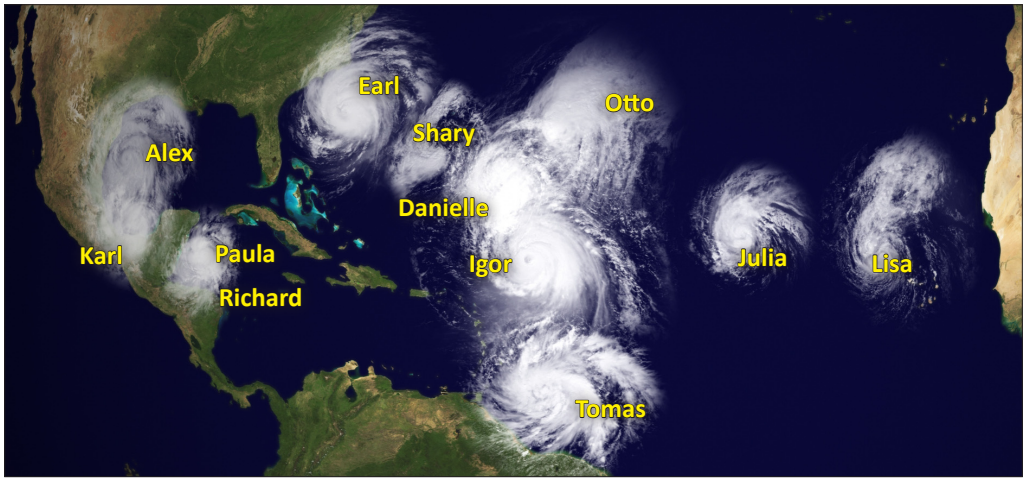
NOAA's Atlantic Hurricane Outlook

Activity Type	NOAA Outlook	Average Season
Named storms	12-18	12
Hurricanes	6-10	6
Major hurricanes	3-6	3

NOAA cautions the outlook provides the public with only a general guide to the expected overall activity for the upcoming hurricane season. It is not a seasonal hurricane landfall forecast, and it does not imply levels of activity for any particular region.

The majority of storm activity typically occurs from August through October, the peak months of the Atlantic hurricane season. NOAA will reassess climatic conditions in early August and issue an updated forecast for the Atlantic basin at that time.

NOAA's seasonal hurricane outlooks are produced by the Climate Prediction Center through a collaboration of scientists with the National Hurricane Center and Hurricane Research Division (HRD) of AOML. HRD meteorologist Stanley Goldenberg has been a member of the seasonal hurricane forecast team since its inception in 1998.



Twelve hurricanes formed during the 2010 Atlantic hurricane season, making it the third busiest year on record. While the 2011 season is not predicted to be quite as active, NOAA's hurricane specialists are still forecasting a year marked by an above-average level of storm activity.

The United States was fortunate last year. Winds steered most of the season's tropical storms and all hurricanes away from our coastlines. However, we can't count on luck to get us through this season. We need to be prepared, especially with this above-normal outlook.

Dr. Jane Lubchenco
Under Secretary of Commerce
for Oceans and Atmosphere
and NOAA Administrator

The tornadoes that devastated the South and the large amount of flooding we've seen this spring should serve as a reminder that FEMA is just part of an emergency management team that includes the entire federal family, state, local and tribal governments, the private sector, and, most importantly, the public. Now is the time to get your plan together for what you and your family would do if disaster strikes.

Mr. Craig Fugate, Administrator
Federal Emergency Management Agency

In addition to multiple climate factors, seasonal climate models also indicate an above-normal season is likely, and even suggest we could see activity comparable to some of the active seasons since 1995.

Dr. Gerry Bell
Lead Seasonal Hurricane Forecaster
NOAA's Climate Prediction Center

Atlantic Named Storms for 2011

Arlene	Harvey	Ophelia
Bret	Irene	Philippe
Cindy	Jose	Rina
Don	Katia	Sean
Emily	Lee	Tammy
Franklin	Maria	Vince
Gert	Nate	Whitney

Experiments Assess Sensors Used in Search for Subsurface Oil

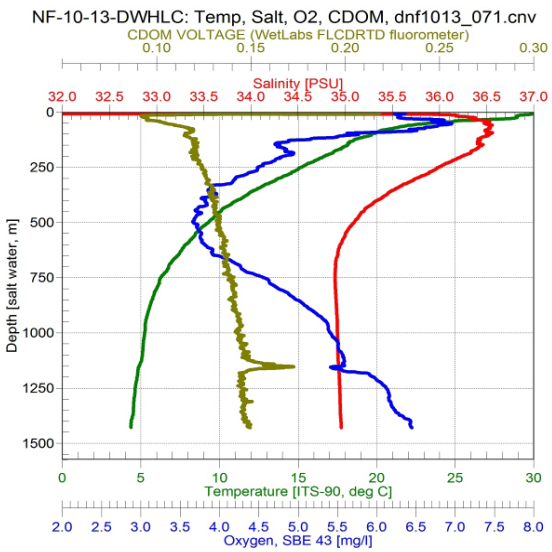
A series of experiments were performed over a two-week period in late May-early June 2011 to assess the performance of the sensors used to search for subsurface oil during the 2010 Deepwater Horizon oil spill. Michelle Wood, Director of AOML's Ocean Chemistry Division, led the effort at the Bedford Institute of Oceanography's Center for Offshore Oil and Gas Environmental Research in Nova Scotia, Canada. Major funding was provided by NOAA, the Alliance for Coastal Technology, and Canada's Department of Fisheries and Oceans.

A) Seawater containing MC-252 source oil from the 2010 Gulf of Mexico Deepwater Horizon spill and dispersant is poured into the wave tank at the Center for Offshore Oil and Gas Environmental Research in Nova Scotia, Canada. B) Initial oil front. C) Oil distributes throughout the wave tank. D) A wave generator helps to transport and mix the oil in the tank.

Finding oil beneath the surface of the ocean isn't easy, as those responding to the Deepwater Horizon (DWH) spill learned in the summer of 2010. When oil floats to the surface, it can be seen by aircraft and observers on ships; when it's entrained as small droplets into subsurface clouds and plumes, visual observation becomes impossible. The oil travels at different depths depending on the water conditions, composition of the oil, the size of the droplets, and other factors.

During the DWH oil spill, application of the dispersant COREXIT 9500, combined with the effects of large volumes of methane erupting with the oil under high pressure, appears to have supported the development of subsurface oil plumes that were first suspected based on vertical profiles of fluorescence obtained from CDOM fluorometers and oxygen profiles. The figure below from the AOML-led research cruise aboard the NOAA Ship *Nancy Foster* in June-July 2010 shows the now iconic CDOM peak/oxygen minimum associated with the underwater plumes.

CDOM, or "Colored Dissolved Organic Matter," has been of interest to satellite oceanographers for several decades, particularly because it causes difficulty in applying standard algorithms for chlorophyll to ocean color data collected in coastal waters. There are many sources of CDOM, including proteins and material called "gelbstoff" derived from decomposing organic matter often associated with black water rivers and other nearshore sources.



Graph from the June-July 2010 research cruise of the NOAA Ship *Nancy Foster* depicting CDOM (olive green line) and oxygen (blue line). The CDOM peak and oxygen minimum near 1200 m suggested the presence of subsurface oil.

Hydrocarbons are also "colored organic matter" and, thus, oceanographers familiar with CDOM sensors immediately began using them to search for subsurface oil. As hydrocarbons are a major source of energy, it was also expected that hydrocarbon-degrading bacteria, particularly those that might specialize on some of the more degradable components of the oil (e.g., butane, toluene, etc.) or on the methane in the plume, might use these energy sources and draw down the oxygen concentration.

These hypotheses seem to be supported by the many profiles that showed simultaneous peaks in CDOM fluorescence and minima in oxygen. On the *Nancy Foster* cruise, researchers found that hydrocarbon concentrations at the depth of these features were elevated relative to background levels after water samples were analyzed by the gas chromatography-mass spectrometry method.

There are, however, major differences between CDOM, as studied by satellite oceanographers and ocean color experts, and oil. This is particularly true with respect to fluorescence, which is the emission of light by a molecule or fluorophore after it absorbs light at a shorter wavelength. All fluorophores have characteristic wavelengths for maximum absorption of light and a characteristic wavelength at which they emit light.

The ability of a CDOM sensor to detect oil partly depends on how well the sensor matches the excitation and emission wavelengths of the oil. Since oil is a complex mixture of organic molecules, it has a complex, three-dimensional excitation and emission spectrum. In general, crude oils have a broad excitation peak in the ultraviolet spectrum and two emission peaks, one in the

Brian Robinson was part of the staff from COOGER that operated the wave tank; here the tank is being cleaned between experiments.

visible spectrum around 450 nm and a much larger and broader peak in the ultraviolet.

Typical CDOM sensors have light sources that excite at slightly longer wavelengths than peak absorption by hydrocarbons and detect emission in the visible. Additionally, there are many fluorometer designs with different light sources, and a few that detect emissions for organic matter in the ultraviolet. As the hunt for subsurface oil continued throughout the summer of 2010, different instruments were used on different ships with differing effectiveness.

An *ad hoc* Fluorometry Working Group formed during AOML's DWH Symposium in July 2010 called for experimental studies to understand the dynamic range, sensitivity, and response of different fluorometers to the oil-dispersant mixtures. As a result, from May 28-June 10, 2011, an experiment was conducted that included the principal fluorometers used to detect subsurface oil in the Gulf of Mexico during the DWH spill and some "next generation" sensors as well.

The experiment was conducted at the Bedford Institute of Oceanography's Center for Offshore Oil and Gas Environmental Research (COOGER) in Dartmouth, Nova Scotia. Major funding for the effort was provided by the Integrated Ocean Observing System through the Alliance for Coastal Technology and NOAA, and from COOGER and Canada's Department of Fisheries and Oceans.

COOGER operates a wave tank designed to work with oil and dispersants and has extensive laboratory facilities for analyzing the chemical and physical properties of oil and oil-dispersant mixtures. Additionally, COOGER scientists played an important role on the Joint Analysis Group (JAG) during the DWH spill and spent many days on ships in the Gulf. COOGER Director Ken Lee is on the National Research Council committee evaluating the impact of the spill on the Gulf of Mexico.

AOML's Michelle Wood was the lead principal investigator for the project; the primary science team was comprised of Paul Kepkay and Ken Lee from COOGER, Paula Coble from the University of South Florida, Robyn Conmy from the Environmental Protection Agency and JAG, Scott Miles from Louisiana State University's Response and Chemical Assessment Team, and Jim Farr from NOAA's Office of Response and Restoration and JAG member. Overall, more than 25 researchers participated in the effort, including 12 COOGER staff needed to operate the wave tank and clean it between each experiment and OCD scientist Chris Kelble.

Researchers collect data from the wave tank on a sunny day. Working at the computers are, from left to right, Jordanna Lacoste (kneeling, Dalhousie University), Robyn Conmy (Environmental Protection Agency), Michelle Wood (AOML), and Mary Abercrombie (University of South Florida). Others present include Zhenkai Li, Paul Kepkay, and Brian Robinson from COOGER and Scott Miles from Louisiana State University (far right).

A total of 15 experiments were conducted during the 12-day workshop, including eight core experiments that involved deploying sensors in the tank with oil added with and without dispersant, and using artificially weathered and unweathered oil. Additional experiments addressed questions about the limits of detection (maximum and minimum) of the different sensors and about the fluorescence of the dispersant alone. A large-volume sampler provided by Jim Payne (Payne Environmental Consultants), who used this instrument extensively in sampling for NOAA during the oil spill, allowed for analysis of the chemical and fluorescence properties of dissolved and particulate/emulsified fractions of the water.

Preparing for the experiment highlighted the improbability of the whole event. In addition to issues relating to successful import of all the equipment into Canada was the initial acquisition of adequate amounts of MC-252 DWH source oil. Although there was a large amount of source oil flowing into the Gulf of Mexico last year, obtaining the oil now, after the event, is difficult because the supply is highly controlled. However, with assistance from NOAA leadership, the team had oil in time for artificial weathering and for preliminary experiments that facilitated planning the work with the sensors.

Another potential problem for the research was the weather. The wave tank is located outside and is filled with water from the Bedford Basin; rain affects its salinity and runoff into the basin affects the background CDOM fluorescence. Additionally, all the sensors relayed data to laptop computers which had to be deployed outside near the tank. However, despite a wet and rainy May, the team experienced a number of brilliantly beautiful days but usually worked under overcast skies; work was cancelled due to rain on only one morning. As the week progressed, open workspace became covered with a canopy, and sun covers were placed over the area of the tank to shade the sensors and prevent interference from light reflecting off the bottom of the tank.

Most of the experiments generated good data from all the sensors. Preliminary results indicate that all the sensors tested were responsive to changes in oil concentration and that they were likely responding to different components of the oil. Analysis of the EEMS (excitation-emission matrices) and sensor data, along with the analytical chemistry and droplet size distribution data collected during each experiment, is needed to fully evaluate the implications for future oil spill monitoring. It is clear that the experiments will yield considerable insight of value for the development of the next generation of oil sensors and interpretation of field data from the DWH oil spill.

Collecting water samples from the wave tank for chemical analysis.

Dr. Larry Mayer (second from the left), Chairman of the National Research Council's committee evaluating the effects of the Deepwater Horizon oil spill and Director of the University of New Hampshire's Center for Coastal and Ocean Mapping, visits with Jim Farr (NOAA), Paul Kepkay (COOGER), and Michelle Wood (AOML) during the experiments.

ANAMAR Representatives Participate in AOML-SEFSC Caribbean Research Cruise

Scientific and technical staff from AOML's Physical Oceanography Division and the Southeast Fisheries Science Center's Early Life History Laboratory (SEFSC/ELH) educated representatives from the Dominican Republic on methods and techniques utilized in modern field oceanography during a research cruise aboard the NOAA Ship *Nancy Foster*. Since their initial contact with AOML in 2010 (see *AOML Keynotes* Vol. 14/No. 5), the Dominican Republic's newly created National Authority of Maritime Affairs (Autoridad Nacional de Asuntos Maritimos, ANAMAR) has continued to work with AOML scientists in an effort to gain experience in oceanographic data gathering.

This collaboration led to the inclusion of three ANAMAR employees (Mario Delgado, Walterio Coll, and Manuel Montes) on a 19-day shipboard survey focused on examining ecosystem connectivity in the US Caribbean. This fifth annual AOML-SEFSC interdisciplinary research cruise was conducted between April 19 and May 7, 2011, and also included participants from the University of the Virgin Islands, the University of Puerto Rico, and the University of South Florida.

During the survey, acoustic Doppler current profiler (ADCP) moorings, deployed between Puerto Rico and St. Thomas as part of the NOAA/Coral Reef Conservation Program funded *Vieques Sound and Virgin Passage Transport Study*, were recovered, refurbished, and redeployed at new locations on the banks south of St.Thomas near marine protected areas of interest. The program aims to provide a more comprehensive understanding of the larval recruitment pathways of economically important reef fish species in the US Virgin Islands (USVI), and to assess the physical and biological connectivity of managed and non-managed marine habitats where spawning aggregations are prevalent.

Samantha Allen (NOAA/Office of Marine and Aviation Operations), Kevin Brown (University of the Virgin Islands), Walterio Coll (ANAMAR), and Sarah Privoznik (SEFSC) quickly swap bongo and neuston nets between stations.

Velocity measurements gathered from the moored array will provide a time-series of mass transport across the USVI coastal shelf. Larval reef fish data collected during the annual interdisciplinary surveys will be utilized in conjunction with the moored time-series to estimate larval flux. These physical and biological data will be incorporated into a high resolution numerical model for the region.

In addition to the fisheries associated with the US Caribbean coral reef ecosystem, offshore areas often support economically important pelagic fisheries. Billfish such as white marlin and blue marlin spawn offshore north of Puerto Rico and the Dominican Republic, and in the Mona Passage. These fish support a large recreational fishery. Although white marlin larvae have been collected in this area previously, historical sampling has been limited.

Walterio Coll (ANAMAR) and Sarah Privoznik (SEFSC) recover an optical profiler while on station in Virgin Passage USVI.

With direct relevance for ANAMAR, the agency responsible for fisheries management in the Dominican Republic, and for US Caribbean fisheries interests, following the completion of the USVI biophysical survey and mooring work a larval billfish survey was conducted in Mona Passage during the April/May cruise. Results from this sampling effort will help to determine if there is evidence of a localized spawning aggregation, or if the passage is just one of several areas associated with broad pelagic spawning activity in the Caribbean. During the Mona Passage survey, a port call was conducted in Santo Domingo where the NOAA Ship *Nancy Foster* hosted an open house for ANAMAR employees and a congressional delegation from the Dominican Republic House of Representatives.

Ryan Smith of AOML's Physical Oceanography Division (left) describes the project's sampling methodology to a Dominican Republic congressional delegation in Santo Domingo.

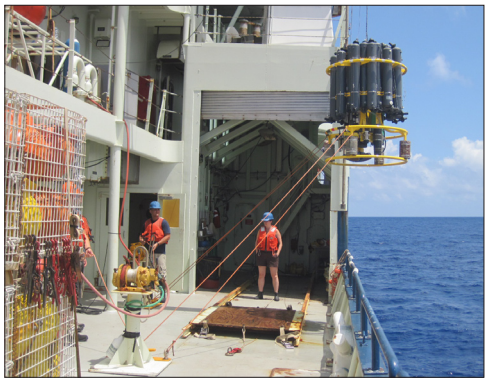
Western Boundary Time Series Cruise Augments Long-Term Climate Observations

Numerical models of the climate system, such as those used for the Intergovernmental Panel on Climate Change reports, have routinely shown that variations in the Atlantic Meridional Overturning Circulation (AMOC) are highly correlated with important quantities such as surface air temperature, precipitation rate, and hurricane intensification.

NOAA has been one of the leading players in research on the AMOC for more than 25 years, dating back to 1982 when scientists with AOML's Physical Oceanography Division (PhOD) joined with partners at NOAA's Pacific Marine Environmental Laboratory and the Rosenstiel School of Marine and Atmospheric Science (RSMAS) of the University of Miami to start a program for monitoring key western boundary components of the AMOC at 27°N east of Florida.

AOML assumed sole direction of this program, presently called the Western Boundary Time Series (WBTS) project, in 2000. The program also represents the cornerstone of a major international initiative between the United States and the United Kingdom that started in 2004. This collaboration, denoted as MOCHA (Meridional Overturning Circulation and Heatflux Array) by the U.S. contributors and RAPID-MOC (Rapid Climate Program-Meridional Overturning Circulation) by the U.K. contributors, is designed to measure the complete MOC along 26.5°N from Florida to Africa.

The complete science party from the April-May 2011 WBTS-MOCHA-RAPID cruise appear on the top deck of the R/V *Knorr*.



Researchers deploy a CTD instrument to gather ocean salinity and temperature data.

In the latest expedition in support of these collaborative projects, five PhOD scientists—Dr. Christopher Meinen, Mr. Pedro Pena, Mr. Rigoberto Garcia, Mr. Andrew Stefanick, and Mr. Kyle Seaton—joined with colleagues from RSMAS and the National Oceanography Centre, Southampton, U.K. on a very successful research cruise aboard the R/V *Knorr* from April 13th to May 3rd. During the cruise, more than 40 high-quality conductivity-temperature-depth (CTD) water column profiles were collected, along with acoustic data from three pressure-equipped inverted echo sounder (PIES) instruments. Three PIES instruments were also deployed, while nearly a dozen short and tall moorings of various types were recovered and deployed.

The continuing success of these joint programs has extended the long time-series of Gulf Stream/Florida Current and Deep Western Boundary Current observations that are crucial for the study of climate time-scale ocean processes, for which few long records are available.

A moored autonomous monitoring buoy was deployed in April at the site of the former Integrated Coral Observing Network/Coral Reef Early Warning Station (ICON/CREWS) pylon in Discovery Bay, Jamaica. Surrounded by thriving coral reefs, hourly physical sensor data are being uploaded from the buoy by an RF antenna, processed in near real time, and made available on the Internet by researchers with AOML's Coral Health and Monitoring Program (CHAMP). The buoy installation is the result of a collaborative partnership between the Caribbean Community Climate Change Centre headquartered in Belize and AOML. Eight additional monitoring buoys will be deployed through this effort to help researchers assess environmental conditions at sensitive coral reef sites throughout the wider Caribbean.

Left: Subsurface view of the moored monitoring buoy deployed in Discovery Bay, Jamaica.

Right: A large coral head appears in the foreground, while the buoy's connected underwater "sled," with sensors to measure ocean currents, sea temperature, salinity, and light, appears in the background. The wealth of data gathered will enable researchers to better assess impacts on Jamaica's reefs from climate change, watershed management, and fishing practices.

St. Croix ICON Station Acquires New Caretaker

Jim Hendee of AOML perched atop the ICON station in Salt River Bay, St. Croix. ICON stations gather in situ environmental data to aid in monitoring the health and well-being of coral reefs worldwide.

During the week of May 23rd-27th, the Integrated Coral Observing Network (ICON) program's Jim Hendee and Mike Jankulak traveled to St. Croix. There they met with personnel from the U.S. Virgin Islands' Department of Planning and Natural Resources (DPNR) to collaborate on the swapout of all the St. Croix/Salt River Bay ICON station's instrumentation. More significantly, they also provided training on how to conduct the station's monthly maintenance operations.

Thanks to a new arrangement with NOAA's Coral Reef Conservation Program (CRCP), DPNR has now assumed responsibility for the station's maintenance throughout the year between AOML visits. This important arrangement solves a long-standing problem since the use of commercial dive operators was previously needed to maintain the station and support the ICON program's annual field work. These arrangements were both prohibitively expensive and logistically suboptimal.

Thus, the ICON team is thrilled to have found caretakers from the St. Croix scientific and conservation community. This new relationship may foster in an era of scientific collaboration as other researchers can now bring their projects to Salt River Bay and trust that their work will be supported by St. Croix's best scientific minds.

At Least Darwin Didn't Get It....

If you noticed some unusual instrumentation going into Darwin's pond about a month ago (Darwin is the name of AOML's itinerant crocodile), you might have wondered what was going on. The answer is the first in situ test for Dr. Natchanon Amornthammarong's newly designed autonomous batch ammonia analyzer.

The instrument measures ammonium in natural waters and was created to be used from a variety of observation platforms. The portable system requires a minimal amount of maintenance and has three working ranges covering 0.03-7.0 µM of ammonium.

A description of the instrument appears in the July issue of the journal *Analytical Methods*.[1] Drs. Amornthammarong and Jia-Zhong Zhang of AOML's Ocean Chemistry Division developed the economical sensor in collaboration with Dr. Peter Ortner, Director of the University of Miami's Cooperative Institute for Marine and Atmospheric Studies. Funding support for their collaborative work was provided by the National Oceanographic Partnership Program.

[1]Amornthammarong, N., J.-Z. Zhang, and P. Ortner, 2011: An autonomous batch analyzer for the determination of trace ammonium in natural waters using fluorometric detection. *Analytical Methods,* 3(7):1501-1506.

Additional testing of the analyzer has taken place at Lake Mabel, the southeast Florida shelf, Florida Bay, the Florida Keys, and Port Everglades. The instrument is working well, despite a change in packaging of the recording devices from the original black plastic bags to a sturdier design (see photos at right).

While Darwin at AOML left the instrument alone, curious iguanas at Lake Mabel caused a bit of mischief and cut the testing cycle short. The new packaging is working well at inhibiting iguana attacks.

The recording devices for a new ammonia analyzer developed at AOML were originally wrapped in black plastic bags, as shown above on the left at Lake Mabel. However, marauding iguanas necessitated the development of a more defensive-oriented outer packaging for the instrument, as shown in the photograph on the right.

Drs. Frank Marks and Sundararaman Gopalakrishnan of AOML's Hurricane Research Division were part of a NOAA delegation that met with researchers and forecasters at the Taiwan Central Weather Bureau in June to discuss potential collaborations on tropical cyclone research. Members of the NOAA delegation presented results from its hurricane forecast improvement project (HFIP) and participated in numerous discussions about Taiwan's research interests and activities. Pictured from left to right are Der Song Chen (Taiwan Central Weather Bureau [TCWB]), Deputy Director Tien Chiang Yeh (TCWB), Fanthune Moeng (NOAA), Vijay Tallapragada (NOAA), Director General Tzay Chyn Shin (TCWB), Frank Marks (AOML), Sundararaman Gopalakrishnan (AOML), Jian Win Bao (NOAA), and Ming Dean Cheng (TCWB).

Farewell

Jules Craynock, an oceanographer with the Ocean Chemistry Division, retired from Federal service in June. A former Cold War veteran and P3C Naval aviator, Jules completed 37 years of Federal service which included 27 years as an active NOAA Advanced Working Diver and 32 years at AOML. He was the Deputy Director of AOML's former Ocean Acoustics and Remote Sensing Divisions for 12 years. As the AOML Unit Diving Supervisor for a NOAA record of 21 years, he conducted more than 45 safe and successful oceanographic instrumentation deployments, including seven successful, high-risk Coral Reef Early Warning Station/Integrated Coral Observing Network installations. Jules is pursuing a new career in veterinary sonography, animal rescue work, and returning to his earlier American folk music efforts.

Diana Aranda, a CIMAS research associate, departed from AOML at the end of May. Diana has accepted a position with Biscayne National Park in Homestead, Florida, working with the Water Quality and Adjacent Lands Program of the Division of Resource Management. During her three years at AOML, Diana provided technical support for both the Ocean Chemistry Division's Environmental Microbiology Laboratory and the Physical Oceanography Division's Ship of Opportunity Program. She is grateful to everyone at AOML for their kindness, mentorship, and friendship and looks forward to hopefully collaborating with AOML staff on future studies.

Four members from the Miami Division of the Federal Bureau of Investigation visited AOML on May 27th to raise awareness about safety and security issues in the workplace. Their appearance at AOML was made possible by the South Florida Federal Executive Board. More than 90 staff members attended presentations aimed at providing information on how to best protect personal, physical, cyber, and information technology resources. For those who missed the informative sessions, they were recorded and can be accessed on the AOML intranet at:

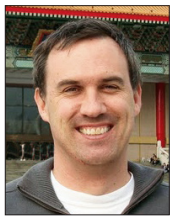
http://intranet.aoml.noaa.gov/safetyrules/SafetyProceduresRules.html

Congratulations

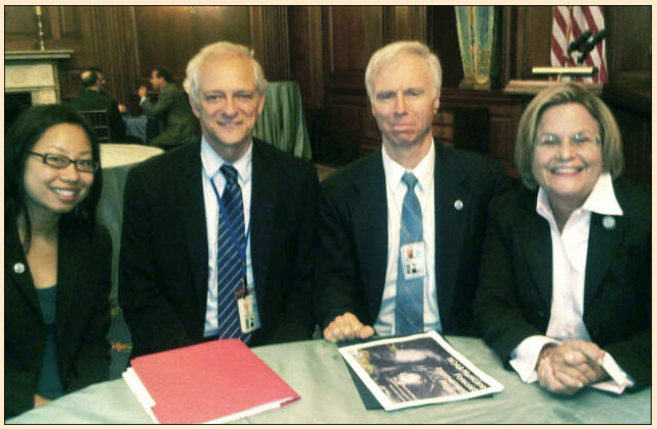
Howard Friedman, Deputy Director of AOML's Hurricane Research Division, has been selected to serve as a member of NOAA's new Workforce Diversity Implementation Strategy Team. The approximate 60-member group is a compilation of staff representing a variety of occupations, geographic locations, positions, and grade levels from across all of NOAA's line and corporate offices. The Team is tasked with developing an implementation plan for workforce diversity and a strategic plan for workplace diversity. These plans are in support of NOAA's overall efforts to recruit and retain qualified employees and, at the same time, create an inclusive workplace that acknowledges and benefits from differences in perspective, thought, background, skill, and experience.

Alan Leonardi, AOML's Deputy Director, has successfully completed all the requirements for the Senior Executive Service (SES) Career Development Program offered through the U.S. Department of Agriculture. The SES program is the primary mechanism used by the federal government for developing civil servants into highly skilled senior executives with leadership and managerial expertise. Alan's training included graduate level course work at American University in Washington, D.C. and a developmental assignment with Google in Mountain View, California. He has subsequently been approved for future SES positions by the Office of Personnel Management Qualifications Review Board.

Alejandra Lorenzo, an information technology specialist with AOML's Computer Networks and Services Division, completed her second triathalon in May as a member of the Leukemia and Lymphoma Society's (LLS) Team in Training. The combined Miami-Dade and Broward county LLS teams raised more than $90,000 from the Miami event that will provide local cancer patients with needed services and support cancer research. Alejandra is grateful to the AOML community for their support of her fundraising efforts through donations to the Monday morning breakfast spreads. She is now training for the follow-up event to the Miami triathalon, the Nike Woman's Marathon, in San Francisco, California, in October 2011.



Robert Rogers, a meteorologist with AOML's Hurricane Research Division, was named the Scientific Employee of the Year by the South Florida Federal Executive Board at its annual Federal Employee of the Year awards banquet in May. Rob was honored for his leadership role during NOAA's 2010 Hurricane Field Program, an effort which involved the collaboration of scientists throughout NOAA, other federal agencies, and academic partners to improve hurricane intensity forecasting. The highlight dataset from the 2010 field program was a multi-day, continuous set of measurements of the lifecycle of Hurricane Earl, which has become one of the most intensively sampled lifecycles for a hurricane ever collected. Rob was also recognized for research that has contributed to a greater understanding of hurricane structure and intensity.



NOAA staff met with Florida Congresswoman Ileana Ros-Lehtinen in Washington, D.C. on May 24th to discuss AOML's research and NOAA's seasonal outlook for the 2011 Atlantic hurricane season. Ros-Lehtinen represents Florida Congressional District 18, which includes Little Havana, Westchester, Miami Beach, and Key Biscayne, as well as the Florida Keys all they way south to Key West. Pictured from left to right are Po Chi Fung (NOAA-Office of Oceanic and Atmospheric Research's Congressional Analysis and Relations Division), Gustavo Goni (AOML), AOML Director Bob Atlas, and Congresswoman Ileana Ros-Lehtinen.

Travel

Chunzai Wang attended the Year of Tropical Convection International Science Symposium and 8th Asian Monsoon Years International Workshop in Beijing, China on May 16-19, 2011.

Alan Leonardi attended a meeting of the Southeast Coastal Ocean Observing Regional Association in Jacksonville, Florida on May 17th, as well as Gulf of Mexico long-term science planning meetings in Tampa, Florida on May 18-19th and New Orleans, Louisiana on June 8-9, 2011.

Dwight Gledhill was an invited participant at the Blue Vision Summit 3 in Washington, D.C. on May 20-23, 2011.

Christopher Sinigalliano and Maribeth Gidley attended the annual meeting of the American Society for Microbiology in New Orleans, Louisiana on May 21-24, 2011.

Bob Atlas attended an OAR Senior Research Council meeting in Washington, D.C. and, together with Gustavo Goni, presented briefings to the White House Office of Science and Technology Policy and Congress on May 23-26; Bob also presented a seminar and met with faculty and students at the University of Maryland in College Park, Maryland, and met with scientists and managers at the NASA-Goddard Space Flight Center in Greenbelt, Maryland on June 22-24, 2011.

Guen-Ha Park and Rik Wanninkhof attended a meeting of the Regional Carbon Cycle Assessment and Processes (RECCAP) effort in Shepherdstown, West Virginia on May 22-27, 2011.

Michael Black made an invited presentation to about 350 emergency managers and local officials from the Gulf Coast region at a seminar hosted by ImpactWeather in Houston, Texas on May 24, 2011.

Robert Rogers was an invited participant at the Genesis and Rapid Intensification Processes (GRIP) Post-Mission Science meeting in Pasadena, California on June 6-8, 2011.

Yeun-Ho Daneshzadeh and Gustavo Goni attended a meeting for the Global Temperature-Salinity Profile Program in Washington, D.C. on June 6-10, 2011.

Pedro Di Nezio made an invited presentation on the El Niño phenomenon at the Massachusetts Institute of Technology in Cambridge, Massachusetts on June 10, 2011.

Frank Marks was the keynotes speaker at the 2011 International Workshop on Typhoon and Flood in Taipei, Taiwan on June 23-24, 2011.

Recent Publications *(AOML authors are denoted by capital letters)*

ATLAS, R., R.N. Hoffman, J. Ardizzone, S.M. Leidner, J.C. Jusem, D.K. Smith, and D. Gombos, 2011: A cross-calibrated, multi-platform ocean surface wind velocity product for meteorological and oceanographic applications. *Bulletin of the American Meteorological Society,* 92(2):157-174 (doi:10.1175/2010BAMS2946.1).

BARBERO, L., J. Boutin, L. Merlivat, N. Martin, T. Takahashi, S.C. Sutherland, and R. WANNINKHOF, 2011: Importance of water mass formation regions for the air-sea CO_2 flux estimate in the Southern Ocean. *Global Biogeochemical Cycles,* 25:GB1005, 16 pp. (doi:10.1029/2010GB003818).

Bender, M.L., S. Kinter, N. Cassar, and R. WANNINKHOF, 2011: Evaluating gas transfer velocity parameterizations using upper ocean radon distributions. *Journal of Geophysical Research,* 116:C02010, 11 pp. (doi:10.1029/2009JC005805).

Brassington, G.B., N. Summons, and R. LUMPKIN, 2011: Observed and simulated Lagrangian and eddy characteristics of the East Australian Current and the Tasman Sea. *Deep-Sea Research, Part II,* 58(5):559-573 (doi:10.1016/j.dsr2.2010.10.001).

DUNION, J.P., 2011: Re-writing the climatology of the tropical North Atlantic and Caribbean Sea atmosphere. *Journal of Climate,* 24(3):893-908 (doi: 10.1175/2010JCLI3496.1).

HELMLE, K.P., and R.E. Dodge, 2011: Sclerochronology. In *Encyclopedia of Modern Coral Reefs: Structure, Form, and Process,* D. Hopley (ed.). Springer Verlag, pp. 958-966 (doi:10.1007/978-90-481-2639-2).

HELMLE, K.P., R.E. Dodge, P.K. Swart, D.K. GLEDHILL, and C.M. Eakin, 2011: Growth rates of Florida corals from 1937 to 1996 and their response to climate change. *Nature Communications,* 2:215 (doi:10.1038/ncomms1222).

LUMPKIN, R., and S.L. GARZOLI, 2011: Interannual to decadal changes in the western South Atlantic's surface circulation. *Journal of Geophysical Research,* 116:C01014, 10 pp. (doi:10.1029/ 2010JC006285).

MURILLO, S.T., W.-C. Lee, M.M. Bell, G.M. Barnes, F.D. MARKS, and P.P. DODGE, 2011: Intercomparison of ground-based velocity track display (GBVTD) retrieved circulation centers and structures of Hurricane Danny (1997) from two coastal WSR-88Ds. *Monthly Weather Review,* 139(1):153-174 (doi:10.1175/2010MWR3036.1).

Pandya, R., D. Smith, S.A. Ackerman, P.P. Brahma, D.J. Charlevoix, S.Q. Foster, V.K. Gaertner, T.F. Lee, M.J. Hayes, A. Mostek, S.T. MURILLO, K.A. Murphy, L. Olsen, D.M. Stanitski, and T. Whittaker, 2011: A summary of the 18th Symposium on Education. *Bulletin of the American Meteorological Society,* 92(1):61-64 (doi:10.1175/2010BAMS2933.1).

Plano, L.R.W., A. Garza, T. SHIBATA, S.M. Elmir, J. Kish, C.D. SINIGALLIANO, M.L. GIDLEY, G. Miller, K. Withum, L.E. Fleming, and H.M. Solo-Garbriele, 2011: Shedding of *Staphylococcus aureus* and methicillin-resistant *Staphylococcus aureus* from adult and pediatric bathers in marine waters. *BMC Microbiology,* 11:5 (doi:10.1186/1471-2180-11-5).

Song, Z.-Y., F.-L. Qiao, and C. WANG, 2011: The correctness to the spuriously simulated semi-annual cycle of the sea surface temperature in the equatorial eastern Pacific. *Science China Earth Sciences,* 54(3):438-444 (doi:10.1007/s11430-011-4176-3).

Stanley, G.D., and K.P. HELMLE, 2010: Middle Triassic coral growth bands and their implication for photosymbiosis. *Palaios,* 25(12):754-763 (doi:10.2110/palo.2010.p10-039r).

Turk, D., C.J. Zappa, C.S. MEINEN, J.R. Christian, D.T. Ho, A.G. Dickson, and W.R. McGillis, 2010: Rain impacts on CO_2 exchange in the western equatorial Pacific Ocean. *Geophysical Research Letters*, 37:L23610, 6 pp. (doi:10.1029/2010GL045520).

ZHANG, X., T.S. QUIRINO, K.-S. YEH, S.G. GOPALAKRISHNAN, F.D. MARKS, S.B. GOLDENBERG, and S.D. ABERSON, 2011: HWRFx: Improving hurricane forecasts with high-resolution modeling. *Computing in Science and Engineering,* 13(1):13-21 (doi:10.1109/MCSE.2010.121).

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