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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

New AA Selected to Lead NOAA Research

Dr. Robert Detrick was selected as the Assistant Administrator of NOAA's Office of Oceanic and Atmospheric Research in January and began his new duties on February 13, 2012. As OAR Assistant Administrator, Dr. Detrick will serve as acting chair of the NOAA Research Council and will lead efforts to advance NOAA's climate and key science enterprise goals.

Before joining NOAA, Dr. Detrick was the Director of the National Science Foundation's Division of Earth Sciences, a position he held since November 2008 while on leave from the Woods Hole Oceanographic Institution (WHOI). At WHOI, he was a senior scientist with more than 20 years of research experience and the vice president of marine facilities and operations.

A marine geophysicist, Dr. Detrick has published more than 100 papers on the seismic structure of mid-ocean ridges and oceanic crust; the size, depth, and properties of ridge crest magma chambers; and the nature of mantle flow beneath mid-ocean ridges.

He was elected a Fellow of the American Geophysical Union in 1994 and received the A.G. Huntsman Award for Excellence in Marine Science in 1996 in recognition of his "seminal contributions that have led to improved understanding of the genesis and evolution of the oceanic lithosphere."

Dr. Detrick holds a bachelor's degree in geology and physics from Lehigh University (1971), a master's degree in marine geology from the University of California, San Diego (1974), and a doctorate degree in oceanography from the Massachusetts Institute of Technology/WHOI Joint Program (1978).

AOML Teams with NASA to Study Role of Salinity in the Tropical Atlantic

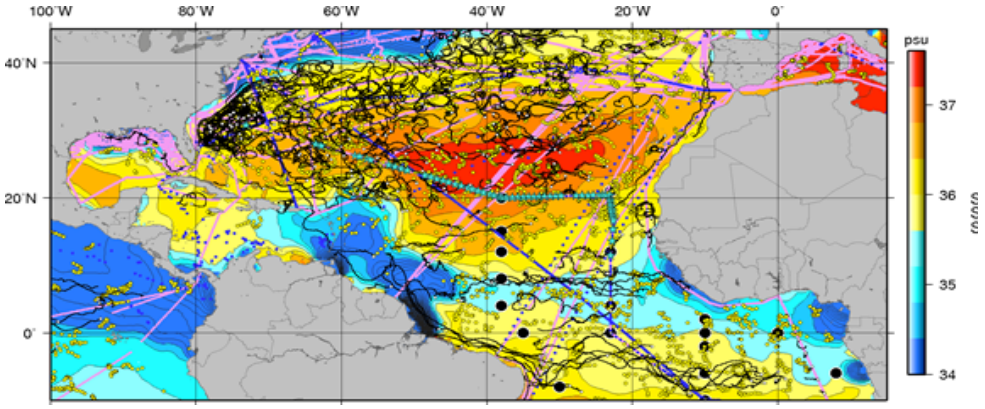
In August 2012, NASA will lead an inter-agency field experiment to study the mechanisms that control the upper ocean's salinity content. With support from NOAA, the Woods Hole Oceanographic Institution, and several academic and international partners, SPURS, or the Salinity Processes in the Upper Ocean Regional Study, will gather satellite and in situ observations in the salinity maximum region of the North Atlantic Ocean.

The salinity of seawater affects its density, which drives ocean circulation and climate. The one-year effort seeks to better understand the links between the global water cycle, ocean circulation, and climate by measuring sea surface salinity. Two new satellites that remotely measure surface salinity—SMOS and Aquarius—are critical to the success of SPURS.

AOML researchers will participate in the SPURS effort by contributing their expertise and by providing sustained ocean observations. Additionally, AOML will be enhancing its AX08 and AX10 expendable bathythermograph (XBT) transects from Cape Town, South Africa to New York and from Spain to Miami, respectively. AOML is also collaborating with researchers at the University of Paris to gather data along the AX20 XBT transect, which runs between France and French Guyana.

These XBT transects will provide temperature data four to five times during 2012 across the region of salinity maximum, which will be key to assessing the tropical ocean current system partly responsible for the fresh water budget. AOML will also provide support for SPURS by servicing new equipment installed on the PIRATA northeast extension (PNE) moorings, and by providing temperature and salinity profiles from an underway conductivity-temperature-depth instrument during the upcoming PNE cruise in August 2012. Key to this experiment and to understanding and assessing the value of the salinity satellite missions will be the deployment of surface drifters in the regions containing salinity sensors, of which AOML will be leading the data processing efforts.

Gustavo Goni of AOML's Physical Oceanography Division (PhOD) is a member of the SPURS science steering team and will host the 2013 SPURS Science Team meeting, while Rick Lumpkin, also of PhOD, will lead AOML's surface drifter efforts.



Location of typical sustained ocean observations carried out during a three-month period in the Atlantic Ocean, some of which AOML plays a key role to implement and maintain: XBT transects (blue lines), thermosalinograph observations (purple lines), surface drifters (black lines), PIRATA moorings (black circles), underway CTD (blue circles), and Argo floats (yellow circles).

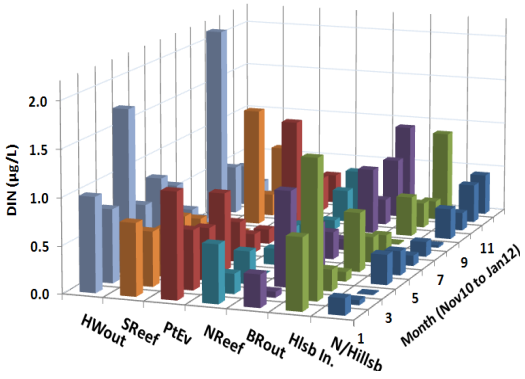
Sampling Cruises Assess Southeast Florida's Coastal Water Quality

In January, AOML's Ocean Chemistry Division (OCD) completed a year-long effort to assess southeast Florida's coastal water quality. OCD researchers conducted 12 monthly sampling cruises offshore of Broward County, an area that includes Port Everglades, one of the busiest cruise ship ports in the world, and the Hollywood and Broward treated-wastewater outfall sites (see figure at far right).

Southeast Florida is a densely populated region of about 5.5 million residents along an approximate 142-kilometer stretch of coastline. The coastal waters of Miami-Dade, Broward, and Palm Beach counties have high water clarity with low nutrient, organic matter, and phytoplankton concentrations and are home to three coral reef tracts of considerable economic, ecological, and aesthetic value.

However, there are significant nutrient inputs to the region, including coastal inlets, wastewater outfalls, groundwater discharge, advected waters from distant sources (e.g., the Mississippi River or southwest Florida), atmospheric deposition, and ocean upwelling. OCD has conducted sampling studies for the past few years to understand the impact of these nutrient sources on water quality, in particular, anthropogenic discharges from coastal inlets and wastewater outfalls.

The microbiological, chemical, and physical data gathered from the just-completed series of cruises will help provide a clearer perspective of the overall nutrient characteristics along the southeast Florida coast and enable a better determination of the region's nutrient sources.

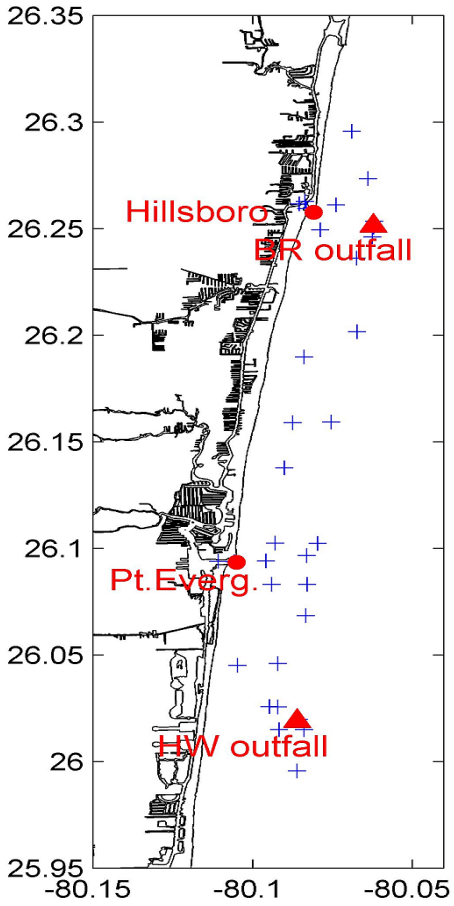


The averaged concentration of dissolved inorganic carbon found at various sampling sites offshore of Broward County.

They will also serve as a baseline for future observations of water quality.

The figure above presents an overview of the dissolved inorganic nitrogen (DIN, nitrate+nitrite+ammonium averaged over depths) concentrations for groups of samples at various sites. The area to the north of Hillsboro Inlet is quite low in the concentration of this analyte, whereas the areas south of the Hillsboro Inlet had more elevated DIN concentrations, with the highest levels occurring at the Hollywood and Broward outfall sites and at the Port Everglades and Hillsboro inlets. However, even samples from locations more distant from the inlets and outfall sites had higher concentrations than expected, based on a similar study near the South Central outfall and Boynton Inlet to the north.

With the completion of the monthly sampling cruises, OCD researchers are now working on a series of tracer experiments using a red dye to be placed in the plumes generated by the Hollywood and

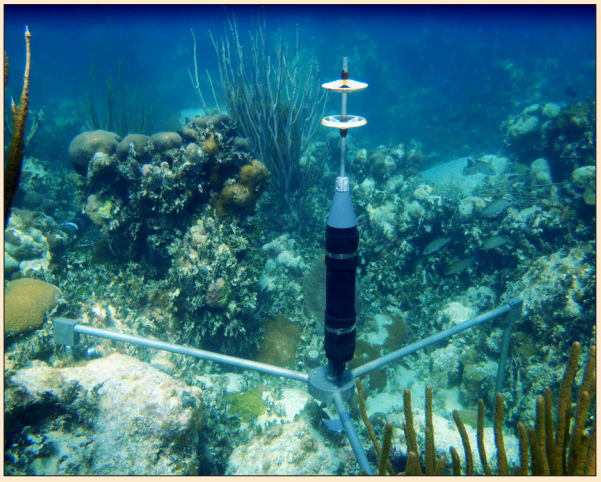


The southeast Florida coast showing the location of sampling sites (+), treated-wastewater outfall sites (▲), and coastal inlets (●) during the Ocean Chemistry Division's water quality sampling cruises.

Broward treated-wastewater ocean outfalls. The emphasis of the experiments will be to determine the extent of the horizontal and vertical diffusion of the plumes, with particular interest on the reef tracts located near the outfalls.

AOML coral researchers—Dwight Gledhill, Derek Manzello, Ian Enochs, and Lewis Gramer—conducted the first of a series of repeat coral reef metabolic studies at Cheeca Rocks in the Florida Keys on January 6-13, 2012. They were joined by a science team from Columbia University, the University of Miami's Rosenstiel School, and the University of Rhode Island to gather data on net ecosystem calcification, net community productivity, benthic community coverage, coral growth and calcification, and reef bioerosion. Three new acoustic Doppler current profiler/wave sensors were also deployed as part of a year-long study on reef circulation in support the Atlantic Ocean Acidification Testbed (AOAT) project funded by NOAA's Coral Reef Conservation Program.

The AOAT project seeks to better understand the effects of ocean acidification on seawater chemistry, marine species, and marine ecosystems. As atmospheric carbon dioxide (CO_2) levels have increased, oceanic pH levels have declined due to greater amounts of CO_2 being absorbed into the oceans and the formation of carbonic acid. Ocean acidity thus poses a significant challenge to reef-forming coral and other marine organisms dependent upon calcium carbonate to build the structures in which they live.



A coral reef oxygen sensing system (CROSS) was deployed on the ocean floor at Cheeca Rocks in the Florida Keys on January 6th. The instrument uses a boundary layer gradient flux methodology, developed by Wade McGillis of Lamont-Doherty Earth Observatory, to measure reef community productivity.

Intrinsic Art: The Beauty of a Coral Reef

As part of AOML's continuing efforts to inform the public about the beauty and fragility of marine ecosystems, AOML coral reef researcher Dr. Jim Hendee wrote the following article that appeared in the February 2012 issue of DEON, a local south Florida magazine that promotes the region's cultural, dining, and nightlife venues.


Closeup of flower coral (*Eusmilia fastigiata*)

After being a certified SCUBA diver for over 40 years, I didn't think the beauty of a coral reef would affect me any differently than it had at all the other great diving spots I've been so fortunate to visit over the years. That day a few years ago, though, that I passed over the Great Barrier Reef, just scant inches below my chest, I literally almost cried in my mask from the beauty of the diverse shapes and colors of the hundreds of marine organisms.

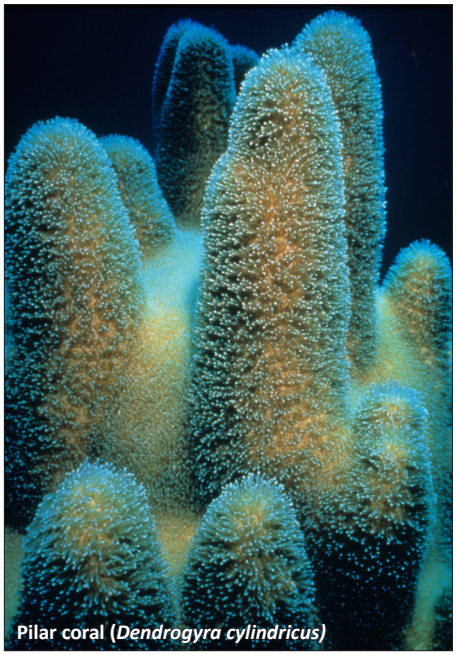
That beauty was here, too, in the Florida Keys and off the Fort Lauderdale coast, back when I was a kid. Now I'm a professional marine scientist, and my colleagues and I fight the three major challenges to the future of coral reefs: climate change, impacts of over-fishing, and land-based sources of pollution. In this issue of *DEON*, I'd like to briefly discuss one of the consequences of climate change, "ocean acidification."As you are probably aware, the acidity of a solution (such as the ocean) is measured in units of potential hydrogen, abbreviated pH.

A neutral solution has a pH of 7, an acidic solution less than that, and a basic solution more than that. The pH of the oceans back in the 18th Century was about 8.179; today it is about 8.069. This change has come about because the oceans are taking up carbon dioxide (CO_2) from the atmosphere.

In fact, about one-third of all the CO_2 put into the atmosphere since the Industrial Revolution has ended up in the oceans. The CO_2 in the atmosphere is, of course, rising due to increased activities by human beings, such as the burning of fossil fuels like gasoline, diesel, and coal. Thus, the lowering of the pH of the ocean toward 7 is what we mean by ocean acidification. The ocean is not acid, it's just heading that way. By the year 2100, it has been calculated that, at the present rate of acidification, the ocean pH will drop to 7.824 (i.e., still a basic solution, but more acidic than it was).

You may well ask, "So what?" The answer is that this increasing CO_2 affects the skeletal and supporting structures of many marine organisms, such as corals, coralline algae, oysters, beautiful little single-celled algae called coccolithophores, and little amoeboid foraminiferans. These organisms use CO_2 in the minerals calcite, aragonite, or high-magnesium calcite that constitute their skeletal structure. Under experimental conditions, scientists have found that an increase in CO_2 in seawater results in a decreased ability for these organisms to form their skeletal structure and, therefore, they become misshaped and weakened.

Again, you may well ask, "So what?" Well, aside from the intrinsic beauty of these organisms, and the fact that every living thing affects and is effected by other living things, coral reefs and the organisms that live in or near them support global commerce at a value of about $375 billion per year. They provide ecosystem services such as tourism, fishing, diving, and shoreline protection from storms and tsunamis.


Pilar coral (*Dendrogyra cylindricus*)

Where would our south Florida economy be without the beautiful coral reefs offshore and in the Florida Keys National Marine Sanctuary? What would happen if there were no more fish because there were no more coral reefs for them to live in? What would diving be like on reefs that were nothing more than colorless dead rocks? How badly would the hurricanes inundate our coastal areas if there were no reefs to help break the storm waves? Let's all do what we can to conserve one of Mother Nature's greatest pieces of art, the coral reef.


Staghorn coral (*Acropora cervicornis*)

AOML Staff Videos Debut

AOML employees bring a broad range of skills and expertise to the workplace every day to help advance NOAA's Research and science mission. A new series of video podcasts produced at AOML highlights the Laboratory's leadership, scientists, and support staff.

Meet some of AOML's employees, learn a bit about their jobs, and why they chose a career with NOAA by browsing the collection of interviews on the AOML website:

www.aoml.noaa.gov/outreach/interview/index.html

Featured AOML employees include:

Robert Atlas	AOML Director
Joseph Bishop	Ocean Engineer
Lisa Bucci	Hurricane Researcher
Gail Derr	Technical Editor
Christopher Kelble	Biological Oceanographer
Alan Leonardi	AOML Deputy Director
Mayra Pazos	Manager, Drifter Data Assembly Center
Paul Reasor	Hurricane Researcher
Andrew Stefanick	Ocean Engineer

2012 Federal Holidays

New Year's Day
Monday, January 2nd

Martin Luther King, Jr. Birthday
Monday, January 16th

Washington's Birthday
Monday, February 20th

Memorial Day
Monday, May 28th

Independence Day
Wednesday, July 4th

Labor Day
Monday, September 3rd

Columbus Day
Monday, October 8th

Veterans Day
Monday, November 12th

Thanksgiving Day
Thursday, November 22nd

Christmas Day
Tuesday, December 25th

Congratulations

Cheryl Brown, a CIMAS research associate with AOML's Ocean Chemistry Division (OCD), earned her Merchant Mariner Credential from the U.S. Coast Guard in January. For the past two years, Cheryl has been accumulating sea days while participating in research cruises in support of OCD's coastal ocean programs aboard the research vessels *Cable, Hildebrand,* and *F.G. Walton Smith.* Having met all the requirements for an Operator of Uninspected Passenger Vessels in accordance with the International Convention on Standards of Training, Certification, and Watchkeeping for Seafarers, Cheryl is now qualified to operate vessels up to 100 gross tons in coastal waters not more than 100 nautical miles offshore.

Pamela Fletcher, a Florida Sea Grant Program marine ecosystem outreach coordinator at AOML, was selected as a U.S. Department of State Climate Change Fellow in January. In fulfillment of her duties as a Climate Change Fellow, Pamela visited San Andres, Colombia in February to develop science-based outreach materials for the Seaflower Biosphere Reserve, a 350,000 square kilometer marine protected area in the southwestern Caribbean Sea. At AOML, Pamela serves as a liaison between NOAA and the public for research, management, and restoration efforts in the Everglades, south Florida, and Florida Keys. Her expertise includes water quality policy, coastal restoration, and coral reef ecology.

AMS President Jon Malay with Shirley Murillo.

Shirley Murillo, a meteorologist with AOML's Hurricane Research Division, received the Dr. Charles E. Anderson award in January while attending the American Meteorological Society's (AMS) 92nd meeting in New Orleans, Louisiana. The Anderson Award is presented annually in recognition of outstanding contributions to the promotion of diversity in the atmospheric and related sciences and broader communities through education and community service. Shirley received the Anderson Award for her "outstanding support of minorities and women to promote a more diverse workforce through mentoring, education, and community service."

In addition Shirley's outreach and advocacy efforts, Shirley has also served on the AMS' Board of Women and Minorities, its National Scholarship Selection Committee, and the Education Symposium Program Committee. A 14-year veteran with the Hurricane Research Division, Shirley specializes in producing hurricane surface wind analyses. These analyses depict the extent of a hurricane's wind field and the location of the strongest winds. She holds a master's degree in meteorology from the University of Hawaii.

Mark Powell, a meteorologist with AOML's Hurricane Research Division, was made a Fellow of the American Meteorological Society (AMS) in January during the AMS' 92nd meeting in New Orleans, Louisiana. Fellows are chosen annually in acknowledgment of their outstanding long-term contributions to the atmospheric sciences. Mark was recognized for his more than 30 years of research that has advanced the state of tropical cyclone knowledge through improvements in real-time wind field monitoring and analysis, rainband structure and dynamics, and hurricane boundary layer structure. He is credited with having developed a hurricane wind analysis system that led to substantial improvements in understanding the extent and strength of the hurricane wind field. His subsequent research on hurricane wind profiles contributed to major improvements in the numerical modeling of hurricanes for track and intensity forecasting, as well as for predicting storm surge and waves. More recently, Mark has developed an Integrated Kinetic Energy scale for assessing tropical cyclone damage potential that expands upon the Saffir-Simpson scale currently used to evaluate tropical cyclones.

Travel

Gustavo Goni attended a Principal Investigator Planning Meeting for the Salinity Processes in the Upper Ocean Regional Study (SPURS) in Seattle, Washington on January 18-19, 2012.

Bob Atlas attended the 92nd annual meeting of the American Meteorological Society in New Orleans, Louisiana on January 22-26, 2012 where he served as Program Chair for the Integrated Observing and Assimilation Conference, Session Chair for three sessions, and as a coauthor of several papers. He also made three invited presentations at the Regional Observing System Simulation Experiment Workshop in Norman, Oklahoma on February 6-8, 2012.

George Halliwell, Frank Marks, Shirley Murillo, and Mark Powell attended the 92nd annual meeting of the American Meteorological Society in New Orleans, Louisiana on January 22-26, 2012.

Shirley Murillo was an invited speaker and trainer at the Regional Conference of the National Geographic's JASON Project in Cincinnati, Ohio on January 26-28, 2012.

James Farrington gathered expendable bathythermograph (XBT) data along the AX18 transect across the South Atlantic Ocean from Buenos Aires, Argentina to Cape Town, South Africa on January 30-February 20, 2012.

Alan Leonardi attended the winter meeting of NOAA's Southeast and Caribbean Regional Collaboration Team in Charleston, South Carolina on January 31-February 2, 2012.

Christopher Sinigalliano attended a meeting of the Gulf of Mexico Alliance Coordination Team in Biloxi, Mississippi on February 13-16, 2012.

Frank Marks made an invited presentation at the Second Conference on Tropical Cyclones and Climate Change in New Delhi, India on February 14-17, 2012.

Shenfu Dong, Gregory Foltz, David Lindo, Hailong Liu, Rick Lumpkin, Derek Manzello, and Rik Wanninkhof attended the 2012 Ocean Sciences Meeting in Salt Lake City, Utah on February 20-24, 2012.

James Haynes attended the NOAA Leadership Effectiveness and Advancement Program (LEAP) in Silver Spring, Maryland on February 28-March 2, 2012.

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

Abdelzaher, A.A., M.E. Wright, C. Ortega, A.R. Hasan, T. SHIBATA, H.M. Solo-Gabriele, J. Kish, K. Withum, G. He, S.M. Elmir, J.A. Bonilla, T.D. Bonilla, C.J. Palmer, T.M. Scott, J. Lukasik, V.J. Harwood, S. McQuaig, C.D. SINIGALLIANO, M.L. GIDLEY, D. WANLESS, L.R.W. Plano, A.C. Garza, X. Zhu, J.R. Stewart, J.W. Dickerson, H. Yampara-Iquise, C. Carson, J.M. Fleisher, and L.E. Fleming, 2011: Daily measures of microbes and human health at a non-point source marine beach. *Journal of Water and Health,* 9(3):443-457 (doi:10.2166/wh.2011.146).

Dietrich, J.C., J.J. Westerink, A.B. Kennedy, J.M. Smith, R.E. Jensen, M. Zijlema, L.H. Holthuijsen, C. Dawson, R.A. Luettich, M.D. POWELL, V.J. Cardone, A.T. Cox, G.W. Stone, H. Pourtaheri, M.E. Hope, S. Tanaka, L.G. Westerink, H.J. Westerink, and Z. Cobell, 2011: Hurricane Gustav (2008) waves and storm surge: Hindcast, synoptic analysis, and validation in southern Louisiana. *Monthly Weather Review,* 139(8):2488-2522 (doi:10.1175/2011MWR3611.1).

DI NEZIO, P.N., A. Clement, G.A. Vecchi, B. Soden, A.J. Broccoli, B.L. Otto-Bleisner, and P. Braconnot, 2011: The response of the Walker circulation to Last Glacial Maximum forcing: Implications for detection in proxies. *Paleoceanography,* 26:PA3217 (doi:10.1029/2010PA002083), 21 pp.

DONG, S., S.L. GARZOLI, and M.O. BARINGER, 2011: The role of interocean exchanges on decadal variations of the meridional heat transport in the South Atlantic. *Journal of Physical Oceanography,* 41(8):1498-1511 (doi:10.1175/2011JPO4549.1).

Guimond, S.R., M.A. Bourassa, and P.D. REASOR, 2011: A latent heat retrieval and its effects on the intensity and structure change of Hurricane Guillermo (1997). Part I: The algorithm and observations. *Journal of the Atmospheric Sciences,* 68(8):1549-1567 (doi:10.1175/2011JAS3700.1).

LEE, S.-K., W. Park, E. van Sebille, M.O. BARINGER, C. WANG, D.B. ENFIELD, S.G. Yeager, and B.P. Kirtman, 2011: What caused the significant increase in Atlantic Ocean heat content since the mid-20th century? *Geophysical Research Letters,* 38:L17607 (doi:10.1029/2011GL048856), 6 pp.

Lirman, D., S. Schopmeyer, D. MANZELLO, L.J. GRAMER, W.F. Precht, F. Muller-Karger, K. Banks, B. Barnes, E. Bartels, A. Bourque, J. Byrne, S. Donahue, J. Duquesnel, L. Fisher, D. Gilliam, J. HENDEE, M. Johnson, K. Maxwell, E. McDevitt, J. Monty, D. Rueda, R. Ruzicka, and S. Thanner, 2011: Severe 2010 cold-water event caused unprecedented mortality to corals of the Florida Reef Tract and reversed previous survivorship patterns. *PLoS ONE,* 6(8):E23047 (doi:10.1371/journal.pone.0023047).

Miller, S.R., A.M. WOOD, R.E. Blankenship, M. Kim, and S. Ferriera, 2011: Dynamics of gene duplication in the genomes of chlorophyll d-producing cyanobacteria: Implications for the ecological niche. *Genome Biology and Evolution,* 3:601-613 (doi:10.1093/gbe/evr060).

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ZHANG, J.A., R.F. ROGERS, D.S. Nolan, and F.D. MARKS, 2011: On the characteristic height scales of the hurricane boundary layer. *Monthly Weather Review,* 139(8):2523-2535 (doi:10.1175/MWR-D-10-05017.1).

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Alan Leonardi .....Deputy Director
Hector Casanova.....Associate Director
Silvia Garzoli .....Chief Scientist
Frank Marks.....Hurricane Research Division Director
Michelle Wood .....Ocean Chemistry Division Director
Gustavo Goni .....Physical Oceanography Division Director

Keynotes is published bimonthly to highlight AOML's recent research activities and staff accomplishments.

***Keynotes* publishing editor:** Gail Derr
www.aoml.noaa.gov/keynotes

AOML conducts 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 provide knowledge that leads to more accurate forecasting of severe storms, better utilization and management of marine resources, better understanding of the factors affecting both climate and environmental quality, and improved ocean and weather services for the nation.