July-August 2013
Vol. 17/No. 4

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

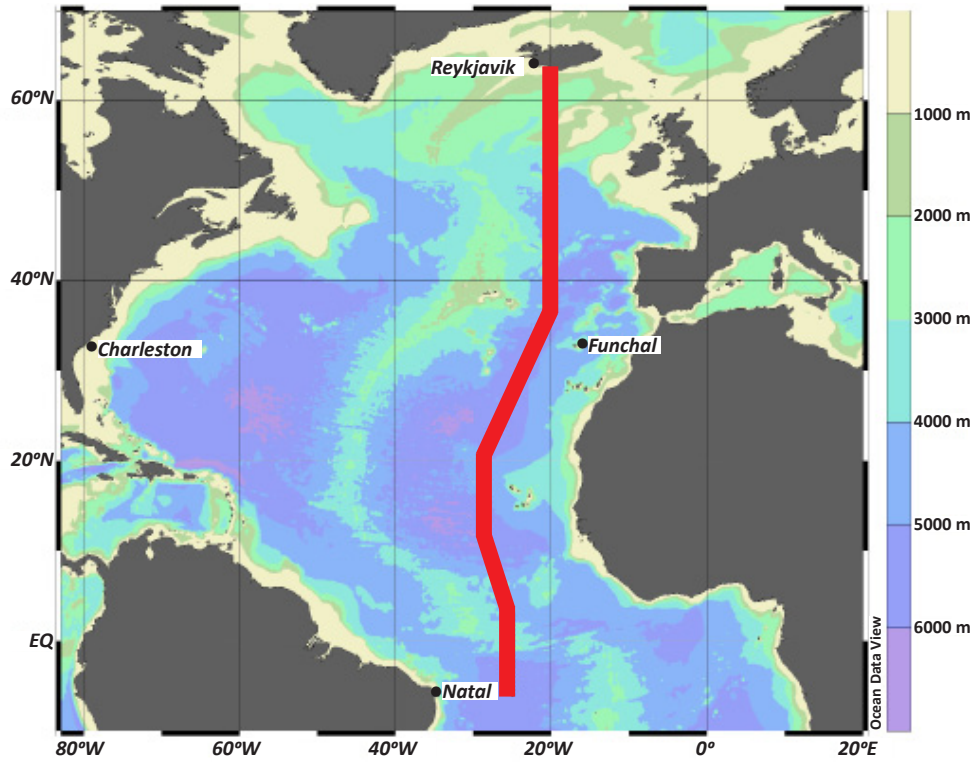
A16N Cruise Documents Decadal Impacts of Climate Change in the Atlantic

Scientists from two NOAA research laboratories and 12 academic institutions boarded the NOAA Ship *Ronald H. Brown* in August to take part in the GO-SHIP (Global Ocean Ship-Based Hydrographic Investigation Program) A16N repeat hydrography cruise from Reykjavik, Iceland to Natal, Brazil. The two-leg transect from 60°N to 5°S was undertaken as part of a decadal effort to monitor changes in the quantity and transport of carbon dioxide, heat, and freshwater in the ocean, as well as assess variability in the ocean's biogeochemical and physical properties.

The *Brown* departed Reykjavik on August 3rd for the start of leg 1 with Drs. Molly Baringer and Denis Volkov of AOML's Physical Oceanography Division serving as chief and co-chief scientists. AOML scientists Robert Castle, Charles Featherstone, Charles Fischer, Jay Hooper, Andrew Stefanick, and Kevin Sullivan were also aboard the *Brown* as part of the scientific team.

During the leg 1 transect, seawater samples were collected every 30 nautical miles from the surface to the bottom of the ocean with the aid of a conductivity-temperature-depth-oxygen (CTD/O_2) water sampler package. At these full water column stations, researchers measured dissolved organic and inorganic carbon, tritium/helium, chlorofluorocarbons, the partial pressure of carbon, pH, alkalinity, and an array of nutrients and other parameters from sampling bottles, along with salinity, oxygen, temperature, and velocity from sensors on the package. A trace metal team also gathered data from a separate CTD water sampler every 1° of latitude.

These data are used to study the physical, chemical, and hydrographic changes occurring in the ocean over time. The data also support the calibration and validation of models, as well as autonomous sensors.



Cruise track (denoted by red line) of the NOAA Ship *Ronald H. Brown* during the A16N transect through the Atlantic Ocean from 60°N to 5°S.

The A16N cruise followed the same track through the Atlantic as did two previous NOAA-led cruises in 1993 and 2003. The sampling in 2003 showed a decrease in carbon uptake in the North Atlantic as compared to the South Atlantic. However, recent (*continued on page 2)*

The NOAA Ship *Ronald H. Brown* at port in Reykjavik, Iceland before the start of the A16N cruise.

Scientists participating in leg 1 of the A16N cruise observed icebergs floating in the Jökusárlón lagoon overlooking Vatnajökull, Iceland's largest glacier.

(*continued from page 1*)

Leg 1 researchers were delighted to spot a pod of pilot whales that briefly swam alongside the *Brown* during its southward voyage through the Atlantic. Photo courtesy of Josh Levy.

Kevin Sullivan of AOML works to measure the fugacity of carbon dioxide in water column samples gathered during leg 1. Photo courtesy of Rachel Shelley.

Rough seas in the Atlantic courtesy of Hurricane Humberto. The *Brown* diverted its course almost 200 miles eastward to avoid a direct impact from the storm during leg 2. Photo courtesy of Josh Levy.

surface measurements from ships of opportunity suggest an increasing carbon uptake over the last decade that will be verified and quantified during this cruise. Many of the same scientists who participated in the 2003 cruise were aboard the *Brown* for the current sampling effort to observe the changes that have occurred in the Atlantic over the past ten years.

Leg 1 concluded on August 23rd as the *Brown* made its scheduled port stop in Funchal, Madeira. Due in part to favorable weather, leg 1 researchers were able to gather data from all 66 planned stations along the A16N transect, as well as four additional stations. Enroute to Madeira, they also deployed ten ocean observing surface drifting buoys and two Argo profiling floats.

Leg 2 began with the *Brown's* delayed departure from Madeira on September 1st due to air conditioning repairs. Dr. John Bullister and Rolph Sonnerup of NOAA's Pacific Marine Environmental Laboratory served as the chief and co-chief scientists. AOML participants for leg 2 included Leticia Barbero, Robert Castle, Charles Featherstone, Charles Fischer, Jay Hooper, and Andrew Stefanick.

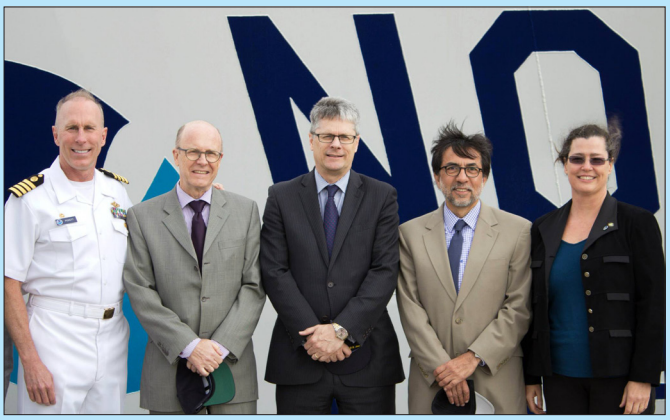
After two successful weeks of full water column sampling operations, the *Brown* was forced to divert its course eastward by almost 200 miles away from the A16N transect to avoid the path of Hurricane Humberto, the Atlantic's first hurricane of the 2013 season.

The *Brown* resumed operations along the A16N track a few days later only to be thwarted by a cable break that resulted in the catastrophic loss of the CTD water sampler and its associated instruments. Sampling operations resumed with the aid of a backup CTD sampler and resolution of the winch/cable issues. The A16N cruise ended with the *Brown's* arrival in Natal, Brazil on October 3rd.

Data gathered along the A16N transect in the Atlantic are focused on improving knowledge of the impact of global change and variability on the ocean interior, including changes in the hydrological cycle, heat storage and transport, and the carbon system. Measurements of the distribution of iron in the North Atlantic will serve as the means to assess future changes in the ocean's biogeochemical cycle in response to natural and/or anthropogenic activities.

The A16N cruise was jointly sponsored by NOAA's Climate Program Office and the National Science Foundation. More information about the cruise is at http://www.aoml.noaa.gov/ocd/gcc/A16N/.

Ambassadors to Iceland from Norway, the United Kingdom, and United States visited the NOAA Ship *Ronald H. Brown* on July 31st shortly before the start of the A16N cruise. Commanding Officer Mark Pickett welcomed the ambassadors aboard ship and provided a tour of the *Brown's* state-of-the-art facilities, while Chief Scientist Molly Baringer of AOML discussed the A16N's scientific mission and objectives. Staff from the offices of the German and Russian ambassadors to Iceland were also present. The ambassadors' visit to the *Brown,* along with information about the A16N effort to resample the Atlantic, were featured in local Reykjavik news stories and media broadcasts.



Captain Mark Pickett, Commanding Officer of the NOAA Ship *Ronald H. Brown,* with Iceland ambassadors Dal Holter (Norway), Stuart Gil (United Kingdom), and Luis Arreaga (United States), along with leg 1 Chief Scientist Molly Baringer of AOML.

Molly Baringer of AOML explains to the *Brown's* distinguished guests how scientists use a CTD/O_2 (conductivity-temperature-depth-oxygen) water sampler package lowered via cable into the ocean to gather data about the physical and chemical properties of the water column.

AOML's Hurricane Researchers Support NASA's HS3 Global Hawk Missions

This summer, AOML's hurricane scientists expanded their observations by collaborating with NASA on its Hurricane and Severe Storm Sentinel (HS3) mission. Due to their expertise, NASA looked to AOML's hurricane researchers to augment its science team in support of the HS3's five-year mission to improve understanding of the processes that underlie tropical cyclone formation and intensity change in the Atlantic Ocean. A key component of the HS3 mission is the use of Global Hawk unmanned aerial vehicles that can gather data over broad expanses and at altitudes as great as 60,000 feet.

AOML's Hurricane Research Division (HRD) has a long history of using NOAA's P-3 Orion turboprop and Gulfstream-IV jet hurricane hunter aircraft to observe and study the inner core and surrounding environment of tropical cyclones. The P-3s usually fly right through the eye of tropical cyclones to gather observations. Dropsondes are routinely deployed for the invaluable information they provide about atmospheric conditions.

As dropsondes are released from the P-3s and descend towards the ocean surface, they measure humidity, pressure, temperature, wind speed, and wind direction. HRD researchers pioneered the use of dropsondes in tropical cyclones and are experts in processing and transferring their real-time data to NOAA's National Hurricane Center and modeling centers worldwide.

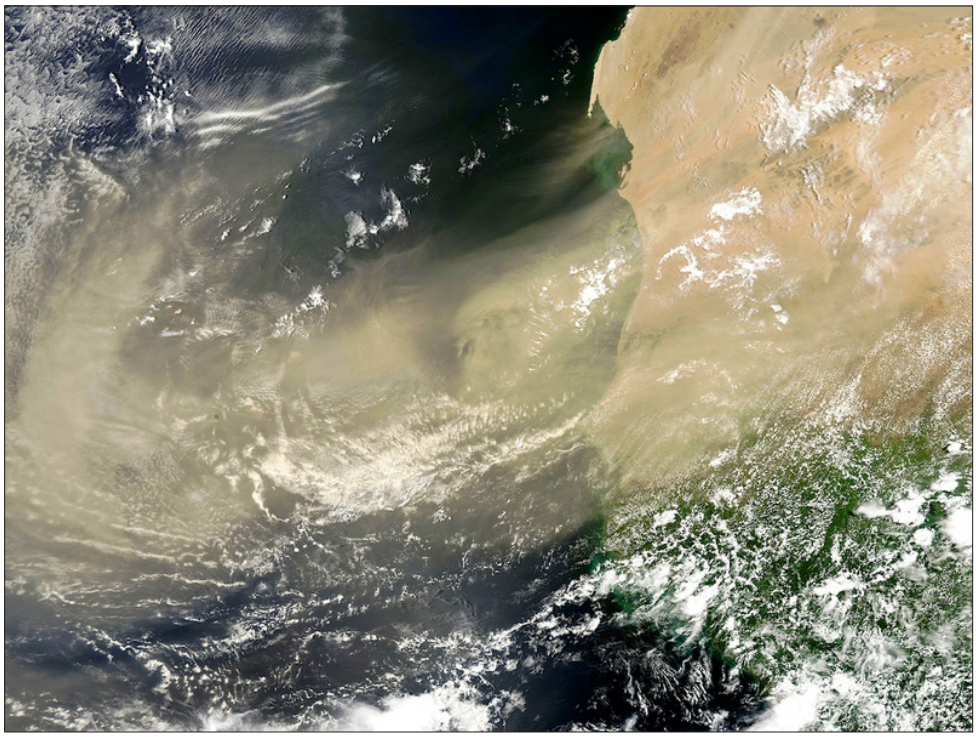
The HS3 science team used dropsondes deployed from the Global Hawk to sample a large mass of Saharan dust that began drifting off the west African coast in late July. African dust storms transport a massive layer of dry air eastward over the Atlantic Ocean, known as the Saharan Air Layer or SAL. Scientists believe this injection of extremely dry air into the region where Atlantic tropical cyclones typically form helps to inhibit their development.

On average, Global Hawk flights are usually three times the length of a traditional hurricane hunter flight, enabling the aircraft to travel greater distances and gather more data. With up to 26 hours of flight time per mission, as many as 89 dropsondes per flight can be deployed. Global Hawk aircraft can also fly at greater altitudes than NOAA's P3 aircraft, directly sampling regions of the Atlantic typically only observed via satellite.

NASA's Global Hawk unmanned aerial vehicle departs for a mission out of the Wallops Flight Facility near Chincoteague, Virginia (Photo courtesy of NASA).

HRD researchers processed and transmitted the Global Hawk dropsonde data during the SAL missions. As a result of their analyses, the SAL was observed as a dense, 2-mile high dust layer drifting above the ocean. In addition to blanketing the Atlantic with dry, dusty air, powerful winds embedded within the SAL made the Atlantic an unfavorable region for storm formation.

As part of AOML's annual hurricane field program, HRD and NASA scientists will also coordinate Global Hawk flights with NOAA's hurricane hunter aircraft to observe the convection that drives intensification within the core of hurricanes, as well as the broader environment that may influence track as well as intensity.



NASA satellite image of July 31st showing a massive cloud of Saharan dust moving off the west African coast and into the Atlantic Ocean. This dusty cloud, the Saharan Air Layer, traveled thousands of miles across the Atlantic, shrouding portions of the southeastern U.S. with hazy skies.

Public Comment Opportunity for New Satellite Antenna and Radome at NOAA

NOAA is conducting a National Environmental Policy Act (NEPA) review for its National Environmental Satellite, Data, and Information Service's (NOAA/NESDIS) plan to replace the existing L-Band antenna with a new X-band satellite receiving system at the Atlantic Oceanographic and Meteorological Laboratory on Virginia Key. While a Categorical Exclusion has been deemed appropriate for this action, NOAA is extending an invitation for public comment.

The proposed direct broadcast satellite data acquisition system includes a parabolic tracking two-axis antenna inside a protective radome (14 ft in diameter and 11.8 ft in height) including interior equipment for data capture, processing, and distribution. The new antenna will expand the capabilities of the station to receive telemetry from the next generation of NOAA's polar-orbiting environmental satellites, the Joint Polar Satellite System (JPSS) constellation.

Operation of the station directly supports NOAA's strategic objectives. Environmental data from these sensors provide input to numerical weather and ocean prediction models and many other applications including management of environmental hazards and disasters, search and rescue operations, radiation budget, ocean productivity and fisheries, and coral bleaching.

AOML is an ideal location for optimal coverage with an excellent line-of-sight for the Caribbean, Gulf of Mexico, and U.S. east coast. The new installation serves as a backup station for data acquisition from JPSS satellites and will provide optimal and low-latency coverage of critical regions in case of the failure of operational acquisition sites. AOML provides high bandwidth connectivity to enable rapid dissemination of satellite data and associated products to government, commercial, academic, and general public users.

Perched on the roof at AOML, a protective radome covers a 1.7 m satellite receiving station.

Installation procedures will be in accordance with applicable NEPA regulations. The roof placement of the antenna places it outside environmentally sensitive areas, flood impact will be nonexistent, and visual impact will be similar to the existing L-Band antenna.

Plans for the new station call for initial operations in the spring of 2014. Individuals wishing to comment on this project or obtain a copy of the draft determination should send their request to the following point of contact:

CDR Stephen Meador, Associate Director
NOAA-AOML
4301 Rickenbacker Causeway
Miami, FL 33149
Email: aoml.associate.director@noaa.gov

All comments must be received via email or in writing to the address above by close of business on November 5, 2013.

Lindsey Visser of AOML holds a sampling net slimed by algae during a quick-response survey to sample a massive algal bloom in Biscayne Bay.

AOML conducted several water quality surveys in July in response to a massive algal bloom that developed in Biscayne Bay. Lindsey Visser and Grant Rawson of AOML gathered samples of the murky, odiferous, green-tinged water for several weeks to monitor changes in the bloom's extent, distribution, and composition. Researchers with AOML's Environmental Microbiology Laboratory also participated in the surveys and discovered the bloom was primarily composed of diatoms but also included some dinoflagellates that exuded an unusual, sewage-like smell. The samples were shared with a variety of research partners collaborating in the investigation.

A production crew from the USA Network television series *Burn Notice* visited AOML for several hours on July 15th to film a brief external scene for the show's two-part finale episode. The seven-year series traced the saga of covert-operations agent Michael Westen and his quest to uncover the truth about being wrongly discredited from service. Although the filming at AOML had minimal impact upon staff and visitors, it did necessitate periods of time when the entrances and exits to and from the AOML facility, as well as the parking lot, were off limits to all. The episode that featured AOML as a backdrop aired on September 5th.

As part of a scene filmed at AOML for the television series *Burn Notice*, an elite squad of armed men runs down the loading dock ramp at AOML to three waiting sport utility vehicles.

Welcome Aboard

NOAA 2013 Hollings Scholar Christine Chesley joined the staff of AOML's Ocean Chemistry Division in August. Christine is currently a senior undergraduate student at the University of Miami with a double major in geology and applied mathematics and a minor in physics. She will be working with Dr. Jia-Zhong Zhang in the Nutrient Laboratory during the fall semester to study the biogeochemical cycle of phosphorus.

Ashley Jefferson joined the staff of the NOAA Miami Regional Library at AOML in July. Ashley comes to the NOAA library after working for more than seven years in support of the public library systems in the Washington, DC and Miami areas. She holds a Master's degree in library science from Clarion University in Pennsylvania and is available to assist AOML staff with inter-library loans, reference materials, and other library services.

4th Annual NOAA-Miami Health Fair

November 12, 2013

10 am – 2 pm

AOML lobby and First-Floor Conference Room

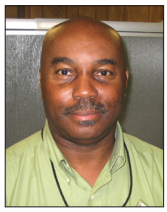
Health care providers will be onsite to provide information and answer questions

Free chair massages provided by Miami-Dade College massage therapist students

For more information:
Howie Friedman
305-361-4319

Congratulations

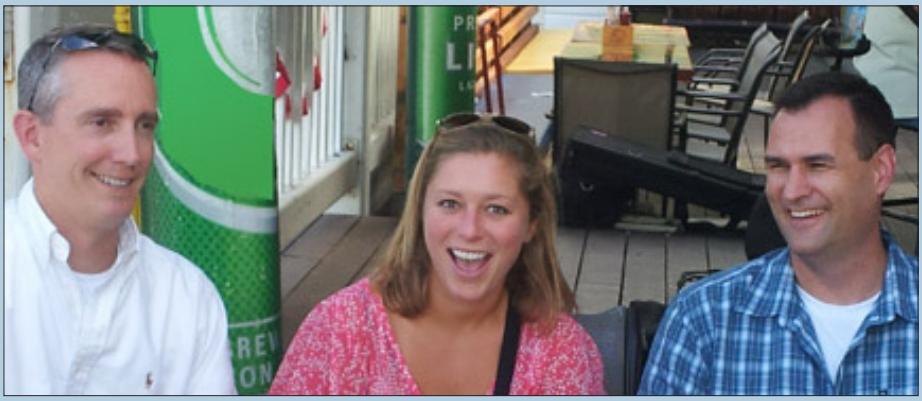
Lewis Gramer, a Cooperative Institute researcher with AOML's Ocean Chemistry Division, successfully defended his Ph.D. thesis, *Dynamics of Sea Temperature Variability in Florida's Reef Tract,* in July and received a doctorate degree from the Division of Meteorology and Physical Oceanography of the University of Miami's Rosenstiel School of Marine and Atmospheric Science. Lew has been awarded a post-doctoral fellowship with the Florida Institute of Oceanography and Keys Marine Laboratory. He will, however, continue part-time at AOML as an assistant scientist, researching the physical oceanographic and air-sea processes that impact coral reefs and other coastal ecosystems in support of NOAA's Coral Health and Monitoring Program.



Rickey Little, a management support specialist with the Administrative Group of AOML's Office of the Director, retired in July after 25 years of federal service. A military veteran and former procurement specialist with the Department of Housing and Urban Development in Washington, DC, Rickey began his employment at AOML in 2009. During his four years with the Administrative Group, Rickey was responsible for an assortment of duties, some of which included the processing of blanket purchase agreements, payment of utility bills, reconciliation of bank card statements, and analysis of financial reports. He also served as AOML's property custodian.

Andrew Stefanick, a physical scientist with the Instrumentation Group of AOML's Physical Oceanography Division, was named NOAA's August 2013 Employee of the Month. Andy recently designed and built an enhanced conductivitity-temperature depth (CTD) frame for use during research cruises to gather data about the physical properties of seawater. The new CTD frame accommodates a host of additional instruments which increases efficiency, improves data collection, and allows for more accurate profiles of velocity in the deep ocean to improve estimates of ocean heat, freshwater, and carbon fluxes. The frame's innovative design will enable AOML researchers to better collect high-quality data during field sampling efforts in support of climate and ecosystem research.

Cathy Steward, AOML's Administrative Officer, retired in August after 37 years of federal service. During her 15 years at AOML, Cathy provided guidance and oversight for the Office of the Director's Administrative Group, which manages the financial, personnel, and procurement functions at AOML. Cathy also served as a liaison between AOML and NOAA's Office of Oceanic and Atmospheric Research on budget, finance, and procurement-related issues. Although retired, Cathy will continue her support of the Administrative Group as a part-time employee of the University of Miami's Cooperative Institute for Marine and Atmospheric Studies.



Congratulations to AOML's three NOAA Corps officers—CDR Stephen Meador, LT Rachel Kotkowski, and LTJG Michael Doig—who hosted a Wetting Down party on July 19th to celebrate their recent promotions. The Wetting Down ceremony is a Naval tradition that originally involved tossing newly-promoted officers into the ocean but nowadays is a party paid for by the officers at a local pub and/or restaurant.

U.S. Department of Commerce
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Secretary of Commerce
www.doc.gov

National Oceanic and Atmospheric Administration
Dr. Kathryn D. Sullivan
Undersecretary of Commerce for Oceans and Atmosphere
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***Keynotes* is published bimonthly to highlight AOML's recent research activities and staff accomplishments.**

Keynotes publishing editor: Gail Derr

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

AKSOY, A., 2013: Storm-relative observations in tropical cyclone data assimilation with an ensemble Kalman filter. *Monthly Weather Review,* 141(2):506-522.

AMORNTHAMMARONG, N., J.-Z. ZHANG, P.B. Ortner, **J. STAMATES, M. SHOEMAKER,** and M.W. Kindel, 2013: A portable analyzer for the measurement of ammonium in marine waters. *Environmental Science: Processes and Impacts,* 15(3):579-584.

BLACK, R.A., and J. Hallett, 2012: Rain rate and water content in hurricanes compared with summer rain in Miami, Florida. *Journal of Applied Meteorology and Climatology,* 51(12): 2218-2235.

Brandt, P., R.J. Greatbatch, M. Claus, S.-H. Didwischus, **V. HORMANN,** A. Funk, J. Hahn, G. Krahmann, J. Fischer, and A. Kortzinger, 2012: Ventilation of the equatorial Atlantic by the equatorial deep jets. *Journal of Geophysical Research,* 117:C12015 (doi: 10.1029/2012JC0-08118), 15 pp.

GARZOLI, S.L., M.O. BARINGER, S. DONG, R.C. PEREZ, and **Q. YAO,** 2012: South Atlantic meridional fluxes. *Deep-Sea Research, Part I,* 71:21-32.

LEE, S.-K., R. ATLAS, D.B. ENFIELD, C. WANG, and **H. LIU,** 2013: Is there an optimal ENSO pattern that enhances large-scale atmospheric processes conducive to major tornado outbreaks in the United States? *Journal of Climate,* 26(5):1626-1642.

McLeod, E., K.R.N. Anthony, A. Andersson, R. Beeden, Y. Golbuu, J. Kleypas, K. Kroeker, **D. MANZELLO,** R.V. Salm, H. Schuttenberg, and J.E. Smith, 2013: Preparing to manage coral reefs for ocean acidification: Lessons from coral bleaching. *Frontiers in Ecology and the Environment,* 11(1):20-27.

MEINEN, C.S., A.R. Piola, **R.C. PEREZ,** and **S.L. GARZOLI,** 2012: Deep Western Boundary Current transport variability in the South Atlantic: Preliminary results from a pilot array at 34.5°S. *Ocean Science*, 8(6):1041-1054.

Riemer, M., **M.T. MONTGOMERY,** and M.E. Nicholls, 2013: Further examination of the thermodynamic modification of the inflow layer of tropical cyclones by vertical wind shear. *Atmospheric Chemistry and Physics,* 13(1):327-346.

Shpund, J., **J.A. ZHANG,** M. Pinsky, and A. Khain, 2012: Microphysical structure of the marine boundary layer under strong wind and spray formation as seen from simulations using a two-dimensional explicit microphysical model, Part II: The role of sea spray. *Journal of the Atmospheric Sciences,* 69(12):3501-3514.

Srokosz, M., **M. BARINGER,** H. Bryden, S. Cunningham, T. Delworth, S. Lozier, J. Marotzke, and R. Sutton, 2012: Past, present, and future change in the Atlantic meridional overturning circulation. *Bulletin of the American Meteorological Society,* 93(11):1663-1676.

WANG, C., and **X. WANG,** 2013: Classifying El Niño Modoki I and II by different impacts on rainfall in southern China and typhoon tracks. *Journal of Climate,* 26(4):1322-1338.

Wang, X., W. Zhou, D. Wang, and **C. WANG,** 2013: The impacts of the summer Asian jet stream biases on surface air temperature in mid-eastern China in IPCC AR4 models. *International Journal of Climatology,* 33(2): 265-276.

Wang, Z.A., **R. WANNINKHOF,** W.-J. Cai, R.H. Byrne, X. Hu, **T.-H. PENG,** and W.-J. Huang, 2013: The marine inorganic carbon system along the Gulf of Mexico and Atlantic coasts: Insights from a transregional coastal carbon study. *Limnology and Oceanography,* 58(1): 325-342.

WANNINKHOF, R., G.-H. PARK, T. Takahashi, R.A. Feely, J.L. Bullister, and S.C. Doney, 2013: Changes in deep-water CO_2 concentrations over the last several decades determined from discrete pCO_2 measurements. *Deep-Sea Research, Part I,* 74:48-63.

ZHANG, J.A., S. GOPALAKRISHNAN, F.D. MARKS, R.F. ROGERS, and V. Tallapragada, 2012: A developmental framework for improving hurricane model physical parameterizations using aircraft observations. *Tropical Cyclone Research and Review,* 1(4):419-429.

Zhao, J., B. Barnes, **N. MELO,** D. English, B. Lapointe, F. Muller-Karger, B. Schaeffer, and C. Hu, 2013: Assessment of satellite-derived diffuse attenuation coefficients and euphotic depths in south Florida coastal waters. *Remote Sensing of Environment,* 131(1):38-50.

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.