May-June 2013
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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 High Probability of Active Atlantic Hurricane Season for 2013

NOAA issued its pre-season outlook for the 2013 Atlantic hurricane season on May 23rd, predicting a high probability for an active to hyperactive season. Climatic conditions that are conducive to above-normal hurricane activity in the Atlantic prompted NOAA to state that a 70% chance existed for 13-20 named storms to form during the six-month long season that lasts from June 1st to November 30th and for the Accumulated Cyclone Energy (ACE), an overall measure of a season's hurricane activity, to be in the range of 120-205% of the median. An ACE of >165% signifies a hyperactive season.

Of the anticipated storms, 7-11 are predicted to strengthen into hurricanes, with 3-6 hurricanes becoming major hurricanes with maximum sustained winds above 110 mph. The long-term averages (1981-2010) are 12 named storms, 6 hurricanes, and 3 major hurricanes.

Climate factors contributing to NOAA's 2013 Atlantic hurricane outlook include the ongoing active phase of the tropical multi-decadal signal, warmer than average sea surface temperatures across the tropical Atlantic Ocean and Caribbean Sea, and the lack of El Niño conditions in the equatorial Pacific Ocean.

The active phase of the tropical multi-decadal signal is believed to have caused an increase in Atlantic hurricane activity since it resumed in 1995, while warmer than average sea surface temperatures also increase storm development. El Niño conditions in the Pacific, which generally inhibit storm formation in the Atlantic basin, are not expected to develop during either the summer or autumn months.

NOAA's 2013 Pre-Season Hurricane Outlook for the Atlantic Basin

Activity Type	NOAA Outlook	1981-2010 Averages
Named Storms (winds 39-73 mph)	13-20	12
Hurricanes (winds ≥74 mph)	7-11	6
Major Hurricanes (winds >110 mph)	3-6	3

The combined impact of these three climate factors should result in above-average overall activity during the 2013 Atlantic season. According to Dr. Gerry Bell, lead forecaster for NOAA's seasonal hurricane outlook team, "This year, oceanic and atmospheric conditions in the Atlantic basin are expected to produce more and stronger hurricanes. These conditions include weaker vertical wind shear, warmer Atlantic waters, and conducive wind patterns coming from Africa."

The majority of the season's storms typically form in August, September, and October, the peak months of the Atlantic hurricane season. NOAA will reassess climatic conditions in early August and issue an updated forecast at that time.

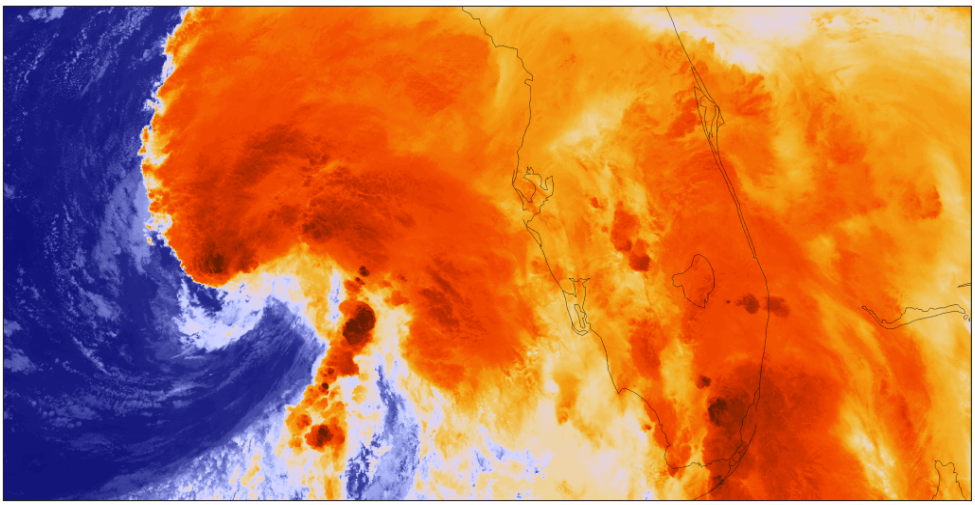
The outlook provides the public with only a general guide to the expected overall activity for the upcoming hurricane season. It is not a seasonal hurricane landfall forecast, and does not imply levels of activity for any particular region.

The 2013 Atlantic pre-season hurricane outlook is an official product of NOAA's Climate Prediction Center, produced in collaboration with the National Hurricane Center and AOML's Hurricane Research Division (HRD). Stanley Goldenberg, an HRD meteorologist, has been a member of the seasonal hurricane forecast team since its inception in 1998.

Coastal residents and communities in areas potentially impacted by landfalling storms are urged to check their preparedness measures and supplies and remain vigilant in monitoring the tropics.

2013 Atlantic Storm Names

Andrea	Humberto	Olga
Barry	Ingrid	Pablo
Chantal	Jerry	Rebekah
Dorian	Karen	Sebastien
Erin	Lorenzo	Tanya
Fernand	Melissa	Van
Gabrielle	Nestor	Wendy



Infrared image of Tropical Storm Andrea, the first named storm of the 2013 Atlantic hurricane season. Andrea formed in the Gulf of Mexico on June 5th and came ashore along Florida's northwest coast on June 6th with 65 mph winds. Much of Florida, including Miami, endured blustery weather that caused widespread flooding before Andrea skirted up the east coast, drenching and flooding coastal communities as far north as Maine.

Sites Surveyed in the Dominican Republic for New Coral Monitoring Station

On June 18th-19th, the Coral Reef Early Warning System (CREWS) team of Jon Fajans (Caribbean Community Climate Change Center), John Halas (Environmental Moorings International, Inc.), and Jim Hendee of AOML's Coral Health and Monitoring Program (CHAMP), met with representatives from the Dominican Republic to discuss possible locations for establishing a new CREWS station to monitor meteorological and oceanographic parameters over a coral reef area.

Two sites were surveyed: one located in La Caleta National Underwater Park (18°26.470′N, 69°41.950′W) and the other near the area of *El Catuan,* a sunken ship (18°25.940′N, 69°34.792′W).

CREWS stations collect hourly data to monitor and assess the health of coral reefs. These data are transmitted to AOML for processing by an expert system that uses artificial intelligence technology and then posted to the CHAMP web site.

Early warning alerts are issued when parameters conducive to coral bleaching and other impact events for corals and coral reef ecosystems are met. CREWS station data, together with data from other networks and satellite data from other locations, form the Web presence called the Integrated Coral Observing Network (ICON).

The recommendation of the CREWS team was that the second site (*El Catuan*) was preferable for logistics, but that the first site (La Caleta) was more ideal for installing the station's bottom pins and because of the region's more diverse and healthy biota. The two sites generated quite a bit of discussion, but Dominican Republic representatives finally decided upon *El Catuan* as the better location.

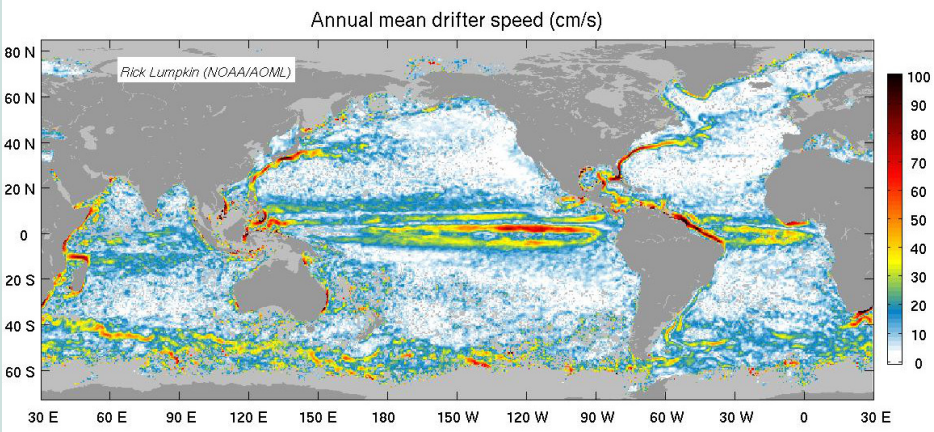
Jon Fajans (Caribbean Community Climate Change Center), John Halas (Environmental Moorings International, Inc.), Hinya De Peña (Reef Check), and Jim Hendee (AOML) gather data during a site survey in the Dominican Republic's La Caleta National Underwater Park. Photo courtesy of Jose Alejandro Alvarez.

The project to install the Dominican Republic CREWS station is funded by the Caribbean Community Climate Change Center, with supplemental funding for data management provided by NOAA's Coral Reef Conservation Program.

The Dominican Republic station will augment the CREWS network, which currently consists of stations located in Puerto Rico, the U.S. Virgin Islands (St. Croix), Cayman Islands (Little Cayman), Belize, and Jamaica. An additional station in Belize, as well as new stations in St. Lucia, Barbados, and Trinidad and Tobago, will make for a total of ten coral monitoring stations throughout the Caribbean. The CREWS network also includes one Pacific station in Lao Lao Bay, Saipan.

Using more than 30 years of observations obtained from satellite-tracked surface drifting buoys, AOML scientists have derived a global climatology of seasonally-varying ocean surface currents at one-half degree resolution. This data set can be used to better understand how the ocean transports properties such as heat, salt, and passive tracers, and as a reference for studying changes in ocean currents over time.

Drifting buoys measure near-surface circulation at unprecedented resolution. A drifter is composed of a surface float which includes a transmitter to relay data and a thermometer that reads temperature a few centimeters below the air-sea interface. The surface float is tethered to a holey sock drogue, centered at 15 m depth. The drifter follows the surface current flow integrated over the drogue depth.



Seasonal climatology of near-surface currents and sea surface temperatures for the world, at monthly and one-half degree resolution, derived from more than 30 years of satellite-tracked surface drifting buoy observations.

Drifter velocities are derived from finite differences of their position fixes. These velocities and their concurrent sea surface temperature measurements are archived at AOML's Drifting Buoy Data Assembly Center where the data are quality controlled and interpolated to quarter-day intervals. The seasonal climatology is available at http://www.aoml.noaa.gov/phod/dac/dac_meanvel.php.

Filling Data Gaps in the South Atlantic: The *Lady Amber* Experience

AOML is the main partner in two ocean observing efforts that rely upon global arrays of profiling floats and satellite-tracked drifting buoys. Data obtained from these instruments enable the Argo and Global Drifter programs to monitor the upper ocean's thermal structure, as well as the global transport of heat and fresh water.

Argo is an international program that seeks to maintain a global array of at least 3,000 profiling floats distributed on a 3° × 3° grid. The floats drift at a depth of 1,000 meters for 10 days and then, while returning to the surface, measure the temperature and salinity in the upper 2,000 meters of the ocean, providing more than 150,000 profiles and velocity measurements annually.

The Global Drifter Program aims to maintain a global 5° × 5° array of ~1,250 satellite-tracked surface drifting buoys to meet the need for an accurate and globally dense set of in-situ observations of mixed layer currents, sea surface temperature, atmospheric pressure, winds, and salinity, and to provide a data processing system for their scientific use. These data support short-term climate predictions (seasonal to interannual), as well as climate and monitoring research.

Both the Argo and Global Drifter arrays depend upon ships of opportunity for the deployment of floats and drifters, and data gaps often emerge in regions not easily accessed by large ships. To improve data density in the South Atlantic, NOAA's Climate Observation Program provided support to charter the sailing vessel *Lady Amber* to deploy Argo floats and surface drifters in regions where few observations were previously collected. The *Lady Amber* is a 38 ton, 20 meter, South-African flagged schooner operated by a crew of four under Captain Peter Flanagan.

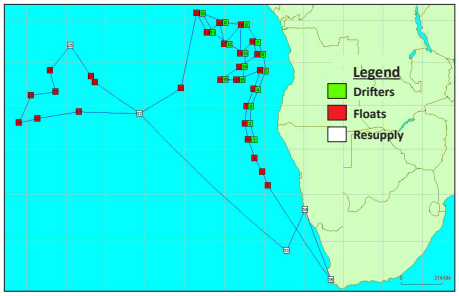
The South African Schooner *Lady Amber*.

The *Lady Amber* expedition departed from Cape Town on December 12, 2012 and returned to Cape Town after 124 days at sea. During this journey, the *Lady Amber* deployed 28 Argo floats and 16 surface drifters in an area of the South Atlantic where data density was extremely low. Following the cruise, data density increased sharply for Argo floats and surface drifters, as shown by the figures in the right-hand column.

There is also an educational benefit to the *Lady Amber* deployments. Schools from the Indian Ocean island nation of Mauritius adopted every float deployed by the *Lady Amber*, enabling students to observe the data stream from their adopted floats via the Internet and learn about the role of oceans in the process. Captain Flanagan also visited Mauritius in June to participate in the launch of an educational program to further increase awareness of this unique ocean observing program.

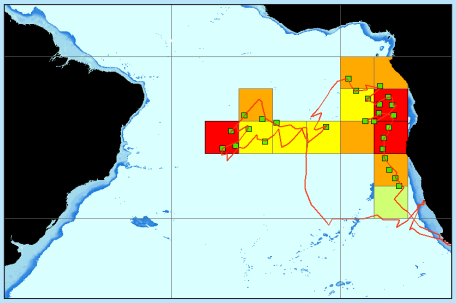
It's our job aboard Lady Amber to close those gaps which are vital to maintaining the Argo array. We sail where ships of opportunity don't or can't go, deploying Argo floats and [surface] drifters in an effort to keep the deployment expenses as low as possible.

Peter Flanagan, Captain of the *Lady Amber*



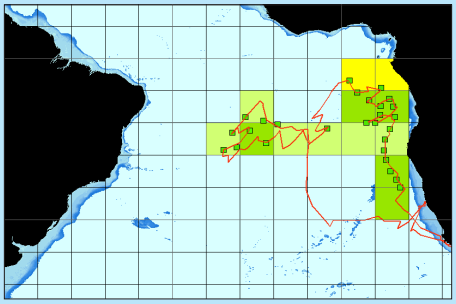
Cruise track of the *Lady Amber*. Red squares indicate where Argo floats were deployed; green squares indicate where surface drifters were deployed.

Deployment of a surface drifter from aboard the *Lady Amber*.



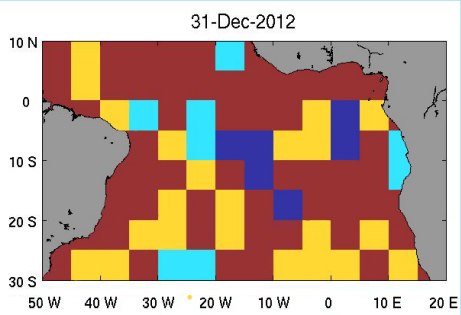
Lady Amber Argo deployments for NOAA/AOML and WHOI
Original Density
0 25% 50% 75% 100% 200% >500%

Argo float deployments in the South Atlantic Ocean superimposed on the data density before the *Lady Amber* cruise. Figure courtesy of Mathieu Belbeoch (Argo Information Center).

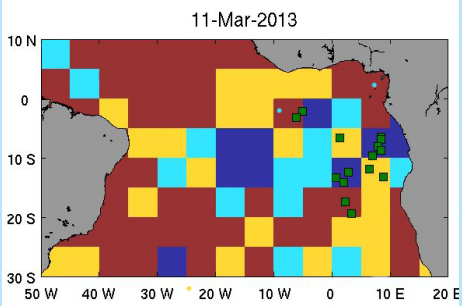


Lady Amber Argo deployments for NOAA/AOML and WHOI
Final Density
0 25% 50% 75% 100% 200% >500%

Argo data density in the South Atlantic Ocean after the *Lady Amber* float deployments. Figure courtesy of Mathieu Belbeoch (Argo Information Center).



Surface drifter data density in the South Atlantic Ocean (shading) before the *Lady Amber* cruise; colors range from red (no drifters in 5° × 5° box) to dark blue (more than three drifters).



Location of the surface drifters deployed from the *Lady Amber* as of March 11, 2013 (green squares), superimposed on the data density following the *Lady Amber* cruise.

Hallee Meltzer, a student intern working with Dr. Chris Kelble of AOML's Ocean Chemistry Division, made a presentation about South Florida's water quality to local Girl Scouts on Saturday, March 9th. *IT Women*, a South Florida organization devoted to encouraging female participation in science, technology, math, and engineering (STEM) fields, contacted AOML with the opportunity to present to the Girl Scouts. *IT Women* partners with AOML to help NOAA science reach under-represented groups across South Florida. Hallee spoke to about 30 girls and presented the history of Florida's fresh water management decisions and the downstream effects of changing limited water flow through the Florida Everglades.

Left: **AOML student intern Hallee Meltzer (standing) speaks to Girl Scouts at Camp Choee about South Florida's water quality being the result of many inter-related ecological factors, the differences between healthy and compromised aquatic ecosystems, and the flow of fresh water through the Florida Everglades.**

Right: **Girl scouts examine various preserved juvenile sport fish samples from Florida Bay and learn about the field sampling techniques scientists use to assess water quality and environmental conditions.**

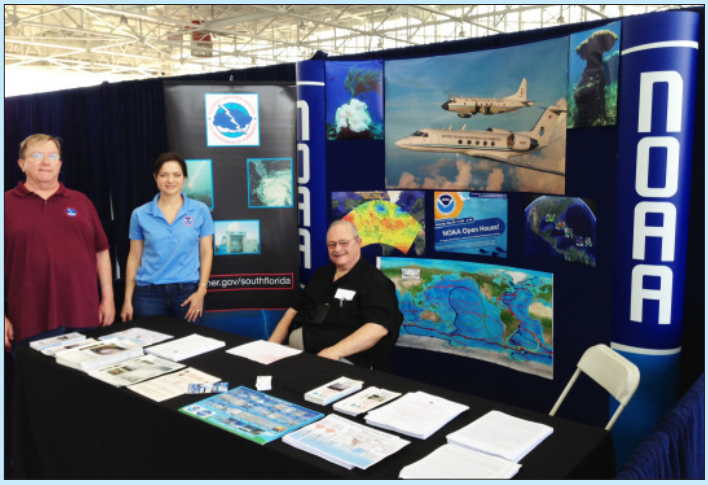
Joe Cione and Erica Rule of AOML (wearing NOAA flight suits), along with CBS4 meteorologists David Bernard and Craig Setzer (red shirts), appear on the giant screens at Marlins Park. Joe and Erica spoke to more than 10,000 students about hurricanes and some of the instruments NOAA uses to measure their strength.

Joe Cione and Erica Rule represented AOML on May 1st for Weather Day at Marlins Park in downtown Miami. The eighth annual event was hosted by the local CBS affiliate, WFOR-TV channel 4, as a fun way to help south Florida kids learn about weather and climate. More than 10,000 students from Miami-Dade, Broward, and Palm Beach counties packed the stadium before the 12:40 start of the game between the Marlins and New York Mets to learn about thunderstorms, lightning, tornadoes, and hurricanes, as well as marlins (the fish).

Joe and Erica spoke about hurricanes and highlighted some of the instruments NOAA uses to gather data about them. They showed how dropwindsondes released from hurricane hunter aircraft measure the wind, temperature, and humidity inside developing storms and are vital to forecast accuracy. They also showed how the Coyote Unmanned Aircraft System that AOML hopes to test during a hurricane flight has the potential to gather observations near the turbulent ocean surface, an area too dangerous for hurricane hunter aircraft to venture.

Twelve children of AOML staff members participated in AOML's annual Bring Your Child to Work science program on Thursday, May 2nd. Students learned about ecosystem health and watersheds and experimented with an enviroscape to explore how different land uses can impact coastal waters. They also learned about microbes in the marine environment and how AOML scientists are able to identify specific types of harmful bacteria. The day's activities ended with a buzzer-style team competition with the winning team receiving copies of the *Tropical Connections* resource book edited by Pamela Fletcher of Florida Sea Grant and AOML's Ocean Chemistry Division. Special thanks to Neal Dorst who grilled the luncheon food for students and their parents.

Top left: **Students use an enviroscape to explore land use impacts on coastal waters.** ***Top right*****: Dr. Maribeth Gidley explains how scientists identify harmful marine bacteria.** ***Bottom left*****: Teams compete by answering science questions with buzzers.** ***Bottom right*****: Aden Annane examines bacteria under a microscope.**



Kim Brabander of the National Weather Service's Miami Forecast Office joined Erica Rule and Howard Friedman (seated) of AOML at the second annual SAFEE event hosted at Opa-Locka Executive Airport to promote careers in the aviation and aerospace industries.

NOAA participated in the second annual South Florida Aviators Fly-In and Educational Expo (SAFEE) at the Opa Locka Executive Airport on May 3rd and 4th. Erica Rule and Howard Friedman of AOML joined with Kim Brabander of the National Weather Service's Miami Forecast Office to co-host a booth dedicated to highlighting NOAA's mission of science, service, and stewardship.

SAFEE was hosted to promote careers in the aviation and aerospace industries. NOAA was one of more than 40 sponsors of the event, which also included private and public-sector organizations and many of south Florida's universities and colleges. The two-day expo was primarily geared towards exposing students to the broad range of available aviation/aerospace career options but also drew aviation enthusiasts.

Thousands of Miami-Dade and Broward county school children had the chance to visit exhibition booths, view a variety of classic and modern aircraft, try flight learning simulators, and meet with pilots, air traffic controllers, and other aviation and aerospace professionals.

On May 31st, AOML director Dr. Bob Atlas met with Congressman Joe Garcia (FL-26) and Congresswoman Debbie Wasserman Schultz (FL-23), along with National Hurricane Center deputy director Ed Rappaport, to review NOAA's 2013 seasonal hurricane forecast for the Atlantic basin. NOAA is predicting an above average year for storm activity, and Bob discussed advances in hurricane research that are expected to improve forecast products. The annual meeting brought together the various components of South Florida's hurricane preparedness and response team. Representatives from the Miami-Dade County Office of Emergency Management, Red Cross, and Florida National Guard also attended the meeting and presented status reports on issues related to their preparedness and readiness efforts. The public is urged to stay informed throughout the six-month long hurricane season and to have an action plan in place should a storm threaten South Florida.

Florida Congressional representatives Joe Garcia and Debbie Wasserman Schultz (left foreground) listen as AOML Director Dr. Bob Atlas (right foreground) discusses NOAA's forecast for the 2013 Atlantic hurricane season.

AOML participated in the "Feel the Force: Hurricanes and Other Hazards" event hosted by the Miami Museum of Science on June 1st, the first day of the Atlantic hurricane season. The event, jointly sponsored by Florida International University's International Hurricane Research Center and the Miami-Dade County Office of Emergency Management, featured a full day of activities and speakers to help the public better prepare for and protect themselves from hurricanes.

Those attending the event had the chance to speak with AOML staff about what it's like to fly into the eye of a hurricane. They also had the chance to learn about how NOAA's P-3 aircraft gather an assortment of real-time data that are vital in generating forecasts during hurricane season.

***Left*: Frank Marks talks with children about the types of information gathered by dropsondes. *Upper right*: Replica of the NOAA P-3 nose cone. *Lower right*: Erica Rule answers questions about hurricanes.**

NOAA Open House

The joint AOML-Southeast Fisheries Open House on May 24th-25th featured video footage from hurricane hunter flights, unmanned aerial vehicles, ocean-observing instruments, three-dimensional visuals of coral and fish, preserved sea turtle specimens, and examples of exotic species such as lionfish. Visitors had a chance to meet and speak with NOAA scientists and learn about hurricane research, climate science, oceanography, local fisheries, coral communities, and endangered species. The feedback from visitors was extremely positive, and many students and teachers who attended on Friday returned with their families and friends on Saturday!

Joint AOML-Southeast Fisheries Open House Draws Record Numbers

AOML partnered with NOAA's Southeast Fisheries Science Center (SEFSC) to host an open house for local students and the public on May 24th and 25th. The two-day event drew 425 students and 275 members of the public for a total of 700 visitors. Staff from Florida Representative Ileana Ros-Lehtinen's office (FL-27) and Florida Senator Marco Rubio's office also participated in the very successful event.

AOML featured four stations with different aspects of its research portfolio: hurricane observations, oceans observations and climate, carbon monitoring and impacts, and coastal ecosystems. At the hurricane station, visitors viewed footage from hurricane hunter flights into the eye of Hurricane Katrina and learned about all of the atmospheric properties measured during these flights. Hurricane scientists also described how these observations inform greater understanding of hurricane dynamics and improve forecast models.

AOML meteorologist Shirley Murillo speaks with students about hurricanes and the various instruments hurricane researchers use to gather data about them.

The NOAA open house was a big success. Our troop had a wonderful time. The staff was excellent and the interactive exhibits really got them interested in the subject matter. We were there for three hours and the girls were engaged the entire time. They loved the experience.

Girl Scout Troop 18

The oceans and climate station began with an overview of global ocean circulation and its influence on regional climate. Technicians then showcased many of the different instruments that are used to collect ocean observations and the engineering that allows them to sample different parts of the ocean. Visitors also learned about observed changes in the global ocean including sea-level rise.

Oceanographer Gustavo Goni (lower right corner) shows students a Google Earth map with the global location of every ocean-observing instrument currently gathering and transmitting data.

I just wanted to tell you how awesome, engaging, and informative the NOAA open house was. I wish we could have brought more of our students! They saw REAL science, in REAL labs, done by REAL scientists. The kids said it was one of the coolest field trips they had been on. Thank you and all the NOAA scientists for their efforts in making this unique learning opportunity possible. Please let us know if/when you will be doing it again!

Key Biscayne K8 Center

At the carbon monitoring and impacts station, visitors toured the Nutrient Lab, which displayed the underway pCO_2 instruments that AOML co-developed to autonomously sample oceanic carbon dioxide on ships of opportunity. Visitors learned about the increasing trends in oceanic and atmospheric carbon and associated impacts, particularly on the calcium carbonate-based structures of coral reefs and juvenile fish through ocean acidification.

The tour concluded with an overview of coastal ecosystems and the effects of increasing human populations in coastal regions. Visitors learned about the impacts of changes in freshwater flow through the Everglades on downstream fisheries in Florida Bay. They also learned about the microbial populations regularly found at Florida's beaches and the techniques developed at AOML to better identify the prevalence and source of microbial pathogens that can cause illness and beach closures.

Teachers, students, and individuals provided overwhelmingly positive feedback, expressing thanks and great appreciation for a highly educational and engaging experience. Visitors most appreciated the opportunity to meet and speak with NOAA scientists.

Our students liked learning about hurricanes and related to the station where the scientist talked about DNA testing of contaminants in water because we studied DNA and DNA technology.

MAST Academy

Thanks are due to Erica Rule, AOML's Outreach and Communications Director, and to Essie Coleman-Duffie of SEFSC for co-organizing the event. Adding to the success of the open house were the contributions of AOML and SEFSC staffers who volunteered their time and expertise.

Sampling Effort Assesses Seagrass and Coral Reefs for Climate Impacts

AOML oceanographer Nelson Melo participated in an intensive field sampling effort in the Florida Keys on May 5-24th. The NASA-funded project, *High Resolution Assessment of Carbon Dynamics in Seagrass and Coral Reef Biomes,* brought together a team of researchers from the University of South Florida, Florida Fish and Wildlife Conservation Commission, U.S. Geological Survey, and AOML to look for the effects of climate change on seagrass and coral reef ecosystems.

Satellites, aircraft, unmanned aerial vehicles, ships, and moorings were used to gather measurements at Cheeca Rocks and Crocker Reef near Islamorada. Two previous field sampling efforts for the project were conducted in the vicinity of Sugarloaf Key near Key West.

The current sampling effort at Cheeca Rocks, a deployment site for NOAA's Atlantic Ocean acidification testbed, provided the research team an opportunity to collaborate with scientists from NOAA (including AOML's Ocean Chemistry Division), the University of Miami, and Columbia University. NOAA uses the testbed site to study changes in ocean chemistry, and the resulting impacts to coral reefs, due to increasing concentrations of atmospheric carbon dioxide being absorbed by the ocean.

A low-flying, remotely-controlled helicopter gathers observations in the vicinity of NOAA's Atlantic Ocean acidification testbed site at Cheeca Rocks. The moored autonomous (MapCO_2) surface buoy deployed by NOAA measures atmospheric and oceanic concentrations of carbon dioxide.

The research team focused on studying the biogeochemical properties of seagrass and coral reefs and tested new unmanned aerial vehicles and sensors. High-resolution airborne observations were made by manned aircraft and unmanned aerial systems that flew over coral patch reefs and seagrass beds within the study area. The small unmanned platforms (two planes and a helicopter), equipped with a hyperspectral scanner, were also used to obtain high-resolution images of the shallow shelf regions over the reef and seagrass patches. These images served to map the location of seagrass beds and coral reefs, their extent, and photosynthetic production. They also provide a means for assessing changes in environmental conditions over time.

Divers use underwater hyperspectral spectroradiometers and a diving PAM (pulse amplitude modulated) underwater fluorometer to assess the color and chlorophyll fluorescence of various coral species as a proxy for coral health.

A substrate coverage characterization was conducted to identify the presence and spatial coverage of the main benthic species in the study area. Optical hyperspectral measurements (infrared to ultraviolet) were simultaneously collected to characterize the water mass and biome at the bottom.

The field work also involved mooring deployments, bio-optical profiling, and shipboard biogeochemical surveys conducted from aboard the RV *Virginia K*. Measurements included chlorophyll-*a* and colored dissolved organic matter, turbidity, absorption, fluorescence, bottom reflectance, backscattering, in-water radiance and irradiance, and remote sensing reflectance. These in situ optical observations complemented the remote sensing and biogeochemical measurements.

Gerardo Toro-Farmer from the University of South Florida and Nelson Melo of AOML prepare a moored setup from aboard the RV *Virginia K* to estimate chlorophyll and organic matter concentration, turbidity, water temperature, salinity, and the direction and speed of currents.

Seagrass and coral reef habitats are susceptible to the effects of climate change, and understanding their current condition is essential to predicting how they might respond to warming ocean temperatures, rising sea levels, and changing seawater chemistry.

The results of this project will increase knowledge of the dynamics and health of important benthic communities found in shallow regions such as the Florida Keys and aid in the development of new remote sensing technologies.

Several vessels, including a barge for unmanned aircraft operations (foreground), gather data from the shallow, nearshore waters of Cheeca Rocks and Crocker Reef near Islamorada in the Florida Keys.

Student Interns Assist AOML Researchers

AOML scientists welcome students throughout the year to work beside them in the field and laboratory to learn about federal scientific careers. The following students have worked at AOML during the past school year and summer through numerous employment, scholarship, and internship opportunities. AOML is proud of their accomplishments and of the dedication shown by the employees who haven taken the time to mentor them. Here is a summary of AOML's student activities:

Sarah Ditchek, Andrew Hazelton, Heather Holbach, and ***Bryan Williams*** used a broad array of satellite and airborne observations, as well as computer models, to explore hurricane structure and dynamics.

Dillon Amaya examined the influence of the central Pacific El Niño phenomenon on tropical Atlantic climate, while ***Alexandra Ramos*** used climate model simulations to explore how the minimum upper ocean heat energy required for generating category 5 hurricanes may change during the 21st century.

Daniel Morales assisted AOML staff and the South Florida Federal Executive Board with computer technical support and updates to website databases.

Michael Goldberg, Rachel Sereix, Aditya Shetty, and ***Kristina Thoren*** participated in water quality field sampling efforts and used molecular techniques to assess and characterize microbial contaminants.

Hallee Meltzer worked to develop habitat suitability models for sport fish species in Florida Bay, while ***Camila Mirow*** assisted in the planning of a project to investigate the stratification of flow through the Boynton Inlet.

Tammy Burton, Danielle Graham, Samuel Hariharan, and ***Lauren Olinger*** worked with coral researchers to better understand the effects of ocean acidification on coral reef ecosystems.

Some of AOML's student interns include Aditya Shetty, Kristina Thoren, Sarah Ditchek, Danielle Graham, Brijonnay Madrigal (Southeast Fisheries Science Center), Dillon Amaya, Sam Hariharan, and Michael Goldberg.

2013 Student Interns at AOML	AOML Mentors
Dillon Amaya, NOAA Hollings Scholar Texas A&M University	Greg Foltz Physical Oceanography Division
Tammy Burton University of Miami	Jim Hendee Ocean Chemistry Division
Sarah Ditchek, NOAA Hollings Scholar Yale University	Sim Aberson Hurricane Research Division
Michael Goldberg Fieldston High School, New York	Chris Sinigalliano and Maribeth Gidley Ocean Chemistry Division
Danielle Graham University of Miami	Derek Manzello Ocean Chemistry Division
Samuel Hariharan Rosenstiel School of Marine and Atmospheric Science	Jim Hendee Ocean Chemistry Division
Andrew Hazelton Florida State University	Robert Rogers Hurricane Research Division
Heather Holbach Florida State University	Eric Uhlhorn Hurricane Research Division
Hallee Meltzer Miami-Dade School for Advanced Studies	Chris Kelble Ocean Chemistry Division
Camila Mirow Gulliver Preparatory School	Tom Carsey Ocean Chemistry Division
Daniel Morales Miami Lakes Educational Center	Alejandra Lorenzo Computer Networks and Services Division
Lauren Olinger University of Miami	Jim Hendee Ocean Chemistry Division
Alexandra Ramos University of Puerto Rico	Chunzai Wang and Sang-Ki Lee Physical Oceanography Division
Rachel Sereix University School of Nova Southeastern University	Chris Sinigalliano and Maribeth Gidley Ocean Chemistry Division
Aditya Shetty Archimedean Upper Conservatory Charter High School	Chris Sinigalliano and Maribeth Gidley Ocean Chemistry Division
Kristina Thoren American Heritage High School	Chris Sinigalliano and Maribeth Gidley Ocean Chemistry Division
Bryan Williams Florida State University	Altug Aksoy and Sim Aberson Hurricane Research Division

In June, Aditya Shetty, a 2012-2013 student intern with AOML's Environmental Microbiology Laboratory, won a Gold Medal at the International Genius Olympiad Environmental Science Fair in New York City. The Genius Olympiad is the world's largest high-school level competition for the environmental sciences. Aditya's presentation on seaweed debris serving as a reservoir for fecal indicator bacteria and other microbial contaminants was based on research he performed at AOML and placed him in the top 20 out of 232 science fair projects. In 2012, Aditya's research from his AOML internship won science fair competitions at the local, regional, state, and national levels, and now he has won at the international level. Congratulations, Adi, on this well-deserved recognition.

Farewell

Christie Wiley, a librarian with NOAA's Miami Regional Library at AOML since 2008, departed in May after accepting a position with the Grainger Engineering Library Information Center of the University of Illinois at Urbana-Champaign. Christie is now an assistant professor of library administration who provides engineering research and data services for the faculty, staff, and students at the Urbana-Champaign campus.

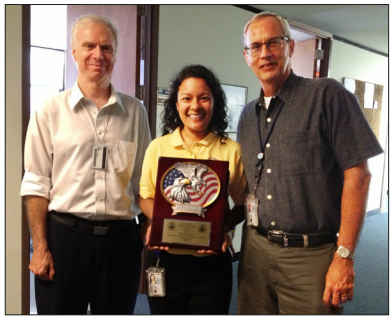
Welcome Aboard

Dr. Denis Volkov, an assistant scientist with the University of Miami's Cooperative Institute for Marine and Atmospheric Studies, joined the staff of AOML's Physical Oceanography Division in May. Denis' research will focus on sea level variability and sea surface circulation using altimetry and in situ measurements, particularly in the sub-Arctic and Arctic seas. He will also contribute to other observational projects at AOML, participate in research cruises, and collaborate with colleagues at AOML, the Jet Propulsion Laboratory, and other institutions to develop new projects.

Congratulations to Jennifer Calderon-Diaz with AOML's Hurricane Research Division (HRD). After three and a half years of attending night and weekend classes, Jennifer earned her B.S. degree in Business Administration from Barry University's School for Adult and Continuing Education. She is pictured above at her graduation ceremony on May 4th with Frank Marks and Howie Friedman of HRD. Jennifer has worked as HRD's administrative assistant for the past nine years.

Congratulations

Sundararaman Gopalakrishnan, a meteorologist and hurricane modeling team leader with AOML's Hurricane Research Division, has been selected to serve as a member of the Science Advisory Board of the Developmental Testbed Center (DTC). The DTC tests and assesses new models and forecast techniques for numerical weather prediction and serves as a bridge between the research and operational communities. The Science Advisory Board helps shape the strategic direction and objectives of the DTC, which is jointly sponsored by NOAA, the National Science Foundation, and Air Force Weather Agency.



AOML Director Bob Atlas, Shirley Murillo, and HRD Director Frank Marks.

Shirley Murillo, a meteorologist with AOML's Hurricane Research Division (HRD), was named a Federal Employee of the Year by the South Florida Federal Executive Board at its annual awards banquet on May 10th. Shirley won in the Management category for her leadership in overseeing HRD's 2012 Hurricane Field Program, an effort which involved the collaboration of scientists throughout NOAA, other federal agencies, and academia. Shirley was also recognized for her leadership in managing NOAA's Joint Hurricane Testbed, a program that seeks to improve tropical cyclone analysis and prediction by transferring new technology, research results, and observational advances from research groups to operational centers.

Chunzai Wang, an oceanographer with AOML's Physical Oceanography Division, was named a Federal Employee of the Year by the South Florida Federal Executive Board at its annual awards banquet on May 10th. Chunzai won in the Scientific category for his professional excellence and exceptional productivity. During fiscal year 2012, Chunzai's research focused on understanding the ocean's role in extreme weather events and on longer-term climate scales led to 22 peer-reviewed papers, three of which were highlighted in prestigious science journals.

Xuejin Zhang, a University of Miami Cooperative Institute for Marine and Atmospheric Studies scientist with AOML's Hurricane Research Division, was selected as NOAA's May 2013 Team Member of the Month. Xuejin was honored for his role in supporting NOAA's Hurricane Weather Research and Forecasting (HWRF) high resolution modeling program within HRD. The 2013 version of the HWRF model includes a number of Xuejin's innovative numerical upgrades that have demonstrated a 20-25% improvement in hurricane intensity predictions.

Staff from the National Hurricane Center (NHC) and AOML formed Team NOAA and competed in the 2013 Corporate Run on April 25th. The 3.1 mile race drew more than 25,000 competitors from 800 companies in the Miami metropolitan area. Team NOAA members included (left to right) Hailong Liu (AOML), Chris Landsea (NHC), John Beven (NHC), Eric Christensen (NHC), Kathryn Sellwood (AOML), Greg Foltz (AOML), Eric Blake (NHC), Corey Walton (NHC), David Zelinsky (NHC), Lisa Bucci (AOML), and Steve Feuer (NHC). Missing from the photo is Kyle Seaton of AOML.

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

Bao, J.-W., **S.G. GOPALAKRISHNAN,** S.A. Michelson, **F.D. MARKS,** and **M.T. MONTGOMERY,** 2012: Impact of physics representations in the HWRF model on simulated hurricane structure and wind-pressure relationships. *Monthly Weather Review,* 140(10):3278-3299.

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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.