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AOML Keynotes

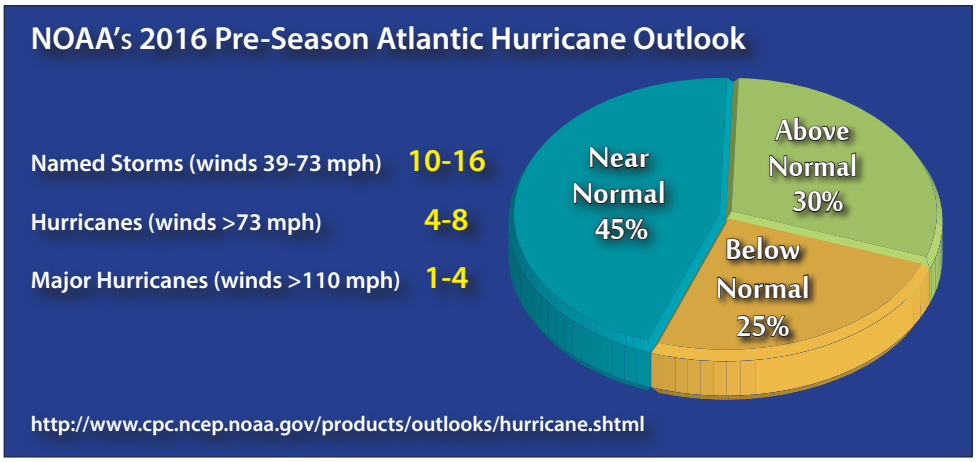
ATLANTIC OCEANOGRAPHIC AND METEOROLOGICAL LABORATORY

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

NOAA Predicts Near-Normal Activity for 2016 Atlantic Hurricane Season

It only takes one storm to significantly disrupt your life. Preparing for the worst can keep you, your family, and first responders out of harm's way. Take steps today to be prepared: Develop a family communications plan, build an emergency supply kit for your home, and make sure you and your family know your evacuation route. These small steps can help save your life when disaster strikes.

Joseph Nimmich, Deputy Director
Federal Emergency Management Agency



A team of NOAA seasonal hurricane forecasters released their pre-seasonal outlook for the 2016 Atlantic hurricane season on May 27th, stating that the highest probability is for a near-normal season. A 70 percent likelihood of 10-16 named storms is anticipated during the six-month long season that stretches from June 1st to November 30th. Of these named storms, 4-8 could strengthen into hurricanes, and 1-4 could further intensify into major hurricanes (categories 3, 4, or 5 on the Saffir-Simpson wind scale). These numbers include four named storms, one of which reached hurricane strength, that have already occurred as of mid-June. While there is a 45 percent chance of a near-normal season, there is also a 30 percent chance of an above-normal season and a 25 percent chance of a below-normal season.

"This is a more challenging hurricane season outlook than most because it's difficult to determine whether there will be reinforcing or competing climate influences on tropical storm development," said Dr. Gerry Bell, lead seasonal hurricane forecaster with NOAA's Climate Prediction Center. "However, a near-normal prediction for this season suggests we could experience more hurricane activity than we've seen in the last three years, which were below normal."

Bell explained there is uncertainty about whether the high-activity era of Atlantic hurricanes, which began in 1995, has ended. This high-activity era has been associated with an ocean temperature pattern called the warm phase of the Atlantic Multi-Decadal Oscillation or AMO, marked by warmer Atlantic Ocean temperatures and a stronger West African monsoon.

The less active hurricane seasons of the last three years might be indicating a shift toward the cool AMO phase, marked by cooler Atlantic Ocean temperatures and a weaker West African monsoon. If this shift has indeed taken place and is not short-lived, a multi-decadal, low-activity era for Atlantic hurricanes may have already begun. High- and low-activity eras typically last from about 15-40 years.

In the shorter term, El Niño has been dissipating, and NOAA's Climate Prediction Center is forecasting a 70 percent chance that La Niña, which normally allows for more hurricane activity, will be present during the peak months of hurricane season—August through October. Current model predictions, however, are showing uncertainty as to how strong La Niña and its impacts will be.

NOAA will issue an updated outlook for the Atlantic hurricane season in early August at the start of the historical peak months of the season.

The 2016 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). HRD meteorologist Stanley Goldenberg has been a part of the seasonal outlook team since its inception in 1998.

Technology and Modeling Innovations Usher in the 2016 Hurricane Season

The rapid intensification of a tropical cyclone, when maximum sustained winds increase quickly in a short period of time, is one of the most difficult and important factors to predict and is thus one of NOAA's top forecasting priorities. AOML scientists are attacking this and many other hurricane-forecasting challenges by flying into storms, poring over observations and model output, and using new technologies to enhance NOAA's observing capacity. This hurricane season, they will have the opportunity to test some of the most advanced and innovative technologies, as well as refined forecasting tools, to better predict the tracks and intensities of tropical cyclones.

Upgraded unmanned technologies for hurricane observations are expected to contribute significantly to NOAA's study of intensity change. Unmanned airborne platforms will provide observations at the interface between the atmosphere and ocean that are vital to understanding and predicting a storm's strength.

The Coyote, a small aircraft launched from NOAA's P-3 aircraft, will collect data in this poorly sampled region where manned aircraft cannot fly. Recent upgrades to the platform by engineers at NOAA's Aircraft Operations Center and Raytheon enable the Coyote to fly up to 50 miles away from the P-3 while measuring a storm's strongest winds and collecting critical, continuous observations in the turbulent lower altitudes in the hurricane. Data from the Coyote will now be transmitted in real-time to NOAA's National Hurricane Center (NHC), where staff monitor storms and develop forecasts. This season, researchers will fly up to eight Coyote aircraft, targeting mature storms (category 1 or higher) in the Atlantic and eastern Pacific.

High above the storm at 60,000 feet, NOAA will once again fly targeted, 24-hour missions with the NASA Global Hawk aircraft. The Global Hawk is part of NOAA's Sensing Hazards with Operational Unmanned Technology (SHOUT) project that seeks to improve hurricane track and intensity forecasts by gathering data from above the storm down to the ocean's surface. Results from recent hurricane modeling experiments suggest that by combining data from the Global Hawk with data from satellites, researchers can achieve full coverage of a storm, leading to significantly improved track forecasts.

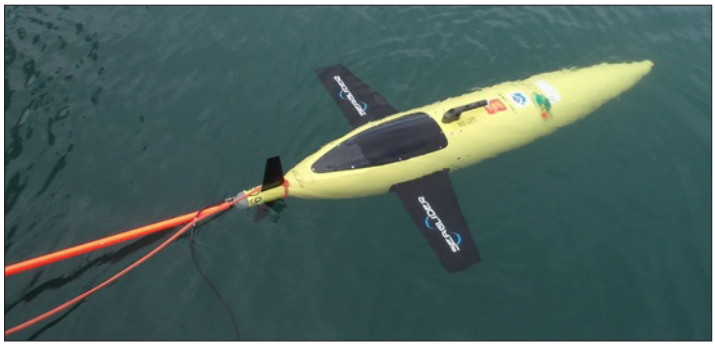
In addition to these airborne unmanned systems, small underwater unmanned systems will patrol the ocean beneath storms. NOAA's underwater gliders are durable, battery-powered autonomous vehicles operated remotely by scientists at AOML and the Caribbean Coastal Ocean Observing System (CariCOOS). Traversing the waters of the Caribbean Sea and tropical North Atlantic Ocean, they are enhancing our knowledge of the role the ocean plays in the intensification of tropical cyclones. Each glider collects thousands of ocean temperature and salinity profile observations that will be used to improve hurricane intensity forecasts.

Four gliders set for deployment in July and August will continuously survey the ocean from the surface down to 1000 meters, even under hurricane-force winds, to analyze the upper ocean's impact on hurricane intensification and vice versa. NOAA scientists are currently assessing the impact of underwater glider data from previous missions to improve (***cont. on page 3***)

Viewed from the International Space Station on September 3, 2007, powerful Hurricane Felix churns in the Atlantic with peaks winds of 175 mph.

AOML hurricane researcher Dr. Joe Cione shows off a Coyote aircraft. The Coyote is launched from NOAA's P-3 Hurricane Hunter aircraft (in the background) to gather data at the turbulent air-sea interface, a region too dangerous for manned aircraft to venture.

Photo courtesy of NASA



Top: **NASA's Global Hawk unmanned aircraft is a major component of NOAA's Sensing Hazards with Operational Unmanned Technology program, gathering data at higher altitudes, broader ranges, and longer periods than conventional aircraft.** ***Bottom:*** **NOAA's underwater gliders are enabling scientists to better understand the role the ocean plays in the intensification of tropical cyclones.**

Continued from page 2

forecasts from the Hybrid Coordinate Ocean Model-Hurricane Weather Research and Forecasting (HYCOM-HWRF) model, being run in test mode.

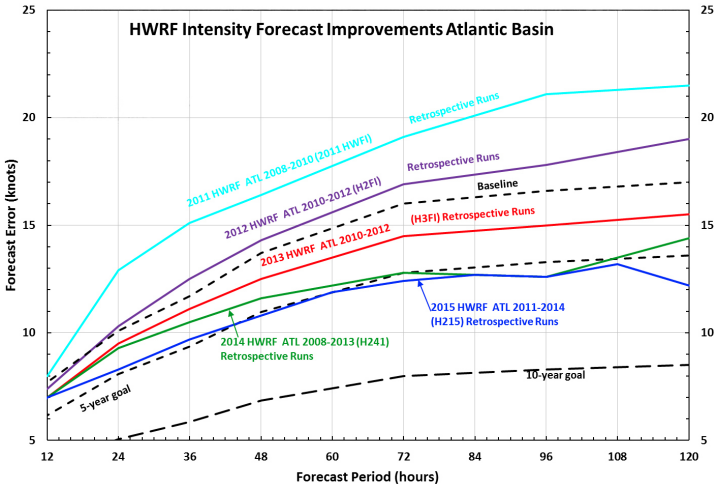
Hurricane researchers also collect data from instruments aboard the P-3 Hurricane Hunter aircraft that fly multiple missions through storms to gather both operational and research data. During the 2016 hurricane season, NOAA will be using a Doppler wind lidar instrument mounted on the side of the P-3 aircraft. Whereas Doppler radar provides three-dimensional wind observations only where there is precipitation, Doppler wind lidar provides wind observations wherever there are aerosols.

The instrument will be used to sample winds within hurricanes that may be driving intensity changes. Coupled with the tail Doppler radar, which can measure winds in clouds and areas of rainfall, the lidar can measure them in clearer air so that the two instruments can provide a more complete three-dimensional picture of hurricane wind structure than has previously been available. Incorporating data from these multiple platforms into dynamical models is vital for accurately forecasting a hurricane's track and intensity.

NOAA will be implementing an improved Rapid Intensification Index, a tool to predict sudden increases in maximum sustained wind speeds. Recent improvements based on research led by AOML extend the forecast period from 24 hours out to 48 hours to forecast wind-speed increases of 20 to 55 knots, providing forecasters with additional lead-time to develop the most accurate predictions of a storm's future intensity.

Researchers and forecasters will also be working with a recently upgraded version of NOAA's operational HWRF model, which produced the best intensity forecast guidance in 2015 for the North Atlantic Basin. This year's version will feature an expanded area of high resolution in the region immediately surrounding a hurricane. Based on observations from NOAA's Hurricane Hunter aircraft, the model will also include improved representation of the lower 2 miles of the hurricane. These model enhancements advance NOAA's ability to predict small-scale features that impact intensity change.

Additionally, the Hurricane Research Division's (HRD) Hurricane Ensemble Data Assimilation System (HEDAS) will incorporate observations into an experimental version of HWRF in near real-time. HRD plans to test new techniques and use new



NOAA's operational Hurricane Weather Research and Forecasting (HWRF) model has demonstrated a 10-15 percent improvement in intensity forecast accuracy each year since 2012.

Doppler radar observations gathered by NOAA's P-3 Hurricane Hunter aircraft, combined with the new Doppler wind lidar instrument aboard the P-3, will provide researchers with a more complete three-dimensional picture of hurricane wind structure than has previously been available.

observations from platforms such as land-based Doppler radar and polar-orbiting satellites, as well as the data types mentioned above. A new algorithm to run on high-performance computers and new quality-control mechanisms that will allow for better and faster incorporation of the data will also be tested. This latest version of HEDAS represents the state-of-the-art in vortex-scale data assimilation.

During the 2016 hurricane season, AOML researchers and their partners will use an array of cutting-edge technologies, data assimilation techniques, and computer models to push the boundaries of NOAA's hurricane forecasting capacity. Data gathered from high above storms to below the ocean surface will be used to improve forecast models and advance the understanding of how some storms are able to rapidly intensify, enabling forecasters to better warn and protect communities from the impacts of severe weather.

Hurricane Preparedness
www.nws.noaa.gov/om/hurricane/

Hurricane FAQs
www.aoml.noaa.gov/hrd/tcfaq/tcfaqHED.html

AOML's Hurricane Research Division
www.aoml.noaa.gov/hrd

AOML's Underwater Glider Project
www.aoml.noaa.gov/phod/goos/gliders/index.php

NOAA-Aircraft Operations Center
www.flightscience.noaa.gov/

NOAA-Environmental Modeling Center
www.emc.ncep.noaa.gov/gc_wmb/vxt/HWRF/index.php

NOAA-National Hurricane Center
www.nhc.noaa.gov

NOAA-SHOUT Program
uas.noaa.gov/shout

NOAA-Unmanned Aircraft Systems Program
uas.noaa.gov/

NOAA's Microbial Research Contributes to National Microbiome Initiative

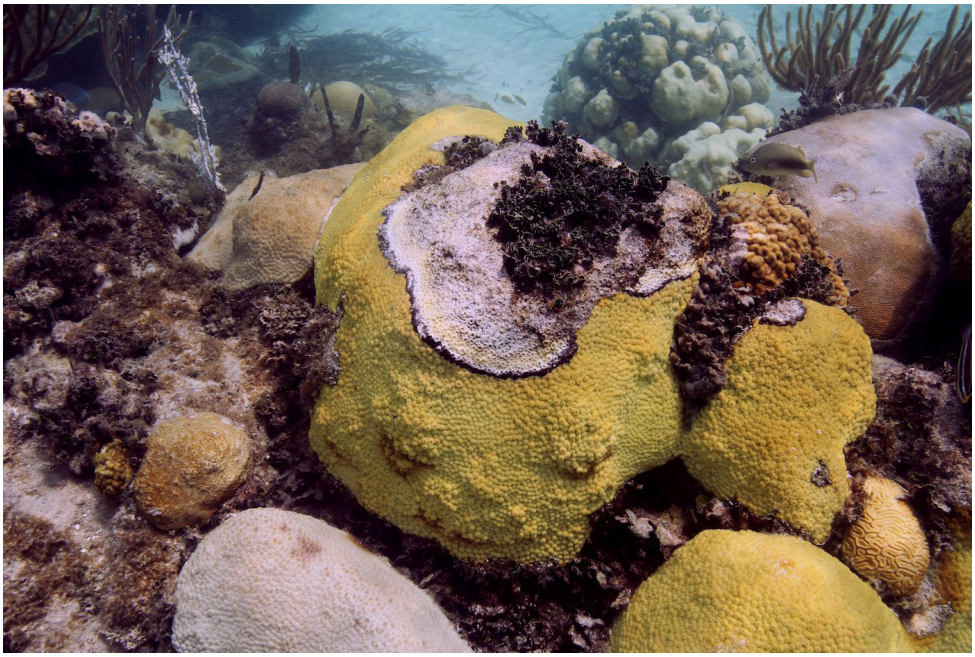
On May 13th, the White House Office of Science and Technology Policy introduced the National Microbiome Initiative, an effort to support multi-agency research to sample and better understand communities of micro-organisms that are critical to both human health and the world's ecosystems. As the nation's premier ocean science agency, NOAA is leading interdisciplinary research to improve the observation and assessment of marine microbiomes. In support of this national initiative, AOML received nearly $2 million in funding this year to conduct a number of projects that integrate genetic sampling techniques and technologies to advance understanding of the ocean's microbiomes.

Microbiomes are communities of diverse microscopic organisms that include plants, animals, fungi, viruses, bacteria, and other organisms that live on and inside of people, plants, animals, soil, the oceans, and the atmosphere. These microbiomes can influence human health, climate change, and food security, as well as many other aspects of our lives and the environment.

By sampling DNA, RNA, and proteins from single cells to whole organisms to entire communities, scientists hope to better understand where these organisms are, what they are doing, how they are affected by changing environmental conditions, and how they, in turn, affect the environment. The multi-disciplinary research conducted at AOML leverages existing resources and partnerships to enhance ecosystem observations and establish new approaches to assessing these communities.

At research sites in Florida and the Caribbean, AOML scientists and their partners will sample coral reefs, seawater, and marine sediments to identify genetic variations that may explain why some corals are more susceptible or resilient to bleaching and coral diseases than others. With a focus on two species of rare and endangered corals, scientists will collect and study coral tissue to identify the genetic makeup and diversity of the microbiome, which currently consists of poorly understood communities of micro-organisms living in close association with the corals.

Researchers hope to identify the genetic traits of the most resilient corals and their microbial communities by using next-generation-sequencing of the DNA and RNA associated with these microbiome communities before, during, and after bleaching or coral disease events. Experiments aim to identify communities associated with the corals that are resistant to warming waters and disease to advise coral restoration efforts across the region.



Black-band disease appears on a coral colony of *Montastraea cavernosa* in the Florida Keys. AOML researchers hope to identify genetic variants to understand why some corals are more resistant to the disease than others.

Another collaborative project will test the potential benefit of a state-of-the-art autonomous underwater vehicle (AUV) to conduct marine microbiome analysis. Successful development and transition of genomic analysis using AUV technology could reduce sample processing time, ship time needs and costs, and reliance on tissue sample collection. This work will test instrumentation from the Monterey Bay Research Institute in partnership with the J. Craig Venter Institute, NOAA's National Marine Fisheries Service, and the Scripps Institution of Oceanography.

In addition to assessing the microbiome to improve the understanding of food web dynamics, the project will also include field-testing of a new technique known as environmental DNA (eDNA), which can be used to detect the genetic signature of macro-organisms such as invertebrates or fish by analyzing cells that have been shed into the water column. Understanding the connection between the marine microbiome and fisheries holds the potential to improve the ability to monitor and predict ecosystem responses to environmental change.

NOAA is also working to enhance an existing ecosystem observation program by adding genetic sampling technology. The multi-agency California Cooperative Oceanic Fisheries Investigations (CalCOFI) program is one of the longest-running ocean observing projects in the US and seeks to gain a more comprehensive understanding of the dynamics of the California Current ecosystem to foster stewardship, resilience, and sustainable resource management.

By including genetic sampling technologies as part of CalCOFI, scientists hope to improve their understanding of the diversity and function of microbes in the ecosystem, enabling better prediction of ecosystem response to environmental pressures, including climate change. This project is a pilot for potentially broader applications to other regions and to NOAA's fleet of research ships.

New projects at AOML will focus on increasing computing capacity and enhancing bioinformatic capabilities. Bioinformatics is the application of computer science to analyze and integrate biological and genetic information. This new field has developed in response to the massive amounts of sequencing data generated by the types of studies described above, all of which rely on bioinformatics. AOML's bioinformatic capabilities will be used to better understand and predict ecosystem responses to changing environmental conditions.

South Florida Participants of ESOL Speakers Program Honored at AOML

AOML hosted an appreciation event for the South Florida Federal Executive Board on June 1st to recognize participants of its English as a Second Language (ESOL) speakers program. Now in its fifth year, AOML information technology specialist Alejandra Lorenzo is credited with creating and developing the program, envisioned as a means of inspiring high school students to learn to speak and read the English language.

Since 2011, employees from the South Florida Federal community, all of whom were once challenged to learn English themselves, have been visiting Hialeah Senior High School to share their personal stories of transition and assimilation. The student population at the Miami-Dade County public school is predominantly Hispanic.

Over the past school year alone, 32 speakers from more than eight Federal agencies volunteered their time to speak with ESOL students at Hialeah High. Although each shared a different story, the message they delivered remained focused on how learning to speak and read English could open doors to career and educational opportunities. Their commitment to encouraging students to expand their horizons is at the core of the program's success.

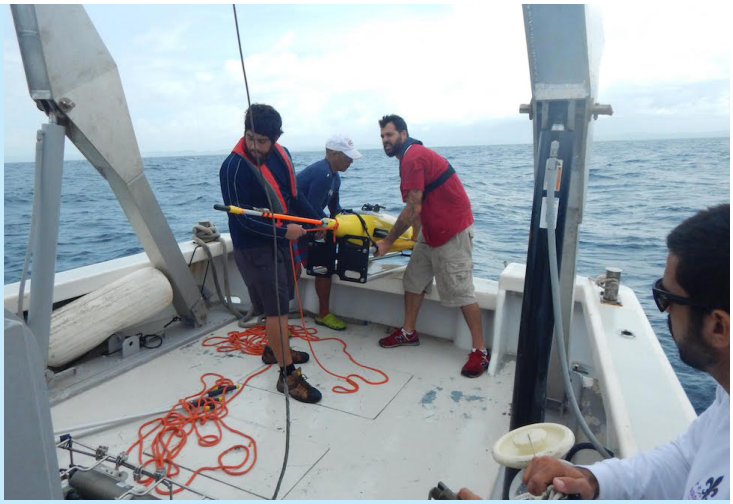
Some of the participants of the South Florida Federal Executive Board's ESOL program flank Alejandra Lorenzo of AOML (center, holding plaque) and include (first row, left to right): Dalynne Julmiste (AOML), Yeun-Ho Daneshzadeh (AOML), Georgina Lopez (Federal Aviation Administration), Lia Ansley (Department of Human Services), Agnes Winokur (Department of Justice), Rebecca Ayala (US Coast Guard), and Mercedes Feliciano (Bureau of Prisons). Second row (left to right): Joaquin Ochoa (Federal Aviation Administration), Ernesto Rancel (Department of Human Services), Leugi Cotayo (US Coast Guard), Martin Perez (Federal Aviation Administration) and Omar Perez (Office of Independent Council).

The event at AOML gave the ESOL speakers a chance to meet and share their experiences. Jaqueline Arroyo, the Executive Director of the South Florida Federal Executive Board, awarded each participant a certificate of appreciation and thanked them for taking time out of their busy schedules to make a difference in the lives of students. All participants expressed an interest in expanding the program to include other schools that face the same language and cultural challenges as the students of Hialeah High. It is this level of commitment to the South Florida community that will enable the ESOL program to grow and prosper.

AOML-CariCOOS Complete Fourth Glider Mission

AOML's fourth underwater glider mission was successfully completed on June 2nd. Grant Rawson, a University of Miami-Cooperative Institute researcher with AOML's Physical Oceanography Division (PhOD), joined partners from the University of Puerto Rico aboard the R/V *La Sultana* to recover the glider in the Caribbean Sea south of Puerto Rico. Ground support to pilot the glider was performed at AOML by Francis Bringas, Ricardo Domingues, Ulises Rivero, Thomas Sevilla, and Gustavo Goni. The glider missions are geared towards obtaining profile data for use in tropical cyclone intensification studies and forecasts.

While at the recovery site, a lowered acoustic Doppler current profiler (LADCP) was deployed to estimate the varying current velocities with depth. A new dropsonde designed and constructed by PhOD engineers was also deployed to calculate the depth-averaged currents and to compare the values obtained with those from the glider and LADCP. These measurements marked the beginning of a new time series that will be expanded upon at every subsequent glider recovery.



Staff from the University of Puerto Rico and AOML bring underwater glider SG609 aboard the R/V *La Sultana* after successfully retrieving it from the Caribbean Sea.

Since AOML glider operations began in July 2014, approximately 9000 temperature and salinity profiles have been collected in the Caribbean Sea and tropical North Atlantic, in addition to 4000 dissolved oxygen, colored dissolved organic matter, and optical backscatter profiles. All data collected by the gliders are disseminated in real-time through the Global Telecommunication System, as well as the AOML glider web site (www.aoml.noaa.gov/phod/goos/gliders/). The next deployment will begin in July, with two gliders in the Caribbean Sea and two gliders in the tropical North Atlantic Ocean. The underwater glider operations during hurricane season will be one component of the field program conducted by scientists with AOML's Hurricane Research Division. This work is funded by AOML, NOAA's Office of Oceanic and Atmospheric Research and the Caribbean Coastal Ocean Observing System (CariCOOS).

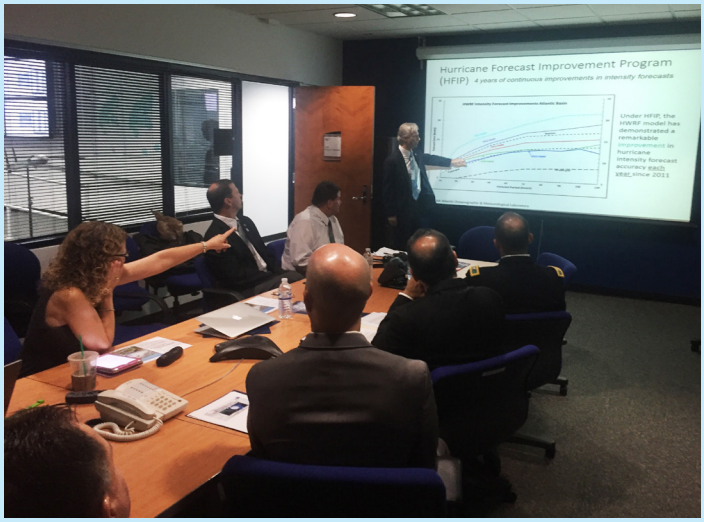
AOML Participates in CBS4 Miami's STEAM Day at Marlins Park

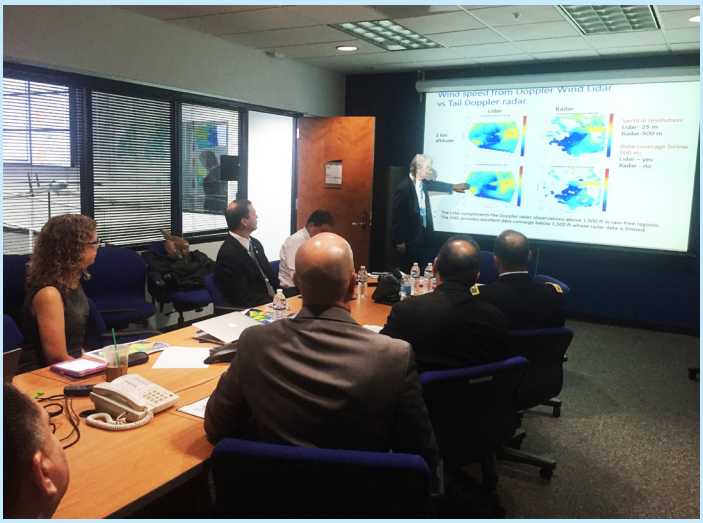
On Tuesday, May 24th, AOML Associate Director and Hurricane Hunter pilot LCDR Justin Kibbey, along with AOML's communications staff, participated in the STEAM (Science, Technology, Engineering, Arts, Mathematics) Day event at Marlins Park, hosted by local news station CBS4. Thousands of elementary and middle-school students from across Miami-Dade and Broward counties participated in the fun-filled, science-focused educational field trip to the baseball park, the current home of the Miami Marlins. The pre-game programming was designed to teach students about the basic concepts of weather and climate and how these topics relate to living in South Florida. LCDR Kibbey discussed what it's like to fly into a hurricane and introduced the Coyote Unmanned Aerial System, a small aircraft NOAA is using to gather data in the lower levels of the hurricane environment.

CBS4 meteorologist Nicole Mitchell and LCDR Justin Kibbey with a Coyote model.

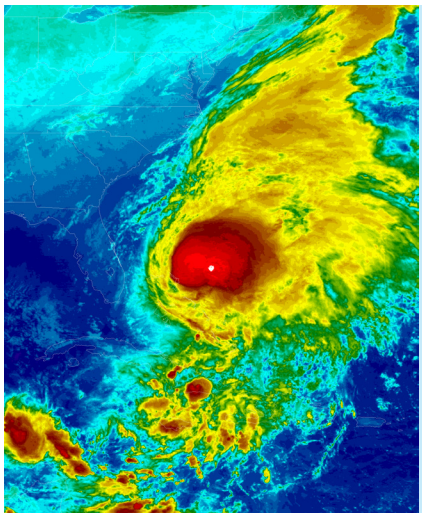
South Florida Leaders Discuss Preparations for the 2016 Atlantic Hurricane Season

AOML Director Dr. Bob Atlas met with Florida Congresswoman Debbie Wasserman Schultz on June 1st at the Miami-Dade Emergency Operations Center to review NOAA's 2016 seasonal hurricane forecast for the Atlantic basin. Representatives from the National Hurricane Center, Miami-Dade County Office of Emergency Management, Red Cross, and Florida National Guard also attended to discuss their preparedness and readiness efforts. NOAA is predicting between 4-8 hurricanes this season, and Bob discussed several advances in hurricane research that are expected to improve the accuracy of NOAA's forecasts, enabling vulnerable communities to be better prepared and resilient to severe weather.





Upper left: **South Florida leaders meet with Congresswoman Debbie Wasserman Schultz.** ***Upper right*****: Bob Atlas shows how NOAA's Hurricane Weather Research and Forecasting model has improved intensity forecast accuracy by 10-15% every year since 2012.** ***Bottom left:*** **Bob Atlas discusses how Doppler wind lidar will provide forecasters at NHC with more accurate wind observations.** ***Bottom right:*** **Debbie Wasserman Schultz and Bob Atlas alongside a Coyote model.**



AOML Researchers Attend 32nd Conference on Hurricanes and Tropical Meteorology

Twenty-three scientists from AOML and AOML's Hurricane Research Division (HRD) participated in the American Meteorology Society's 32nd Conference on Hurricanes and Tropical Meteorology held this year in San Juan, Puerto Rico on April 17-22. Roughly 650 presentations (452 oral presentations in 70 sessions and 196 posters in two sessions) were submitted to the conference. AOML and HRD scientists served as either authors or co-authors on 36 presentations and 11 posters.

Of the 440 tropical cyclone-related presentations and posters at the conference, 205, or about 46%, used data sets developed at HRD. There were four regular sessions and one poster session dedicated to NOAA's Hurricane Forecast Improvement Project (HFIP) with 34 presentations, plus another 50 presentations sprinkled throughout the rest of the program that reported on HFIP and NOAA-Intensity Forecast Experiment (IFEX) related work. It was also clear that HFIP research influenced a number of other presentations through recognition of the importance of evaluating numerical model system developments.

Seminars Highlight 60-Year History of AOML's Hurricane Research Division

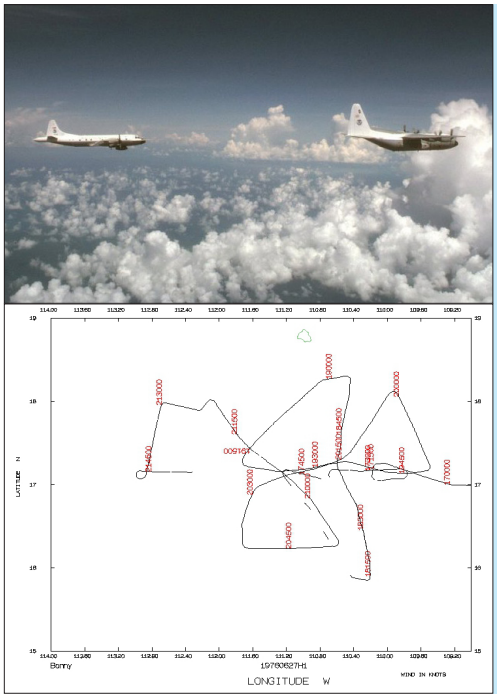
Rob Rogers and Neal Dorst of AOML's Hurricane Research Division (HRD) collaborated with Chris Landsea of the National Hurricane Center to present a three-talk seminar on the history of HRD on May 18th. The three talks were originally presented in March 2016 at the National Hurricane Conference in Orlando, Florida, but it was requested they be given again for the benefit of the Miami community.

HRD began operations as the National Hurricane Research Project in 1956 when some 30 scientists assembled in a converted warehouse at Morrison Air Field (now Palm Beach International Airport) to conduct research into hurricanes with the hope of improving their scientific understanding of them, which, in turn, would improve forecasting skill. The operations also included flying Air Force Hurricane Hunter aircraft into hurricanes to make direct observations. Over the next 60 years, HRD scientists have continued their annual field program and expanded their studies to include satellite data, computer simulations, and climatological studies.

The Miami chapter of the American Meteorological Society sponsored the talks, which were recorded at ftp://ftp.aoml.noaa.gov/hrd/pub/blog/seminars/2016/Miami_AMS_Chapter_Seminar_20160518.mp4 for future reference. The titles of the three presentations included:

- Neal Dorst (HRD)—*60 Year History of the Hurricane Research Division*
- Rob Rogers (HRD)—*NOAA's HRD: Advancing Tropical Cyclone Research and Prediction Using Aircraft Observations*
- Chris Landsea (NHC)—*Hurricane Research Division: Analysis and Forecasting Milestones*

Former AOML scientist Dr. Christopher Landsea, currently the Science and Operations Officer at the National Hurricane Center, shared a number of significant analysis and forecasting milestones directly derived from AOML's hurricane research.



NOAA's P-3 Orion Aircraft Celebrates 40 Years of Hurricane Hunting

On June 27, 1976, scientists aboard NOAA's new P-3 Orion aircraft (N42RF) took off from Acapulco, Mexico to fly a mission into Hurricane Bonny in the eastern Pacific. The flight marked the P-3's first time in a hurricane, and scientists aboard the specially-equipped aircraft used the latest computer technology, weather instruments, and radar systems to study the storm.

The Department of Commerce acquired the plane the previous year to replace the aging DC-6 research aircraft in use since 1960 to gather in situ weather data. Hurricane Camille in 1969 and the cloud physics requirements of Project STORMFURY were both spurs for NOAA to improve its aircraft fleet, and the process of transitioning to the new airframes culminated in 1977 when a companion P-3 (N43RF) aircraft began service.

At the time of the flight, Hurricane Bonny was a minimal hurricane, with winds just over 74 mph (120 km/hr) and a central pressure of 987 mb. The aircraft, along with NOAA's C-130, caught up with Bonny as the storm passed south of Mexico's Soccoro Island. The aircraft spent 6 hours reconnoitering the system before returning to Acapulco. The planes returned to Miami the following day, since Bonny had moved out of range. Not much use was made of the data collected, but the flight proved to be an excellent "shake down" mission, testing the new radars and avionics and getting the crews accustomed to their new vehicle.

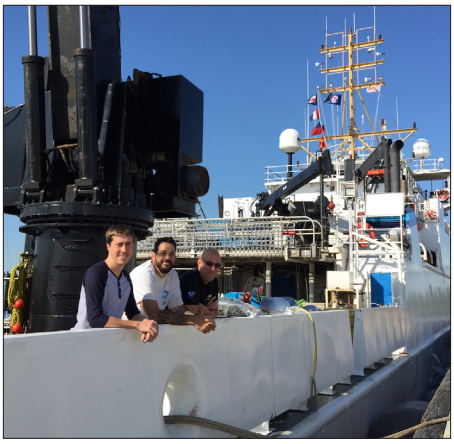
Top left: **NOAA's P-3 and C-130 aircraft in flight circa 1977.** ***Bottom left:*** **Flight track of NOAA's P-3 aircraft into Hurricane Bonny on June 27, 1976 (breaks in track are due to data fallouts).**

NOAA Scientists Study Ocean Currents and Larval Fish Distribution

AOML researchers recently returned from an interdisciplinary fisheries oceanography survey conducted aboard the NOAA Ship *Nancy Foster* during May and June 2016. The research cruise focused on quantifying larval fish distributions in parts of the southern Gulf of Mexico and Caribbean Sea and on examining how regional currents may influence the presence or absence of key species. The joint endeavor, supported by AOML and NOAA's Southeast Fisheries Science Center (SEFSC) partners, is part of a long-term effort that pools resources in a collaboration to better understand the early life history and larval recruitment pathways of important fisheries in the region, including the ecologically and commercially valuable Atlantic bluefin tuna.

Beginning in May, the science team sampled data-poor areas of the southern Gulf of Mexico and western Caribbean Sea adjacent to the western end of Cuba and the Yucatan Peninsula (areas outside of the Atlantic bluefin tuna's primary spawning grounds found farther north in the Gulf of Mexico). Physical oceanographic measurements and fish larvae were gathered to examine how the southern frontal regions of the Loop Current and Florida Current affected the aggregation and transport of Atlantic bluefin tuna and other pelagic larvae across the survey domain.

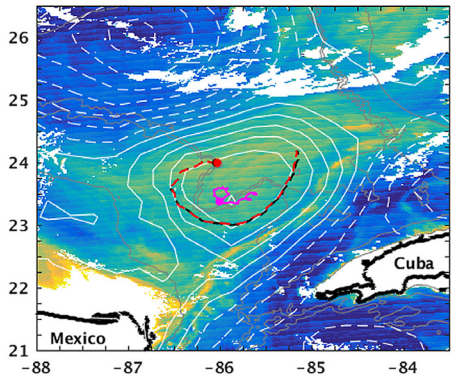
The data will help researchers identify additional areas of tuna spawning activity,



Matthieu Le Henaff and Grant Rawson (AOML), along with John Lamkin (SEFSC), prepare to sail from Miami aboard the NOAA Ship *Nancy Foster*.

improving larval habitat models. NOAA, along with the International Commission for the Conservation of Atlantic Tunas (ICCAT), uses the larval abundance data from the joint surveys to calculate and improve tuna stock assessments. In addition to sampling for pelagic species, this year's survey also sampled for larvae of economically important coastal reef fish species such as grouper and snapper. Identifying the role that major current systems play in the dispersal and retention of these species is essential for population connectivity assessments and the development of adaptive management strategies for regional marine protected areas.

During the cruise, scientists aboard the *Nancy Foster* used satellite altimetry and

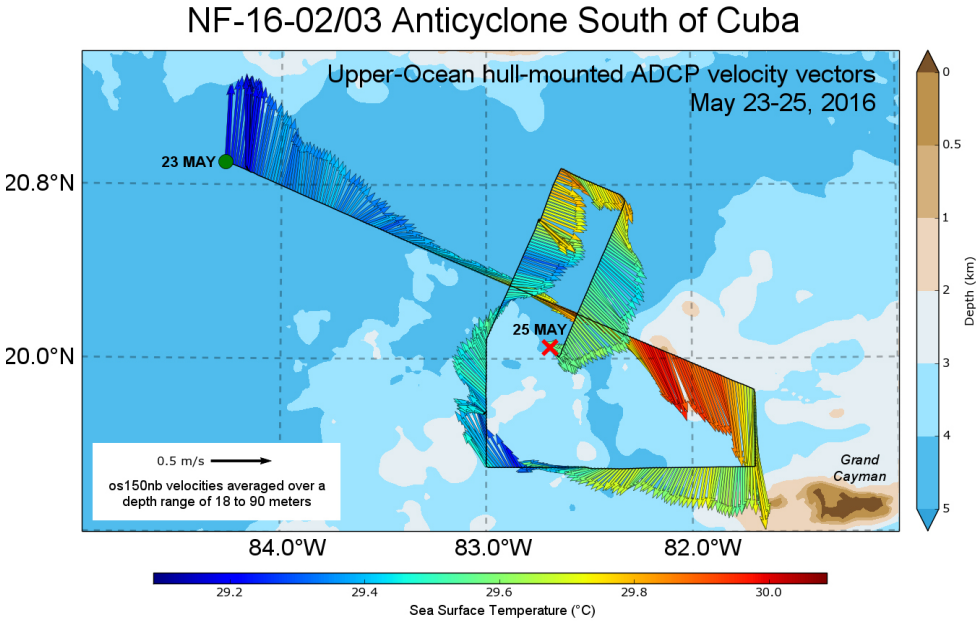


Sea surface chlorophyll a (chl_a) in the southern Gulf of Mexico on May 21, 2016 from the Modis Aqua satellite (blue: low levels of chl_a, orange: high levels). Contours of sea surface height anomaly from AVISO altimetry are shown as white lines. Continuous closed white contours indicate positive anomalies associated with cyclonic eddies, while dashed white contours represent negative anomalies associated with anticyclonic eddies. Three surface buoys (dots mark deployment locations) can be observed circulating counter-clockwise within the cyclonic frontal eddy north of the Yucatan Channel (trajectories are shown as magenta, dashed red, and dashed black lines).

ocean color data, as well as drifting buoy trajectories, to monitor the position of major regional circulation features. These data were compared with in situ measurements collected by the ship's hull-mounted acoustic Doppler current profiler (ADCP) to determine optimal sampling locations in relationship to the frontal regions of the currents observed.

Following work around the western end of Cuba, research continued in the northeastern Caribbean. AOML and SEFSC scientists partnered with scientists from the University of the Virgin Islands and the Department of Planning and Natural Resources in St. Thomas. Together, they surveyed oceanographic conditions, larval reef fish populations, and zooplankton concentrations across the coastal shelf of the US Virgin Islands and surrounding area.

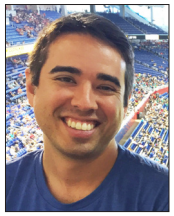
Data collected from the survey will enhance understanding of the connectivity and variation in the supply of reef fish larvae between managed and non-managed areas in the Virgin Islands. Additional DNA and nitrogen isotope sampling from collected larvae and zooplankton aim to provide definitive biological linkages and trophic structure comparisons between populations of larval parrotfish (an economically important species for the region) found near St. Croix, with groups found on the banks north and south of St. Thomas, St. John, and the British Virgin Islands.



Upper ocean current velocity vectors from a portion of the survey that mapped an anticyclonic eddy south of Cuba in late May. Following this survey of the eddy, larval fish sampling was targeted in the center, at the frontal boundary, and outside of the feature. At each location, sampling was continuous over the course of a 24-hour period. Once the collected larvae have been sorted and identified, scientists will examine variations in the larval abundance for each regime.

Farewell

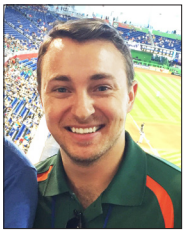
Renee Carlton, a University of Miami Cooperative Institute research associate with AOML's Ocean Chemistry and Ecosystems Division, resigned in May to accept a position with the Khaled bin Sultan Living Oceans Foundation headquartered in Annapolis, Maryland. During Renee's 4 years at AOML, she was a member of the Acidification, Climate, and Coral Reef Ecosystems Team that conducted research to assess the impacts of climate change and ocean acidification on coral reef communities throughout the Atlantic and Caribbean.



Edward Pritchard, a University of Miami-Cooperative Institute communications intern, departed in May after completing a one-year appointment with the Office of the Director. During Ed's time at AOML, he assisted Erica Rule, the Director of Communications and Outreach at AOML, and worked closely with staff to promote their research to a wider audience. He also championed social media technology, more than doubling the number of AOML's Twitter followers. Ed graduated from the University of Miami's Rosenstiel School in May with a Master of Professional Science (MPS) degree in Marine Affairs and Policy. He begins his next chapter as the Executive Director of Beneath The Waves, a non-profit organization that serves as a global platform for ocean conservation, education, and discovery.

Welcome Aboard

Jonathan Christophersen joined AOML's Physical Oceanography Division (PhOD) in May as a University of Miami-Cooperative Institute research associate. Jonathan will collaborate with several researchers within PhOD on data analysis studies for ocean dynamics and heat transport. He holds a Masters degree in meteorology from Florida State University and is currently a doctoral candidate with Florida State University's Department of Earth, Ocean, and Atmospheric Science.



Nicholas Komisarjevsky joined AOML's Office of the Director in May as a new University of Miami-Cooperative Institute communications intern. Over the next year, Nicholas will assist AOML Communications Director Erica Rule in promoting the lab's research and outreach activities to a broader audience and crafting web content using Twitter and other social media platforms. He is currently a graduate student at the University of Miami's Rosenstiel School working towards his Master of Professional Science degree in atmospheric science.

Congratulations

HRD Director Dr. Frank Marks congratulates Sonia Otero as he presents her with a plaque from NOAA's Aircraft Operations Center.

Sonia Otero, a University of Miami-Cooperative Institute senior research associate with AOML's Hurricane Research Division (HRD), was recognized by NOAA's Aircraft Operations Center in June for her "dedication and software engineering leadership during the development of the Airborne Atmospheric Measurement and Profiling System (AAMPS)." Sonia led the AAMPS development effort to standardize data collection, distribution, and display aboard NOAA's WP-3D and Gulfstream-IV Hurricane Hunter aircraft. AAMPS is critical to mission success as it provides real-time data dissemination capability, ensuring customers such as the National Hurricane Center have timely and accurate information to aid in analysis and forecasts of tropical cyclones. Furthermore, AAMPS provides several layers of redundancy, ensuring continuous data flow to all workstations on the aircraft, uninterrupted data transmission off the aircraft, and that all raw data are properly recorded.

Team NOAA-Miami Competes in 5K Corporate Run

Team NOAA-Miami competed in the 2016 Mercedes-Benz 5K Corporate Run on April 28th. This year's 16-member group was represented by NOAA employees from the National Hurricane Center, South Florida Weather Forecast Office, Southeast Fisheries Science Center, and AOML. More than 26,000 competitors from local businesses, corporations, government agencies, financial institutions, and non-profits participated in the event held at Bayfront Park in downtown Miami. Overall, Greg Foltz of AOML had the best team time (21:27), finishing in 150th place. Additionally, Team NOAA-Miami finished in second and fourth places, respectively, in the State/Federal Government Employees category for the men's and women's teams.

Some of the members of Team NOAA-Miami included Marlos Goes, Claudia Schmid, Ricardo Domingues, Greg Foltz, Luana Goncalves, Steve Diaz, and Kathryn Sellwood.

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

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