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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

The Global Ocean is Absorbing More Carbon from Emissions

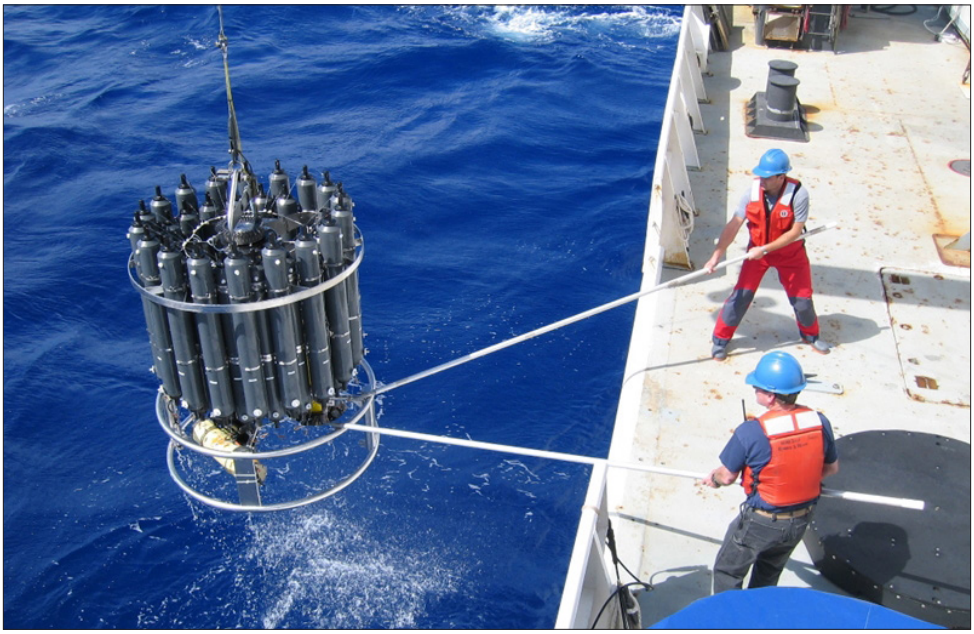
The global ocean absorbed 34 billion metric tons of carbon from the burning of fossil fuels for the 14-year period from 1994 to 2007 compared to 118 billion metric tons of carbon for the 195-year period starting from the Industrial Revolution in 1800 to 1994.

The new research published by NOAA and international partners in the journal *Science** finds that as carbon dioxide emissions have increased in the atmosphere, the ocean has absorbed a greater volume of these emissions. Although the volume of carbon dioxide going into the ocean is increasing, the percentage of emissions—about 31 percent—absorbed by it has remained relatively stable when compared to the first survey of carbon in the global ocean published in 2004.

By absorbing increased carbon dioxide from the atmosphere, the ocean reduces the warming impact of these emissions were they to remain in the atmosphere. However, carbon dioxide dissolved into the ocean causes seawater to acidify, threatening the ability of shellfish and corals to build their skeletons and affecting the health of other fish and marine species, many that are important to coastal economies and food security.

"The increasing load of carbon dioxide in the ocean interior is already having an impact on the shellfish industry, particularly along the US West Coast," said coauthor Richard Feely of NOAA's Pacific Marine Environmental Laboratory. "We have been working with the industry partners to provide an early warning system against the most severe impacts of rising carbon dioxide levels."

This article is adapted from a news story that appeared on NOAA 's Office of Oceanic and Atmospheric Research website on March 14 (https://research.noaa.gov)



A conductivity-temperature-depth (CTD) instrument and sampling bottles, used to measure physical and chemical oceanic properties needed to quantify the uptake of carbon, is recovered on the NOAA Ship *Ronald H. Brown* during the A16N GO-SHIP (Global Ocean Ship-Based Hydrographic Investigations Program) survey conducted in 2003.

Rik Wanninkhof, an oceanographer with AOML's Ocean Chemistry and Ecosystems Division and another coauthor of the study, added: "Critical questions that warrant continued observations of the ocean are if this uptake can be sustained and what might happen to the Earth's atmosphere if the ocean is unable to continue to absorb increased amounts of carbon dioxide."

The new research was led by Nicolas Gruber of ETH Zurich in Switzerland and builds on a 2004 NOAA-led study that found that 118 billion metric tons of carbon were absorbed by the global ocean from the start of the Industrial Revolution in 1800 to 1994.

The recent findings are based on an analysis of data collected by 50 research cruises that gathered more than 100,000 water samples, including cruises conducted by the NOAA Ship *Ronald H. Brown*. Because these cruises do not occur annually, it takes years for the data to be collected and thoroughly analyzed that represent all ocean basins.

Building on this extensive effort, NOAA has created an international Ocean Carbon Data System database, i.e., OCADS, that serves as a repository of ocean carbon data collected from around the globe. Researchers can access a wide array of carbon data from the OCADS database to monitor changes in ocean chemistry over time (https://www.nodc.noaa.gov/ocads/).

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*Gruber, N., D. Clement, B.R. Carter, R.A. Feely, S. van Heuven, M. Hoppema, M. Ishii, R.M. Key, A. Kozyr, S.K. Lauvset, C. Lo Monaco, J.T. Mathis, A. Murata, A. Olsen, F.F. Perez, C.L. Sabine, T. Tanhua, and R. Wanninkhof, 2019: The oceanic sink for anthropogenic CO_2 from 1994 to 2007. *Science,* 363(6432):1193-1199 (doi:10.1126/science.aau5153).

AOML Temperature Sensor to be Deployed at Reef Sites Worldwide

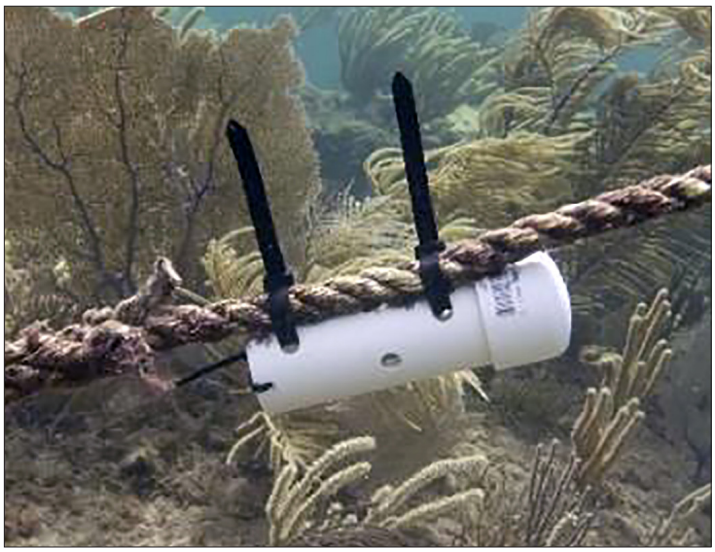
Researchers with AOML's Ocean Chemistry and Ecosystems Division have entered into a collaborative agreement with Reef Check Foundation to deploy an AOML-designed temperature sensor at coral reef sites around the world. Measuring only six inches in height, the inexpensive, highly-accurate sensors will greatly enhance efforts to more precisely monitor small-scale temperature fluctuations that occur at reefs over time and at various depths.

The partnership between NOAA and Reef Check Foundation, an international organization dedicated to preserving coral reefs, has been dubbed the Opuhala Project in honor of the Hawaiian goddess of corals and spiny creatures. As part of this joint endeavor, NOAA will supply the sensors and Reef Check Foundation will coordinate their deployment. The Opuhala Project brings together divers, scientists, managers, and conservationists from around the globe to create a community of practice that can learn from their shared experiences.

Throughout 2019, teams of volunteer Reef Check Foundation divers are expected to deploy and maintain more than 400 of the sensors at 95 selected reef sites throughout the Caribbean Sea, Atlantic Ocean, and Indo-Pacific at three depths and at three different types of reefs, i.e., fringing, barrier, and atolls. The sensors will remain in place for up to four months, collecting hourly measurements to help scientists track changes in ocean temperatures over time.

Each sensor costs approximately $9 to build, collects accurate temperature measurements to ±0.05-0.1°Celsius, is powered by two AA batteries, and can be built by anyone who knows how to solder. Coral Health and Monitoring Program researchers at AOML tested the sensors for more than a year at reef sites in south Florida in water depths as great as 75 feet.

The diminutive AOML-designed temperature sensor, assembled for about $9 in parts, will be deployed at coral reef sites throughout the Caribbean Sea, Atlantic Ocean, and Indo-Pacific through a partnership with Reef Check Foundation.



A temperature sensor deployed and housed within a protective casing.

The sensor was designed by University of Miami and coral researchers at AOML out of a need to better understand the bleaching dynamics that occur at reefs sites. Data from the sensors will help scientists better understand why some coral species undergo bleaching while other species are more resilient. Coral bleaching occurs when the colorful algae that live in coral limestone are ejected due to stressors such as prolonged exposure to warm ocean temperatures.

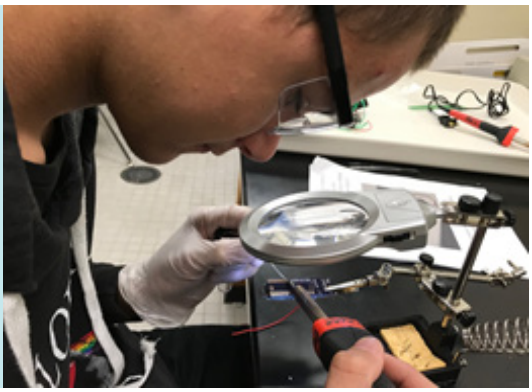
Scientists and marine environmental managers currently rely on satellite-derived sea surface temperature measurements from polar-orbiting satellites to predict regional and/or global scale incidences of coral bleaching. However, these measurements are often not representative of the actual water temperatures that occur at deeper depths where corals reside.

The expanded number of global observations from the new sensors will help fine-tune satellite algorithms to better predict sea temperatures under the conditions and locations of where the sensors are deployed. Data from the sensors will also be combined with other in situ coral observations to derive more accurate temperature thresholds for coral bleaching, enabling scientists to better understand the physiological dynamics of this phenomenon and other biological events.

The data will be shared with both Reef Check Foundation and NOAA, as well as appear on NOAA's Coral Health and Monitoring Program website (www.coral.noaa.gov/research/opuhala.html).

Students Aid Efforts to Build Opuhala Temperature Sensors

In March, students at two magnet schools in Broward County built close to 60 Opuhala temperature sensors designed by Coral Health and Monitoring Program researchers at AOML. In the near future, more south Florida students and schools will become involved in the activity of assembling the sensors. The effort is being led by Dr. Pamela Fletcher, a former coral reef scientist at AOML and currently an assistant professor at Broward College. Each temperature sensor is named for the student who built it. After the sensors are deployed, the student's name will appear on NOAA's Coral Health and Monitoring Program website (www.coral.noaa.gov/research/opulala.html), along with the location of the sensor on a Google map.



A Broward County student works to assemble an Opuhala temperature sensor.

Scientists Use 3D Printing Technology to Study Water Chemistry at Coral Reefs

AOML researchers have taken an innovative approach to studying the changing carbonate chemistry of seawater at shallow coral reef sites. Using 3D printing technology made possible by the new Advanced Manufacturing and Design Lab at AOML, researchers have been able to create their own water sampler within the lab.

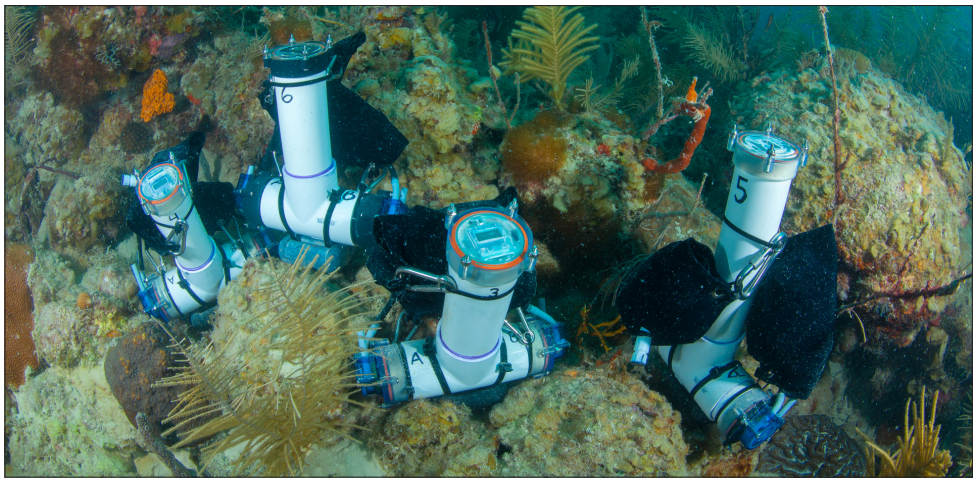
The new instrument, a Subsurface Automated Sampler minimizes some of the financial hurdles encountered in performing marine research by serving as a low-cost, open-source alternative to existing water samplers. Its simple design is also easily modified to accommodate evolving research needs.

The subsurface automated sampler was designed and built by coral ecologists Dr. Ian Enochs and Nathan Formel. The instrument was envisioned to address two of the largest hurdles to marine research—time and cost. "The issues of time and cost are the biggest obstacles often faced in marine research," said Enochs. "Our objective was to overcome these issues, making it easier to study carbonate chemistry on shallow reef habitats."

Prior to the development of the subsurface automated sampler, most of the water samples collected on reef sites were done manually. While automated water samplers do exist, their design is proprietary, adding an inflated cost to their use. They are also typically unwieldy in size, limited to single samples, and not always functionally applicable to shallow-water environments.

The sampler makes field work more efficient by enabling researchers to study coral reef carbonate chemistry at finer spatial and temporal scales. It can be programmed to collect water samples and temperature measurements at predetermined dates and times. Additionally, its compact size allows researchers to deploy multiple instruments and collect them at a later date for in-lab analysis of the water chemistry at different points across a reef site or at different times within an area.

Nathan Formel, a Cooperative Institute research associate at AOML, deploys a Subsurface Automated Sampler to monitor temperature and carbonate chemistry changes at a reef in the Florida Keys.



Four examples of the new Subsurface Automated Sampler designed and constructed at AOML using in-house 3D printing technology.

The ocean's long-term uptake of carbon dioxide has gradually made seawater more acidic. This phenomenon, widely known as ocean acidification, detrimentally affects coral reef ecosystems. While open ocean carbonate chemistry shows a clear trend in decreasing seawater pH, shallow-water systems are inherently more dynamic. Fluctuations in water chemistry occur over time scales ranging from daily to seasonal. To accurately characterize their variability and to monitor ocean acidification trends, high-frequency sampling is needed.

Work began in 2015 to develop the first sampler prototype capable of deployment at reef sites to depths of 15 meters (49 ft) and programmed in advance to collect two 500-ml samples at pre-set times. "We wanted to create something to maximize our effectiveness in collecting ocean acidification data on coral reefs," said Enochs. "To do this, we needed a waterproof device to reliably collect water samples at least as effectively as the current common practice while also strong enough to endure the often rough water conditions found in shallow nearshore reef habitats. Because conditions are dynamic, we also needed the instrument to be adaptable and field programmable. We built a small, power efficient screen and infrared receiver into the unit that can be programmed using a handheld remote control, even under water."

Drawing on their collective wealth of marine research experience, AOML scientists have since then tested and refined this first prototype, leading to the production of what is now the Subsurface Automated Sampler. As a result, researchers are poised to better determine how changes in dissolved inorganic carbon, total alkalinity, and ocean acidity have occurred over time and space at coral reef sites, furthering their understanding of these fragile ecosystems.

While AOML scientists are using 3D printing technology to achieve their research goals, they are also committed to ensuring the science is accessible and remains open source. Detailed instructions for how to build the samplers and the circuitry that powers them are available at www.coral.noaa.gov/accrete/sas. Construction and operating guides, along with sampler code, 3D printing design files, laser cutting files, and circuit board design files, are also available for download. Additionally, lesson plans developed in conjunction with Far Outreach Solutions are available online to teach students about ocean acidification, as well question-based engineering and design.

The sampler is currently being used by NOAA's National Coral Reef Monitoring Program (see https://www.coris.noaa.gov/monitoring/) and scientists at the Mote Marine Laboratory, the University of the Philippines, Texas A&M University, the University of Hawaii, the Escuela Superior Politécnica del Litoral (Ecuador), and the Universidad de Concepción (Chile), among others.

Researchers Study the Tropical Atlantic's Impacts on Climate and Weather

Scientists at AOML participated in a research cruise in March as part of NOAA's ongoing efforts to study how ocean-atmosphere interactions in the tropical Atlantic impact regional weather and climate variability. The cruise aboard the NOAA Ship *Ronald H. Brown* was led by Dr. Renellys Perez of AOML (chief scientist) with Erik Valdes, Diego Ugaz, Jonathan Christophersen, and two students completing the AOML team. They were joined aboard the *Brown* by scientists from Howard University and NOAA's National Environmental Satellite, Data, and Information Service, engineers from NOAA's Pacific Marine Environmental Laboratory, observers from the Brazilian Navy, and various university students.

The Prediction and Research Moored Array in the Tropical Atlantic project is an international partnership between the US, France, and Brazil to maintain an array of 18 moorings in the tropical Atlantic. These moorings provide real-time temperature, salinity, current structure, and surface meteorological data of the upper ocean to monitor seasonal-to-interannual variability in the atmosphere and the ocean. The data area also used for climate research and weather forecasting.

The *Brown* departed from Charleston, South Carolina on March 1, crossed the Atlantic to complete a transect along 23°W in the vicinity of the Cape Verde Islands, and then returned to Charleston on March 29. During the cruise, three moorings were recovered and redeployed, oceanic and atmospheric measurements were collected along the entire cruise track, and 12 hydrographic casts were conducted. Additionally, 14 surface drifters in support of NOAA's Global Drifter program and 22 profiling floats in support of the Argo program were deployed in areas with limited data coverage. The measurements from these drifters and floats provide much needed data to help maintain the tropical Atlantic observing system.

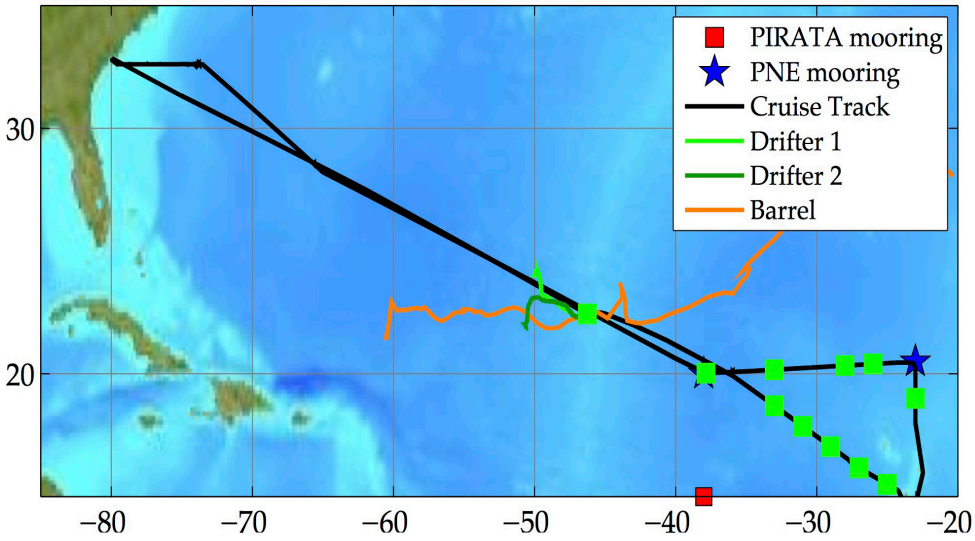
Science party aboard the NOAA Ship *Ronald H. Brown* off the coast of Praia, Cape Verde after servicing the 11.5°N, 23°W mooring. The hazy sky is due to dust from the Sahara Desert. The stop at Praia was necessitated due to a crew member needing to be medivaced to shore. Photo credit: Vernon Morris (Howard University).

Members of the science team also conducted a study—the Aerosols and Ocean Science Expeditions—focused on the impacts and evolution of mineral dust during its long-range transport over the tropical Atlantic after exiting the west coast of Africa. They collected a comprehensive suite of in situ, ground truth data in the midst of a large Saharan dust event.

Overall, the scientific objectives for the cruise were curtailed due to the number of days at sea being shortened from 41 to 29. However, a bright spot during the cruise was crossing paths with and providing aid to French adventurer Jean-Jacques Savin.

Jean-Jacques is transiting across the Atlantic from Spain in an orange wooden barrel propelled only by the currents and wind with the hope of reaching the Caribbean. Although he departed Spain in December 2018, he was still nearly 1,000 nautical miles from his destination when he encountered the *Brown*.

The ship's crew supplied Jean-Jacques with food and water and wished him well on his journey, which he completed in May. The AOML team deployed two GPS-tracked surface drifters in his wake to test whether they could assist in tracking his barrel's movements (see map at left).



Cruise track with locations of drifter deployments for the Global Drifter program and nearby mooring locations identified. The orange line shows the cruise track of Jean-Jacques Savin as of April 26. The green lines show the trajectories of the two drifters deployed in his wake from March 23 to April 25.

Jean-Jacques Savin, crossing the Atlantic in an orange barrel, communicates via radio with chief scientist Renellys Perez. Photo Credit: Peter Nick Granozio (*Ronald H. Brown*).

Florida Congresswoman Donna Shalala Visits AOML

On April 15, Congresswoman Donna Shalala of Florida's 27th District visited AOML to learn about the lab's research programs and collaborations that directly impact and improve south Florida communities and the nation. Representative Shalala was accompanied by her district director, Mr. Raul Martinez, NOAA's Acting Administrator, Dr. Neil Jacobs, and AOML's Acting Director, Dr. Gary Matlock. Dr. Roni Avissar, the dean of the University of Miami's Rosenstiel School, along with Dr. Ed Rappaport, the Deputy Director of NOAA's National Hurricane Center, and Dr. Clay Porch, the Director of NOAA's Southeast Fisheries Science Center, also participated in her visit.

AOML Deputy Director, Dr. Molly Baringer, welcomed Representative Shalala and guests and began a tour with a visit to AOML's Experimental Reef Laboratory on the grounds of the Rosenstiel School campus to learn of researchers' efforts to study coral resiliency in an era of warming ocean temperatures and ocean acidification. Coral reefs generate substantial revenue in south Florida, as well as serve as the spawning/nursery grounds for thousands of fish species. The lab enables researchers to observe how coral species respond to stress factors that challenge their health and well-being with the goal of helping them adapt to a marine environment in transition.

Returning to AOML, Dr. Frank Marks of the Hurricane Research Division highlighted AOML's efforts to advance tropical cyclone forecasts through data-gathering missions aboard NOAA's Hurricane Hunter aircraft, the collection and assimilation of data into hurricane models, and advances in NOAA's high-resolution hurricane modeling approaches. National Hurricane Center Deputy Director Dr. Ed Rappaport joined the discussion to emphasize the collaborative efforts between NHC and AOML in keeping south Florida communities and the nation prepared for severe weather through up-to-date warnings and forecasts.

Continuing with the theme of improved forecasts, the group visited the Physical Oceanography Division wing where Drs. Gustavo Goni and Rick Lumpkin highlighted an array of ocean-observing instruments that scientists deploy globally to monitor and assess the ocean's changing physical, chemical, and biological properties, helping to improve understanding and forecasts of weather, climate, and even fisheries. Dr. Hosmay Lopez discussed how underwater gliders can improve hurricane intensity forecasts by gathering temperature and salinity data. He also discussed how ocean patterns can help inform regional patterns of heat waves.

Dr. Chris Kelble of the Ocean Chemistry and Ecosystems Division finished the tour by discussing AOML's research to study Florida's coastal waters, including AOML's ongoing monitoring of water quality and indicators of ecosystem health associated with Everglades Restoration. He was joined by Dr. Mandy Karnauskas from NOAA's Southeast Fisheries Science Center. Together they highlighted joint research efforts to investigate the impacts, extents, and causes of the devastating red tide event on Florida's west coast in 2018.

1. Molly Baringer (right) leads the group on a walking tour of AOML. 2. Coral researcher Graham Kolodziej (right) explains how scientists use the Experimental Reef Laboratory to study how corals respond and adapt to climate change. 3. Frank Marks (rear center) speaks of efforts to keep south Florida communities and the nation prepared for severe weather through up-to-date forecasts. 4. Gustavo Goni discusses how ocean-observing instruments enable scientists to assess physical, chemical, and biological changes in the ocean that impact weather and climate. 5. Chris Kelble (center) and Mandy Karnauskas (left foreground) highlight joint AOML-SEFSC efforts to study the impact, extent, and cause(s) of the 2018 red tide event along Florida's west coast.

Coral Researchers Provide Educational Platform for Middle School Students

In March, AOML's coral researchers partnered with the ANGARI foundation to help Experimental Design students at Conniston Middle School in West Palm Beach learn about coral reefs. Approximately 50 students took a virtual field trip to NOAA's Florida Keys National Marine Sanctuary via a 360-degree film entitled *Generation Ocean: Coral Reefs.* The film features AOML coral researcher Dr. Ian Enochs and his research team as they study coral reef habitats. The Conniston students were able to explore coral anatomy featuring corals made with 3D printed materials from AOML, as well as had the chance to learn about 3D mosaic reef imagery. The students also interviewed Dr. Enochs via Skype for an in-depth question and answer session about coral reef conservation.

Conniston middle school students interview Dr. Ian Enochs via Skype.

Hurricane Scientists Go Purple for Cancer Research

For the past 3 years scientists with AOML's Hurricane Research Division have participated in the annual PurpleStride 5K walk/run in support pancreatic cancer research. The group was originally motivated to support PurpleStride due to the illness and subsequent passing of their colleague Paul Willis. The organization was brought to their attention by Anita Marks, the wife of HRD division head Frank Marks, who lost her brother to the disease. This year the HRD team joined forces with Anita Mark's team, *Walk for Jerry*, to increase the impact of their combined fundraising efforts. The team collectively raised more than $1,000 for research geared toward ending pancreatic cancer.

HRD members of the *Walk for Jerry* PurpleStride team—Laura Ko, Frank Marks, Kathryn Sellwood, Jon Zawislak, Lisa Bucci, and Xuejin Zhang—at Tropical Park on March 9.

Team NOAA Competes in 2019 Corporate Run

Staff from AOML, the National Hurricane Center, and Miami Weather Forecast Office joined forces on April 25 to compete as Team NOAA in the 2019 Mercedes-Benz Corporate Run. The 15-member group were part of close to 27,000 participants who flocked to downtown Miami's Bayfront Park on a warm, sunny evening for the 5K run-walk event to promote fitness and healthy living. Overall, Greg Foltz (AOML) led the men with a place finish of 161 out of a field of 12,856 male competitors, while Lisa Bucci (AOML) lead the women with a place finish of 376 out of a field of 13,842 female competitors. In addition to a fun evening focused on wellness, a portion of the proceeds from the race were donated in support of the United Way.

Members of Team NOAA at Bayfront Park before the start of the 2019 Mercedes-Benz Corporate Run.

Researchers Monitor Florida Current Volume Transport/Water Mass Changes

In April, AOML researchers conducted a 2-day hydrographic survey along 27°N in the Florida Straits aboard the R/V *F.G. Walton Smith*. This cruise and other similar surveys, performed quasi bimonthly, are a component of AOML's Western Boundary Time Series project designed to quantify Florida Current volume transport and water mass changes. The cruises also help to calibrate daily estimates of the Florida Current volume transport derived from a submarine telephone cable across the Florida Straits. Additionally, and in collaboration with the National Oceanography Centre in Southampton, total alkalinity, dissolved inorganic carbon, and nutrient samples were also collected during the cruise.

AOML scientists (left to right) Andy Stefanick, Jay Hooper, Ryan Smith, and Diego Ugaz with a CTD (conductivity-temperature-depth) rosette used to gather water column samples.

Welcome Aboard

Dr. Rafael Goncalves join the staff of AOML's Physical Oceanography Division in April as a University of Miami-Cooperative Institute post-doctoral scientist. Rafael will work closely with PhOD scientists to assess the impact of in-situ oceanographic data on hurricane intensity forecasts and on monitoring Atlantic meridional heat transport. He holds a PhD in Meteorology and Physical Oceanography from the University of Miami's Rosenstiel School, awarded in 2018.

As part of AOML's efforts to document its early history, reproductions of several watercolor and oil paintings, as well as black and white drawings, by artist Jack Coggins have been printed, framed, and mounted along the third-floor hallways. Coggins created the two images above and many more at the request of AOML founder Dr. Harris Stewart. In 1969, Stewart invited Coggins aboard the U.S. Coast and Geodetic Survey vessel *Discoverer* (top image) to chronicle shipboard activities during a research cruise as the crew and scientists worked to deploy instruments and gather data. Thanks to Dr. Adriana Y. Cantillo, a former AOML researcher and artist, who led the effort to recover and repurpose Coggins' artwork.

Congratulations

Dr. Ghassan "Gus" Alaka, a University of Miami-Cooperative Institute scientist with AOML's Hurricane Research Division, became a federal information technology specialist in December 2018. Gus, a member of HRD's Numerical Modeling Group, is focused on improving the accuracy of hurricane track and intensity forecasts through the development and evaluation of NOAA's operational high-resolution Hurricane Weather Research and Forecasting (HWRF) model, the experimental basin-scale HWRF system, and the next generation Hurricane Analysis and Forecast System (HAFS).

Lisa Bucci, a University of Miami-Cooperative Institute senior research associate with AOML's Hurricane Research Division, became a federal NOAA Pathways Intern in March. Lisa began at AOML in 2010 to help develop a regional Observing System Simulation Experiment capability at AOML. She is currently pursuing her PhD in atmospheric science at the University of Miami's Rosenstiel School. The Pathways Internship Program enables students to hold federal positions and explore public service careers while still in school.

Dr. Xuejin Zhang, a University of Miami-Cooperative Institute scientist with AOML's Hurricane Research Division, became a federal information technology specialist in December 2018. Xuejin began at AOML in 2008 after earning a PhD in atmospheric science from North Carolina State University. He is a member of the Numerical Modeling Group focused on improving the accuracy of hurricane track and intensity forecasts through the development and evaluation of NOAA's operational high-resolution Hurricane Weather Research and Forecasting (HWRF) model, the experimental basin-scale HWRF system, and next generation Hurricane Analysis and Forecast System (HAFS).

Gopal

Robert Rogers

Drs. Sundararaman Gopalakrishnan, aka Gopal, and Robert Rogers, meteorologists with AOML's Hurricane Research Division, have been selected as members of the eleventh class of NOAA's Leadership Competencies Development Program (LCDP). The LCDP engages participants in a series of learning experiences and assignments geared toward broadening their understanding of NOAA's strategic vision, mission, and goals, as well as business practices. The 18-month program, which begins in July 2019, has proven to be an important source of candidates for NOAA senior and/or executive level positions.

Dr. Luke Thompson (center) is congratulated by OAR Assistant Administrator Craig McLean (left) and Stuart Levenbach of NOAA's Office of the Under Secretary/ Administrator (right) at the OAR Awards Ceremony in Silver Spring, Maryland on March 12.

Dr. Luke Thompson, a Northern Gulf Institute professor with AOML's Ocean Chemistry and Ecosystems Division, and AOML coauthor Kelly Goodwin are the recipients of an Outstanding Scientific Paper Award from NOAA's Office of Oceanic and Atmospheric Research (OAR) for their landmark paper entitled *A communal catalogue reveals Earth's multiscale microbial diversity*. The paper was selected by OAR as the top FY-2018 science article in the Oceans and Great Lakes category. Thompson *et al.* (2017)* presents an analysis of microbial samples collected by hundreds of researchers worldwide for the Earth Microbiome Project. The paper serves as both a reference database and a framework for incorporating data from future studies, advancing the characterization and understanding of Earth's microbial diversity.

*Thompson, L.R., *et al.,* 2017: A communal catalogue reveals Earth's multiscale mirobial diversity. *Nature,* 551(7861):457-463 (doi:10.1038/nature24621).

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Keynotes editor: Gail Derr

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

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