2023

ATLANTIC OCEANOGRAPHIC AND METEOROLOGICAL LABORATORY

Accomplishments Report

Office of Oceanic and Atmospheric Research | National Oceanic and Atmospheric Administration

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Expanding Our Reach Through Partnerships

We are grateful for our Cooperative Institute partners—the Cooperative Institute for Marine and Atmospheric Studies (CIMAS) and the Northern Gulf Institute (NGI)—who work with us as a cohesive unit to execute our mission and advance scientific discovery.

UNIVERSITY OF MIAMI
COOPERATIVE INSTITUTE for
MARINE & ATMOSPHERIC STUDIES

NORTHERN GULF INSTITUTE
a NOAA cooperative institute

We also appreciate our numerous research partners and funders who support our work around the world and make so much of our research possible. The following accomplishments are supported in part by NOAA's Climate Program Office, Coral Reef Conservation Program, Global Ocean Monitoring and Observing Program, Integrated Ocean Observing System, National Weather Service, National Marine Fisheries Service, Office of Marine and Aviation Operations, Ocean Acidification Program, and Weather Program Office.

Letter from the Director

It is my pleasure to present this document highlighting the major accomplishments of NOAA's Atlantic Oceanographic & Meteorological Laboratory (AOML) for Fiscal Year 2023 (FY23). At AOML, every member of our team—from scientists to administrative, information technology, facilities, engineering, and communications staff—plays a vital role in contributing to the lab's world-class Earth system research. Central to everything we do is the advancement of scientific knowledge and the application of this knowledge to enhance environmental stewardship and ensure a better world for current and future generations.

Our research focuses on the Atlantic Ocean, its role in climate change, and the impacts of global changes on the Atlantic Ocean region. Throughout FY23, we worked diligently to inform the accurate forecasting of extreme weather and ocean phenomena, observe and manage marine resources, and provide data, assessments, insights, and models to decision makers and the public.

In May 2023, President Joe Biden announced the official end to the federal declaration of the COVID-19 public health emergency, prompting a return to the workplace after more than 3 years of "safety at home" telework. In spite of the numerous challenges posed by the pandemic, AOML's dedicated workforce persevered, finding workaround solutions to hardships that upheld the lab's productivity.

This fiscal year we also proudly marked the 50th anniversary of AOML's founding on Virginia Key. NOAA and NOAA Research leaders joined the AOML community in celebrating the event to reflect on how the lab's research and technology have evolved over the past five decades. We also reflected on numerous milestones that fueled the science and achievements that have brought us to where we are today.

Building on 50 years of accomplishments and innovation, AOML will continue to capitalize on advances in technology to power cutting-edge research to address societal challenges. Our strategic plan, along with my priorities of people, science, and communication, will be our roadmap for guiding these efforts, furthering our role as a leader in Earth system science to provide trusted scientific data and knowledge.

From informing millions about the damaging impacts of heat stress on coral reef ecosystems to spearheading the development and transition of NOAA's new state-of-the-art hurricane forecast system, AOML remains committed to delivering world-class science for the American people that supports NOAA's mission and serves our local, national, and international stakeholders.

Sincerely,

Preface

The mission of our lab is to conduct and transition world-class Earth system research to inform: the accurate forecasting of extreme weather and ocean phenomena, the management of marine resources, and an understanding of climate change and associated impacts, thereby improving ocean and weather services for the region, the nation, and the world.

As we work towards achieving our vision of being the leader in Earth system research for the Atlantic Ocean region, providing trusted scientific data and knowledge to predict changes in weather, climate, oceans, and marine ecosystems, we are dedicated to building a more inclusive, diverse, equitable, and accessible workplace, encouraging new ideas and creative solutions focused on some of society's most pressing issues.

In 2023, NOAA Research identified four main societal challenges for which we will address solutions. These challenges are:


Confronting Challenges from our Changing Climate


Protecting Against Extreme Weather Events and Environmental Hazards


Managing Too Much and Too Little Water


Sustaining a Healthy Environment and Economy

Working to address these issues today through our continued and expanded research efforts is paramount to preparing societies that will be made more vulnerable to the impacts of a changing climate. Throughout this document, you will find the above icons to show how our accomplishments made progress in addressing these challenges.

Our team takes action to better understand how the Earth system responds to environmental stressors, from mass coral bleaching events to an active hurricane season, to foster resilience and advance our understanding of the natural environment. In this regard, we are relentless in our pursuit of fulfilling NOAA's mission to build a climate-ready nation with research today that will protect both lives and property tomorrow.

We use state-of-the-art models and technology to enhance hurricane forecasts. Observation of the Earth system from the upper levels of hurricanes to the depths of the ocean enables tracking changes across a variety of ecosystems to monitor the impacts of climate change and advance our understanding of this existential global threat. The data we collect from analyzing samples, enhancing models, flying directly into storms, crossing entire oceans, and conducting new experiments transition into products made publicly available. These products assist decision-makers, emergency managers, scientists, and communities both nationwide and globally. These goals, as outlined in our FY 2022-2026 Strategic Plan, are exemplified by the following accomplishments for FY23.

2023 By-the-Numbers

47
Award winners

10,000+
People reached through outreach activities

100+
Ship of Opportunity Program cruises

2500+
Person at sea days

200+
Person days supporting hurricane missions

6
Research to operations transitions

141
Peer-reviewed publications (setting a new AOML record!)

Goal #1: Empower our team

Create an inclusive and cutting-edge environment that fosters discovery, exploration, and success.

Expanding Diversity and Inclusion Efforts:

AOML flies Juneteenth flag for the first time

The Juneteenth flag was proudly hoisted for the first time this year in remembrance of the day federal troops arrived in Galveston, Texas, in 1865 to take control of the state and ensure that all enslaved people were freed - two and a half years after the Emancipation Proclamation was signed.

Black History Month tour of Virginia Key Beach Park

Our neighbors at Historic Virginia Key Beach Park Trust led us on an informative tour of the park during Black History month to share the rich history of this beach, formerly known as "Virginia Beach, a Dade County Park for the exclusive use of Negroes." Virginia Key Beach was, and still is, a place for celebrations, community gatherings, and merriment, and we are honored to have been invited to tour such a special place in our community.

AOML contractor serves on first AMS panel for transgender, nonbinary, and gender nonconforming folks at the 103rd Annual Meeting

Thia Griffin-Elliott (they/she), Groundswell Communications Specialist at AOML, participated in the American Meteorological Society's first panel for transgender, nonbinary, and gender non-conforming folks and their allies, discussing the joys, challenges, and examples of allyship. Panel members discussed both the successes and challenges of creating equity for people on the gender diversity spectrum and expressed that the panel and subsequent discussion made them feel heard.

AOML staff honored with Andrew Awards

Our Diversity, Inclusion & You (DIY) group presented Andrew Awards to AOML, Cooperative Institute, and contract staff members for exceptional professionalism and dedication to NOAA's mission by going above-and-beyond their regular duties during extraordinary circumstances. The award is named in recognition of the team who selflessly helped their coworkers in the devastating aftermath of Hurricane Andrew. This year, the AOML community celebrated those who supported their coworkers over the past few years, including but not limited to, the COVID-19 pandemic.

Awards

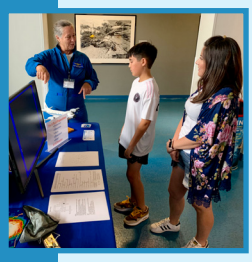
In FY23, 47 scientists at AOML received 21 prestigious awards for their research achievements and powerful impact on society. These awards included the Department of Commerce Gold Medal, NOAA Research Employee of the Year Award, NOAA Employee of the Month Award, NOAA Boulder Outreach Gold Star Award, South Florida Federal Executive Board Employee of the Year Award, and American Meteorological Society Editor's Award.

AOML Takes Action Campaign

AOML leadership launched a new internal initiative designed to empower each member of our AOML community to actively contribute to maintaining a safe, productive, and harmonious laboratory environment. The AOML Takes Action Campaign centers on fostering collective responsibility and engagement in various aspects of our laboratory's well-being. By focusing on essential topics such as physical and emotional safety, supporting each other, and ensuring a conducive work environment, we can elevate both productivity and well-being.

AOML Scientists Lead Water Quality and Biodiversity Workshop in Brazil

Scientists from AOML, CIMAS, and NGI led a workshop in São Paulo, Brazil, where they met with local leaders to identify pathways for integrating sustainable management into the state's decision-making process focused on water quality and marine biodiversity. The event was held at the US Consulate General of São Paulo and represents the beginning of a cooperative effort between NOAA and the Brazilian Secretary of Infrastructure and Environment with government agencies, academia, and private sector organizations at the workshop.



Scientists Engage Communities in Outreach Events Nationwide

AOML scientists, staff, and partners reached over 10,000 people through in-person community events, hands-on activities, games, and conversations. These events included the Deering Seafood Festival, Museum of Discovery and Science's Eye of the Storm Hurricane Awareness Day, Miami-Dade County Youth Fair, and NOAA's Hurricane Awareness Tour. Our dedicated scientists also eagerly presented to 1000 students and teachers through formal education programs such as Skype-a-Scientist, Scouts, and Scientists in Every Florida School, teaching them about our research and inspiring the next generation of scientists and environmental stewards.

AOML Continues Support of Diverse Internship Opportunities

During FY23, AOML hosted more than 30 interns, ranging from high school students to post-doctoral fellows, including NOAA-William Lapenta interns, NOAA-Experiential Research and Training Opportunities interns, NOAA-Educational Partnership Program/Minority Serving Institutions interns, our very first Knauss Fellow, plus two NOAA Leveraging Abilities, Needs, Talents, Energies, and Resources Network development program employees. They joined us from US high schools, national and international universities, and NOAA Line Offices across the country to study corals, microbes, hurricanes, air-sea interaction, ocean dynamics, ocean acidification, communication strategies, research transition processes, and more.

AOML Celebrates 50 Years of Science

AOML celebrated the 50th Anniversary of its founding on Virginia Key this year. An event in September served as a celebration of AOML's history, research accomplishments, and contributions to society. It consisted of a gathering of current and former staff that reflected on how far the lab had come and concluded with an awards ceremony that highlighted numerous achievements and scientists. AOML was pleased to celebrate the occasion with NOAA leaders, including Richard Spinrad, PhD, Under Secretary of Commerce for Oceans and Atmosphere and NOAA Administrator; Michael Morgan, PhD, Assistant Secretary of Commerce for Environmental Observation and Prediction; and Steve Thur, PhD, Director of NOAA Research, as well as a video from a few former NOAA Administrators.

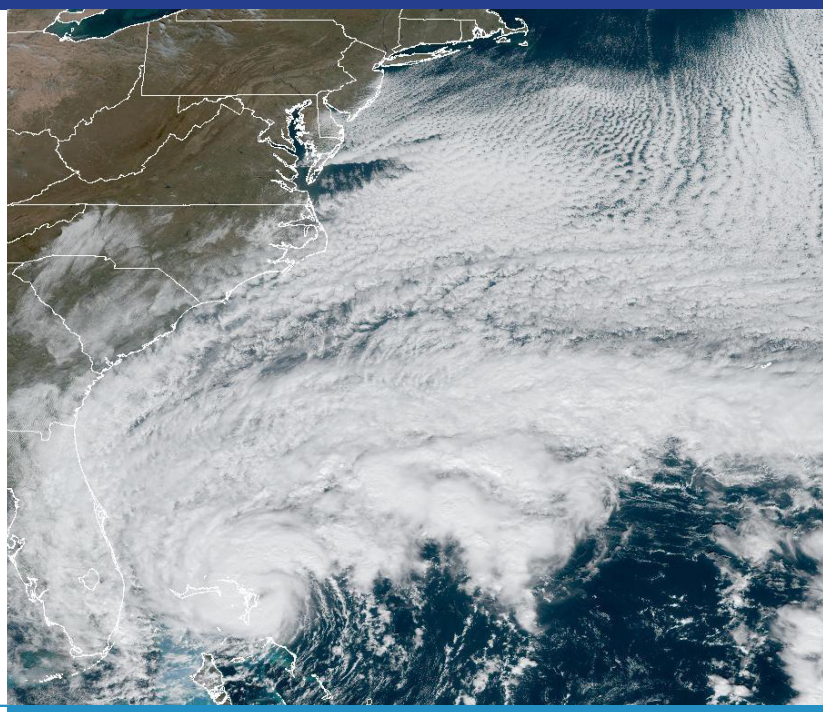
Goal #2: Observe the Earth System

Collect and evaluate ocean, atmosphere, and marine ecosystem observations that contribute to the body of scientific knowledge of the Atlantic Ocean region to improve the ability to better assess and predict the Earth system.

The term 'hurricanes' will be used throughout this report to generally refer to all forms of tropical cyclones (intense low-pressure wind systems that form over tropical oceans).

The ocean's influence on hurricane formation

Research led by AOML found that hurricane intensification rates near the US Atlantic coast have increased significantly over the last 40 years and will likely continue to increase in the future. Scientists analyzed hurricane intensification patterns in the 230 mile area of the shoreline using storm track data and found that Atlantic coast hurricanes are intensifying faster than 40 years ago. Climate models showed that hurricanes near the US Atlantic coast enter into an increasingly favorable environment just ahead of landfall, which can cause storm wind speeds to increase quickly. This comes as scientists at AOML have also found that Atlantic Niño, the counterpart of the Pacific El Niño, increases the formation of hurricanes off the West African coast. The study is the first to investigate the links between Atlantic Niño/Niña and seasonal Atlantic hurricane activity and the associated physical mechanisms.



GO-SHIP cruise assesses decadal changes in Atlantic, contributes to landmark study

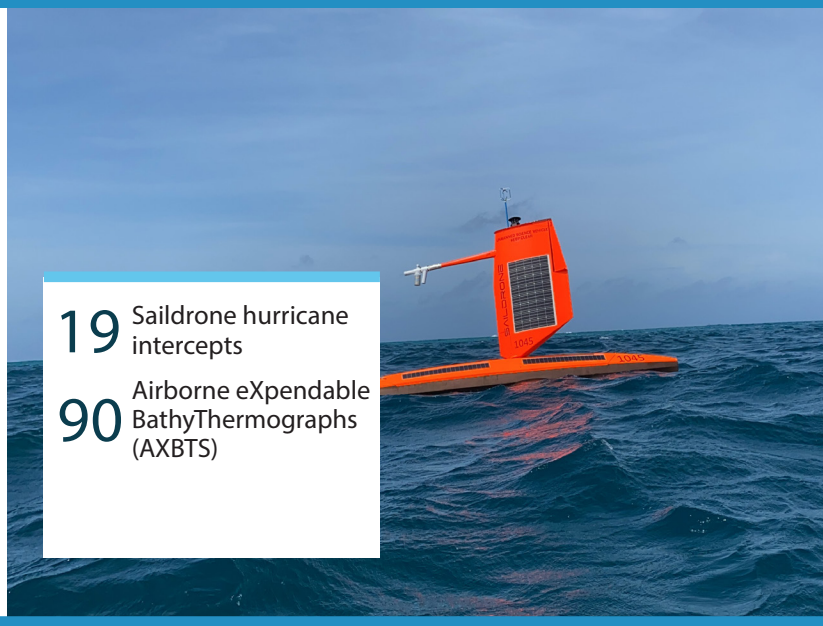
AOML scientists led the Global Ocean Ship-based Hydrographic Investigations Program (GO-SHIP) 55-day A16N cruise from Brazil to Iceland on the NOAA Ship *Ronald H. Brown*, performing crucial research to analyze critical decadal changes in the ocean's circulation and the ocean's uptake of anthropogenic (human-caused) carbon dioxide emissions. The importance of these cruises to science were underscored this year as AOML scientists analyzed decades of GO-SHIP inorganic carbon measurements that were integral to an international landmark study demonstrating the ocean's role as a carbon sink, and its ability to store anthropogenic carbon, may be weakening.

Larger than normal Atlantic warm pool leads to an Increase in US heat waves

Heat extremes are the number one weather-related cause of death in the United States, prompting the climate community to study the driving forces behind these extreme events to improve their prediction. A study led by AOML found an increase in the occurrence of summertime heat waves over the US Great Plains was linked to a larger than normal tropical Atlantic warm pool.

Hurricane season research missions advance forecasts

During the 2023 hurricane season, NOAA scientists collected critical data from the air, sea surface, and underwater to enhance forecasts and increase scientific knowledge. As Hurricanes Franklin and Idalia strengthened, a fleet of strategically placed oceanographic instruments (saildrones, gliders, drifters, floats) gathered temperature, salinity, and surface wind speed data while NOAA's Hurricane Hunter aircraft repeatedly flew into the storms to collect atmospheric data that were integral to National Weather Service forecasts.



19 Saildrone hurricane intercepts

90 Airborne eXpendable BathyThermographs (AXBTS)

2 Anduril Altius 600 sUAS

3 Black Swift Technologies S0 sUAS

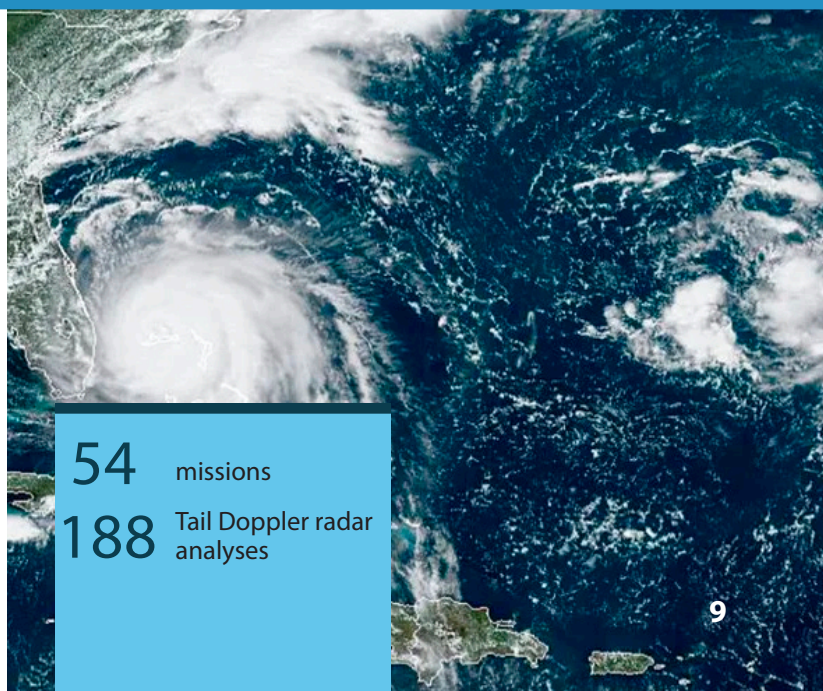
1,273 GPS dropsondes

New tools and strategies for collecting hurricane data

This season, AOML, CIMAS, and partners deployed a Black Swift Technologies small Uncrewed Aircraft System (sUAS) for the first time that gathered critical data from the most dangerous part of the storm. Our research missions also resulted in the *first* successful coordination of a low flying drone (Anduril's Altius 600), an ocean surface uncrewed vehicle (Saildrone), atmospheric profilers (dropsondes), and ocean profilers (bathythermographs), collecting vital data in the lower levels of the storm that have historically been too hard to reach. In total, six of the P-3 missions were coordinated with operations of saildrones to capture more observations of the air-sea interactions.

Studying the development of hurricanes under different conditions

AOML and CIMAS scientists collaborated with the Office of Naval Research's Moisture and Aerosol Gradients/Physics of Inversion field campaign during the 2023 hurricane season. This collaboration included P-3 missions near Barbados to study how the lowest levels of the atmosphere above the ocean (called the boundary layer) evolve over time in different environments, such as African easterly waves and Saharan dust outbreaks.

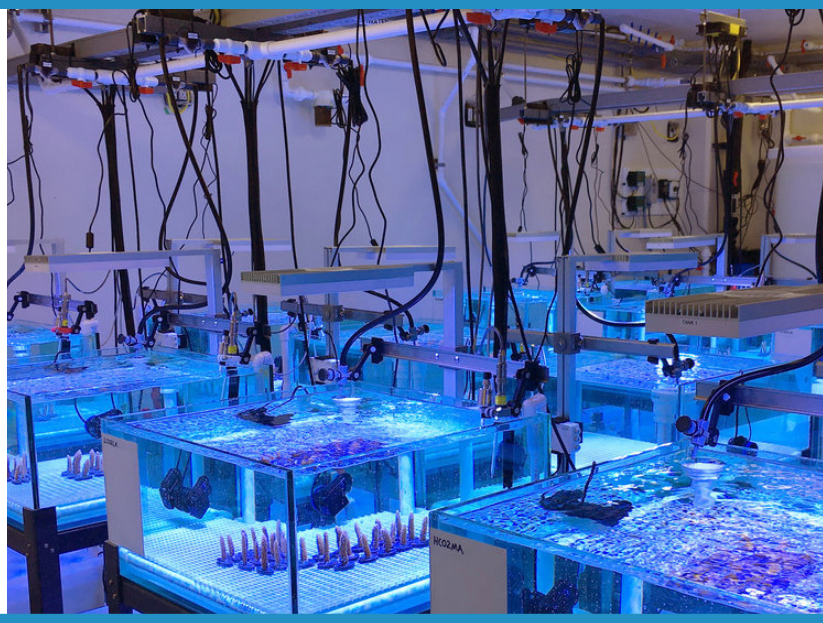


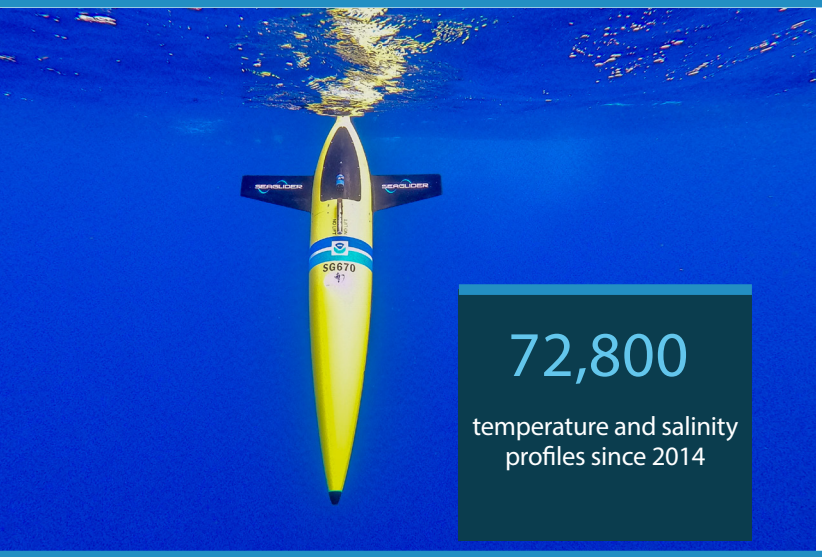
54 missions

188 Tail Doppler radar analyses

Multiple studies advance research on coral diseases

As coral diseases such as Stony Coral Tissue Loss Disease (SCTLD) rapidly spread across reefs with high mortality rates, AOML and CIMAS scientists with the Coral Program aimed to better understand diseases and their potential co-stressors. A joint AOML/CIMAS study suggested the spread of SCTLD throughout Florida and the Caribbean may be linked to ship ballast water, the water stored in the hull of ships between ports to maintain stability while underway. A meta-analysis of microbiome datasets compiled from multiple field and laboratory studies on SCTLD found one bacterium to be highly abundant in "unaffected" coral tissue and two bacteria that may be associated with the spread of the disease. Scientists hope to develop strategies for limiting or stopping the spread of disease to other regions.





72,800

temperature and salinity profiles since 2014

Ten years of hurricane glider operations

This summer marked AOML's tenth consecutive year of gathering underwater glider observations during the Atlantic hurricane season. The project began in 2014 with two gliders deployed off Puerto Rico to study the ocean's role in hurricane development and intensification. Since then, glider observations have become an integral part of the data gathered annually to improve hurricane forecasts and help researchers better understand how the ocean and atmosphere interact during their passage.

Monitoring coral resilience in the wake of a marine heatwave

AOML/CIMAS coral scientists visited Cheeca Rocks, the shallow, inshore reef and long-term climate monitoring site in the Florida Keys, in early August to find the reef completely bleached due to a persistent marine heatwave. Despite proving resilient to environmental stressors, the bleaching observed at Cheeca Rocks exemplified the severity of the heatwave and the susceptibility of corals to heat stress, including those in the Port Miami exposed to significant anthropogenic stress. Despite the devastation and an earlier study finding that 70 percent of Florida's coral reefs are eroding due to disease, bleaching, and ship groundings, the Coral Program's dedication to furthering research and understanding the impacts of the bleaching event is crucial as they continue to advance coral restoration and resilience efforts. These efforts are applicable to reefs beyond the keys, including those in the eastern Pacific, where team members from UM and AOML used data from three mass bleaching events and observed that a heat-tolerant algae found in some tropical Pacific coral species may make reefs more resilient to heatwave events.

Goal #3: Assess and Model the Earth System

Understand the Earth system by creating accurate, predictive, high-fidelity models that characterize and assess change and predict future Atlantic Ocean regional and global outcomes.

AOML leads real-time experiments of HAFS

AOML scientists, in collaboration with the Environmental Modeling Center and with support from the Hurricane Forecast Improvement Program (HFIP), led real-time experiments of NOAA's new hurricane model, the Hurricane Analysis and Forecast System (HAFS). The experiment provided critical information to guide the forthcoming upgrade of HAFS, especially the impact of advanced physics parameterizations that target rapid intensification. This year marked the eleventh consecutive year AOML has participated in the HFIP Real-time Experiment to improve NOAA's hurricane forecast models.

NOAA scientists publish river chemistry and discharge dataset for US rivers

Scientists at AOML, NGI, and NOAA's Geophysical Fluid Dynamics Laboratory developed a new data product that will aid future research on the river chemistry and discharge of 140 US rivers along the West, East, and Gulf of Mexico coasts. The dataset, called RC4USCoast, is based on historical records from the US Geological Survey and US Army Corps of Engineers. It provides essential information on variables, including alkalinity, pH, and dissolved inorganic carbon concentration, for use in future studies of biogeochemical processes of rivers, as they influence ocean modeling and coastal ecosystem responses to river runoff.

Caribbean Sea eddies influence prediction of Loop Current

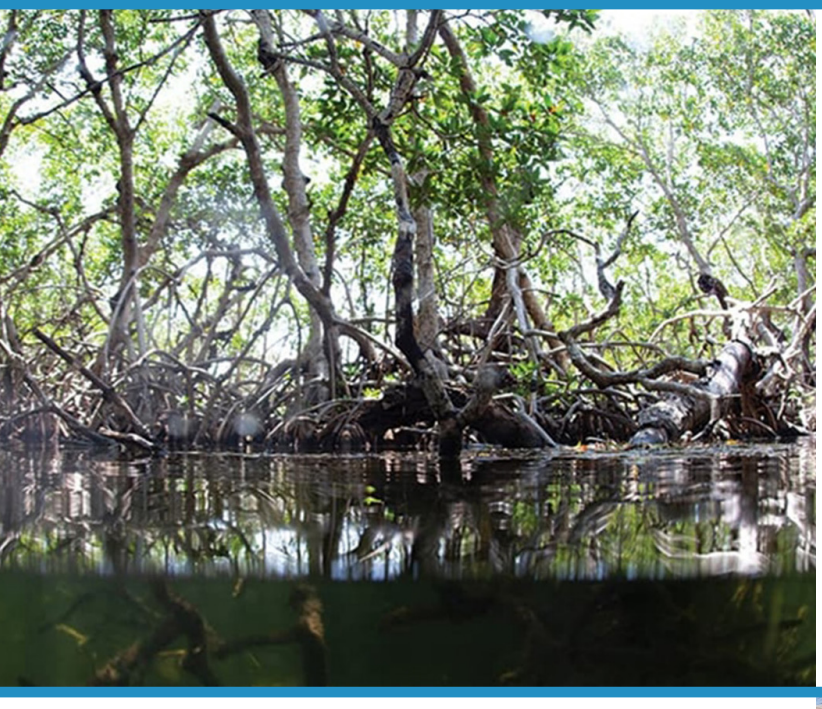
A study by scientists at AOML and partners at the University of Miami used a numerical modeling approach to investigate the impact of the eddy field in the Caribbean Sea on Loop Current predictions in the Gulf of Mexico. They found that eddy activity in the Caribbean Sea is crucial for the accurate prediction of eddy shedding by the Loop Current. Characterizing and predicting the state of the Loop Current has important implications, as it affects all ocean-related processes in the Gulf of Mexico, from larval connectivity to pollution transport to oil platform operations.

"Long-read" genetic sequencing improves ability to recover plankton genomes

Scientists at AOML discovered that "long-read" genetic sequencing can help them to learn more about the eukaryotic plankton that play an integral role in the food chain as a key food source for fish and whales. The study involved collecting water samples from the California Current during an annual NOAA Fisheries cruise called the Rockfish Recruitment and Ecosystem Assessment Survey. While "short read" genetic sequencing was used to analyze the samples, "long-read" sequencing allowed for a deeper look at the eukaryotic DNA from organisms more challenging to detect using "short-read" sequencing, specifically single-celled algae and zooplankton.

Changes detected in Meridional Overturning Circulation

Scientists at AOML have shown that the Global Meridional Overturning Circulation (GMOC), commonly known as the global ocean conveyor belt, has changed significantly in the Southern Ocean since the mid- 1970s, with a broadening and strengthening of the upper overturning cell and a contraction and weakening of the lower cell. The study indicates these changes are attributed to human-induced ozone depletion in the Southern Hemisphere stratosphere and increased carbon dioxide in the atmosphere. The findings suggest changes in the Southern Ocean are slowly advancing into the South Atlantic and Indo-Pacific oceans. An additional collaborative study led by scientists from AOML and CIMAS found that changes in basin-wide ocean heat content induced specifically by the Atlantic portion of the GMOC are influencing the frequency of flooding along the US southeastern coast. These findings are significant, as they have serious implications for future flood events and sea-level rise.

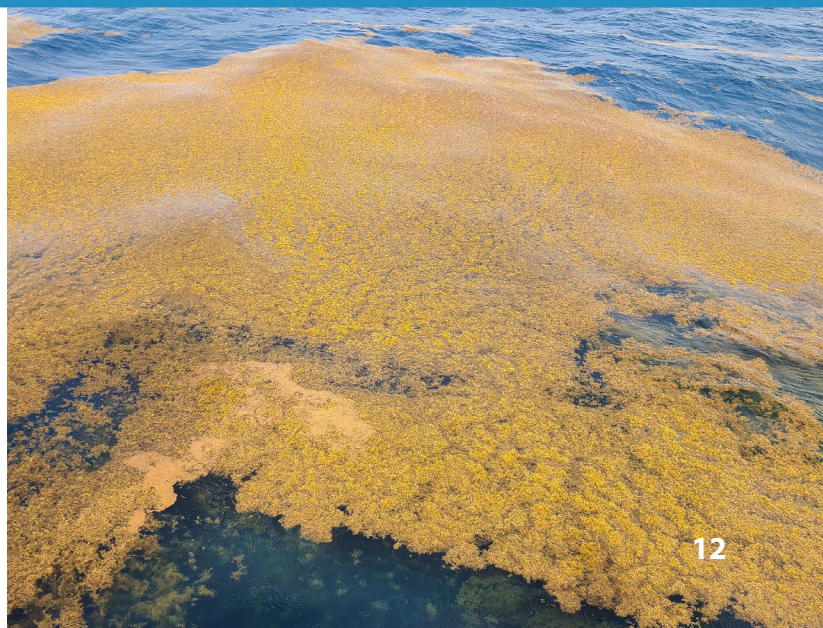


Global Carbon Project highlights importance of natural carbon sink

Scientists at AOML, in collaboration with NOAA's Global Monitoring Laboratory and PMEL, largely contributed to the CO_2 ocean and atmospheric observations made in the 2022 edition of the Global Carbon Project report. The report projected that atmospheric CO_2 concentrations would reach an estimated 50% above pre-industrial levels, with an average of 417.2 parts per million and emissions estimated at 40.6 billion tonnes in 2022. These levels rival the highest annual total emissions ever recorded: 40.9 billion tonnes of CO_2 in 2019. The report also highlights the significance of natural land and ocean carbon sinks continuing to increase as atmospheric CO_2 concentrations increase. However, climate change has also led to a reduced growth of these natural carbon sinks, given that a warmer ocean is unable to absorb as much carbon, and significant land-use changes such as deforestation have contributed greatly to carbon emissions.

Wind and citizen science data improve *Sargassum* inundation estimates

Since 2011, large accumulations of *Sargassum* along coastlines have been a recurrent problem in the Caribbean Sea, Gulf of Mexico, and tropical Atlantic. In partnership with Coastwatch, AOML releases weekly experimental Sargassum Inundation Risk (SIR) maps that estimate the level of coastal inundation in these regions. Scientists compared wind information alongside SIR maps against citizen science reports of inundation and found that including wind metrics in SIR maps improved *Sargassum* trajectories in coastal areas for forecast purposes. To improve *Sargassum* monitoring efforts and enhance products, AOML released a new *Sargassum* reporting form. A *Sargassum* FAQ webpage was also created to assist with an influx of media interview requests following a massive bloom of *Sargassum* that developed during the spring in the tropical Atlantic.



Goal #4: Transition Our Research

Empower end users with research and knowledge that enables decision-making, drives outcomes for operational partners, and advances scientific knowledge. AOML's efforts to accelerate and facilitate the transition of Research and Development (R&D) to operations, applications, commercialization, and other uses (R2X) realized major gains in FY23. Using a streamlined transition planning and tracking process, the lab completed six full R2X transitions, doubling the number of transitions in FY22, with a total of 18 fully signed transition plans.

Developing the Next Generation Hurricane Forecast Model

Developed by AOML's Hurricane Modeling Group in close collaboration with NOAA operational partners, the Hurricane Analysis and Forecast System (HAFS) next generation forecast model is now the official hurricane forecast model for NOAA's National Weather Service. This advanced system offers higher-resolution forecasts over land and sea, crucial for saving lives and safeguarding property. HAFS's moving nest component is what makes this system unique; it allows the model to zoom in on hurricanes across the Atlantic and Pacific basins. As the HAFS model is used over time, it has the potential to track multiple hurricanes at once, which has been shown to improve forecast accuracy. HAFS provides forecasts out to 7 days with skillful guidance on track and intensity (including rapid intensification), storm size, genesis, storm surge, rainfall, and tornadoes associated with hurricanes. More accurate and timelier forecasts result in a more prepared public, reducing mortality, property damage, and economic loss. HAFS, which is part of the Unified Forecast System, is a great example of community-based collaboration on model development and the streamlining of the operational transition process.

Optimizing Commercial Weather Data Assimilation

AOML transitioned software that exploits radio occultation (RO) observations and assimilates them in global/hurricane numerical weather prediction (NWP) models through focusing on the optimization of RO from the Commercial Weather Data Pilot, leading to more dynamic approaches. Commercially sourced data is about one-quarter to one-half the cost of government-sponsored missions; hence, NOAA supports this continued procurement. A follow-on project expected to transition in FY24 will investigate the impact of a much larger volume of RO profiles in current NWP capabilities under the Radio Occultation Modeling Experiment framework as part of an international effort.

AOML makes the Guinness Book of World Records

In FY23, along with our colleagues at PMEL and our private sector partners at Saildrone, Inc. and Anduril, AOML set not one, but two Guinness World Records:

1. Highest wind speed recorded by an Uncrewed Surface Vehicle (USV) using a specially-designed saildrone to gather the highest wind speed ever recorded by a USV, occurring during Hurricane Sam, a category 4 hurricane, on September 30, 2021.

2. Longest endurance inside a hurricane by a small Uncrewed Aircraft System (sUAS) with the Altius-600 deployed from NOAA's P-3 Hurricane Hunter aircraft into category 5 Hurricane Ian on September 28, 2022. Once deployed, the drone flew for a record 102 minutes inside Ian's eye, recording wind speeds of 216 mph at distances up to 135 miles from the P-3 aircraft.

Strengthening International Collaboration

Through a US-India International Agreement, AOML is collaborating with the India Meteorological Department Ministry of Earth Sciences to develop an ocean-land-atmosphere coupled regional modeling system. This new system will feature a relocatable high-resolution (1-2 km horizontal resolution) grid in the atmospheric model to simulate and forecast severe convective scale events, including tropical depressions, extreme rainfall, and flooding that occur during monsoon season. Such an effort will not only enhance the use of NOAA models and products across the globe, it will help leverage partnerships to better understand severe weather events and create a capacity of next generation model developers and scientists for both countries.

Contributing to State of the Climate Knowledge

AOML contributed to the State of the Climate report published annually in the Bulletin of the American Meteorological Society where our scientists communicated the impacts of the Earth's warming and seasonal-to-decadal climate variability on the global oceans. This transition of knowledge benefits the scientific community through improved understanding of the changing climate system and supports a climate-literate public.

Increasing Access to Drifting Buoy Data

The Global Drifter Program at AOML has a new, publicly available Environmental Research Division Data Access Program (ERDDAP) server that hosts hourly and 6-hour quality-controlled interpolated drifter datasets. ERDDAP provides a simple, consistent way to download drifter data in common file formats, resulting in easier access to data for the scientific community.

Advancing Autonomous 'Omics

AOML, in collaboration with NOAA's Great Lakes Environmental Research Laboratory and National Centers for Coastal Ocean Science, produced a transition plan, outlining efforts to advance technology for collecting and processing samples for 'Omics detection and analyses. Using long-range autonomous underwater vehicles, the transition plan describes the development and testing of the 3rd generation Environmental Sample Processor that provides specimen collection capability, environmental DNA analysis, and on-board sampling and preservation in both the ocean and Great Lakes environments. Plans to develop toxin sensors, known as Surface Plasmon Resonance Sensors, that provide on-the-fly transmission of Harmful Algal Bloom toxin concentration data to resource managers are outlined in the transition plan. This capability will support timely decision making for protecting public health and mitigating other socioeconomic impacts.

Looking Forward to FY24

In FY24, AOML will continue to conduct groundbreaking research using an arsenal of state-of-the-art technology and ensure our research transitions into use in support of NOAA's mission. Through our streamlined tracking process, we anticipate to nearly double the number of research to operation transitions in FY24. AOML will also continue to build a workforce that reflects the American population and foster collaborations with academic, private, and government institutions to address societal issues exacerbated by climate change.

To enhance hurricane forecasts, AOML will test and evaluate remote sensors that provide continuous, high-resolution inner-core observations, including next-generation airborne Doppler radars and profilers such as the Light Detection and Ranging (LiDAR), Imaging Wind and Rain Airborne Profiler (IWRAP), and Airborne Phased Array Radar (APAR). Plans to develop a fully coupled data assimilation system that accounts for the atmosphere, ocean, and waves will improve the understanding of these interactions in hurricane forecast models These advances will be complemented by our use of NOAA's hurricane hunter aircraft and new techniques to assimilate more field observations with improved data quality control.

Recent studies indicate the variability of the Atlantic Meridional Overturning Circulation (AMOC) influences fluctuations in sea level and flooding along the US East coast, and we plan to investigate and quantify the AMOC's influence on regional sea level variations to better understand its potential impacts. Beyond this, the development of biogeochemical and climate models that expand into the Mid-Atlantic Bight region, as well as a coupled ocean-wave-atmosphere modeling system, exemplify how we will continue to play an integral role in advancing the understanding of local, national, and global impacts of climate change by observing natural processes.

We are thrilled by the recent announcement of $4.2 million in new funding awarded to AOML and our collaborators to examine how multiple environmental stressors, from ocean acidification to hypoxia and increasing ocean temperatures, influence marine ecosystems under climate change through the Florida Regional Ecosystems Stressors Collaborative Assessment. AOML also aims to advance ocean carbon cycling and biological carbon pump research to inform climate change predictions and aid in developing marine Carbon Dioxide Removal (CDR) techniques.

Advancements in the 'Omics lab and the expanded application of new technologies to collect and analyze environmental DNA will additionally aid NOAA's mission of predicting changes in our natural environment. Ultimately, these future projects demonstrate how AOML will prioritize investigations into how climate change will impact marine ecosystems, support resource managers in predicting these impacts, and facilitate the implementation of ecosystem-based management to further the Blue Economy.

NOAA Atlantic Oceanographic & Meteorological Laboratory

Office of Oceanic & Atmospheric Research

December 2023

Gina M. Raimondo
United States Secretary of Commerce

Dr. Richard W. Spinrad
Under Secretary of Commerce for Oceans and Atmosphere
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Dr. Steve Thur
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