

Supercomputer Powers Leap in Modeling Capabilities

A study published in the March 1st issue of the journal *Geophysical Research Letters* examines the dramatic impact of using a high performance computer to conduct global modeling simulations. Drs. Bo-Wen Shen of the Goddard Space Flight Center, Robert Atlas of AOML, Shian-Jian Lin of the Geophysical Fluid Dynamics Laboratory, and co-authors used NASA's Columbia supercomputer for runs of the finite-volume General Circulation Model (fvGCM).

Columbia's superior computing capabilities enabled the authors to obtain ultra-high resolution simulations of hurricanes and other phenomena. This jump in resolution presents new frontiers for both global and regional modeling applications, as well as a means for advancing the understanding of climate and weather processes.

The study builds upon a 2005 paper by Atlas *et al.* (*Geophysical Research Letters*) which described model runs of the fvGCM using the Columbia supercomputer at 0.25° resolution. The pioneering model depicted hurricane structure more realistically and produced examples of highly accurate track intensity predictions for the 2004 hurricane season. Shen *et al.* doubled the fvGCM horizontal resolution to 0.125° in the current study to further investigate the effect of increasing model resolution on weather and hurricane prediction (see Shen *et al.*, "Recent Publications," last page).

Administrative Professionals Day...
April 26, 2006

Lost Instrument Packages Recovered "Alive and Ticking"

Jack Stamates, Ocean Chemistry Division/Coastal Environment Group

In February 2005, members of AOML's Coastal Environment Group deployed an instrument mooring containing an acoustic Doppler current profiler (ADCP) in 63 m of water off the coast of Miami. This mooring was deployed to monitor ocean currents near the site where dredge material from the port of Miami is deposited. The deployment was scheduled to last for only four to six months.

When attempts were made to recover the mooring via acoustic releases, however, the release mechanism failed to free the anchor, and the instrument package remained on the ocean floor. To make matters worse, a second mooring placed in the same area in August 2005 also failed to respond to acoustic commands to release its anchor. After several unsuccessful attempts to dislodge the moorings from their anchors, the services of the NASA vessel *Freedom Star* and the heavy lift remotely operated vehicle (ROV) from the Naval Surface Warfare Center/South Florida Ocean Measurement Center in Dania, Florida were enlisted on February 24, 2006 to help recover the moorings.

The *Freedom Star* is one of two vessels that NASA uses to recover the space shuttle solid fuel booster rockets after they are jettisoned from the shuttle and parachute into the Atlantic Ocean. The ROV from the Navy group in Dania is somewhat unique in that the large umbilical cable that connects the ROV to its support ship enables it to lift heavy objects from the seafloor.

Once the *Freedom Star* was on site and the ROV deployed, the moorings were quickly located using the search sonar and cameras on the ROV. The ship then positioned directly over the first mooring and the ROV brought it to the surface, anchor and all. When the mooring was brought on deck, the syntactic foam sphere that contained the instrument package was observed to be teeming with life. There were crabs, barnacles, and fish living inside the sphere, and the surface of the sphere was covered with an amazing variety of creatures.



Marine growth that formed on an instrument mooring prevented acoustic release mechanisms from functioning, leaving the mooring stranded on the ocean floor for a year.

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Magnified view of the marine life that took up residence on a syntactic foam sphere submerged in 63 m of water off the coast of Miami to monitor ocean currents.

One positive result for the mooring's delayed recovery was that its ADCP unit was still operating. Its extended deployment provided unexpected but valuable ocean current and acoustical backscatter data of Hurricanes Dennis, Katrina, Rita, and Wilma during their passages along the Miami coast. The NOAA-Navy-NASA team recovered the second lost mooring as well, which had also become a habitat for a rich assortment of marine life forms.

Cruise Data Confirm Oceans Becoming More Acidic

Data obtained from the Repeat Hydrography Program's recent P16N cruise confirm model projections that the oceans are becoming more acidic. Investigators with NOAA's Pacific Marine Environmental Laboratory, AOML, and several academic institutions sampled the surface waters of the northeastern Pacific Ocean from Tahiti to Alaska and found decreases in pH of about 0.025 units and increases in dissolved inorganic carbon of about 15 $\mu\text{mol/kg}$. The lower pH concentrations observed are viewed as direct evidence for acidification in the Pacific.

These changes in water chemistry are principally attributed to the uptake of anthropogenic carbon dioxide (CO_2) by the oceans over the past 15 years. The global oceans are the largest natural long-term reservoir for anthropogenic CO_2 , absorbing approximately one-third of all atmospheric emissions due to human activity.

CO_2 -enriched waters challenge the health and stability of marine ecosystems worldwide. Calcium-secreting organisms such as corals and planktonic mollusks are particularly vulnerable and adversely impacted by greater levels of ocean acidity.

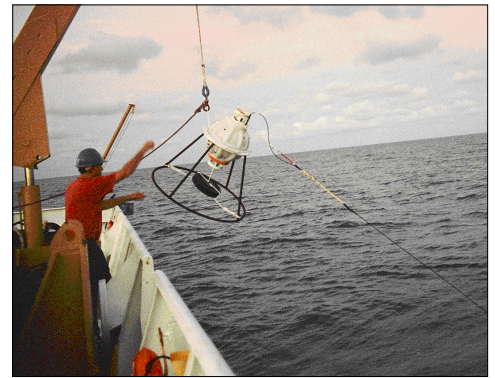
Monitoring Efforts Continue in Western Atlantic

Scientists with AOML's Physical Oceanography Division participated in a research cruise aboard the NOAA Ship *Ronald H. Brown* in March as part of a continuing effort to monitor currents in the Atlantic that help propel the global Meridional Overturning Circulation (MOC). Dr. Molly Baringer of AOML served as the chief scientist. She was joined at sea by colleagues from AOML, the University of Miami, and the National Oceanographic Centre of Southampton, United Kingdom.

The MOC acts as a conveyor belt that carries warm equatorial water to the far northern latitudes where it is chilled by cool air and sinks to great depths. The cold, deep water then returns southward towards the equator. Climate models and paleoclimate observations have demonstrated a strong correlation between changes in the MOC and global climate variability.

AOML researchers have monitored Atlantic components of the MOC for more than 20 years. A submarine cable between Florida and Grand Bahama Island has enabled them to monitor the pulse of the Florida Current since 1982. The northward flowing Antilles Current and southward flowing Deep Western Boundary Current have been monitored by hydrographic surveys since 1985. In 2004, a line of moored pressure inverted echo sounders (PIES) was deployed east of Abaco Island in the Bahamas as a time series monitoring system for the Antilles and Deep Western Boundary Currents to complement the Florida Current time series obtained via submarine cable.

Dr. Baringer and colleagues recovered and redeployed two PIES moorings in support of the Deep Western Boundary Current time series project, downloaded data acoustically from three additional PIES moorings, collected conductivity-temperature-depth (CTD) profiles, and aided in the turn-around of several United Kingdom moorings. The cruise contributed to NOAA's efforts to better monitor MOC variability and the collaboration of NOAA with international partners to quantify the complete Atlantic MOC system.



Deployment of a pressure inverted echo sounder (PIES) mooring from the NOAA Ship *Ronald H. Brown*.

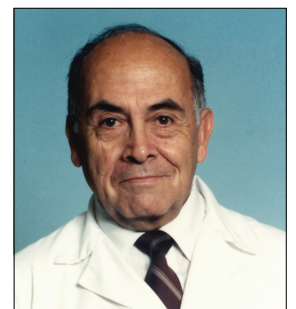
Former AOML Chemist Dies

AOML was saddened by the recent death of Antonio Mendez, a former chemist with the Ocean Chemistry Division. Mendez passed away on March 26, 2006 after suffering from Alzheimer's disease for many years. He was 78 years old.

Mendez immigrated to the United States from his native Colombia after obtaining a B.S. degree in chemistry from the University of Bogota. In 1954, he began working with the Water Quality Division of the University of Miami's Marine Laboratory (forerunner of the Rosenstiel School of Marine and Atmospheric Science) where he was principally responsible for performing chemical analyses on seawater samples. After 21 years with the University, Mendez left in 1975 to work in the Nutrients Laboratory at AOML.

In 1976, AOML established its Ocean Chemistry Division, and Mendez became a full-time member of the Division's scientific staff. Over the years, Mendez performed water sample nutrient analyses and, with others in the Division, co-authored a number of technical publications and reports. He retired in March 1995 after a career that spanned more than 40 years.

Mendez is remembered as a disciplined, diligent scientist whose careful and meticulous analyses could always be counted on for their accuracy. He is also remembered for his skilled and articulate command of the Spanish language. Mendez was a man of integrity who enjoyed his work, was always courteous and respectful of others, and willing to lend a hand. He is survived by his wife and step-daughter.



Antonio Mendez
1927-2006

National Hurricane Research Project



50th Anniversary Celebration...

Open House at AOML

May 18th
9:00 a.m.-3:00 p.m.

Official Ceremony and Plaque Dedication

(plus hurricane aircraft flyover)

May 22nd
3:00 p.m.

Reception and Banquet at the Rusty Pelican

(present/former hurricane researchers, friends, family, and collaborators)

May 22nd
5:30 p.m.

Hurricane Aircraft Tours

Opa-Locka Airport
May 23rd
9:00 a.m.-12:00 noon

50 Years of Hurricane Research: A Symposium

Rosenstiel School of Marine and Atmospheric Science

May 23rd
1:00-5:00 p.m.

Contact Neal Dorst for more info:
305-361-4311
Neal.M.Dorst@noaa.gov

Foundation Installed for New CREWS Station in Jamaica

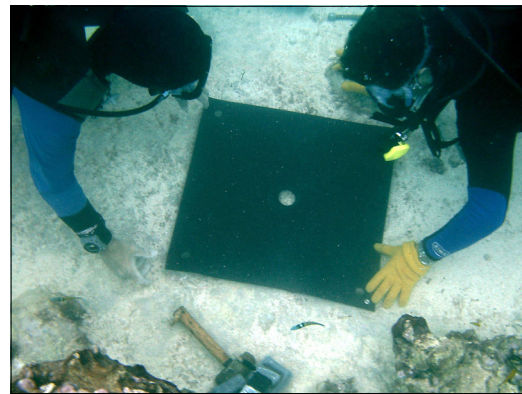
In late February, divers with AOML's Ocean Chemistry Division installed the foundation for a new Coral Reef Early Warning System (CREWS) station near the Discovery Bay Marine Laboratory in northern Jamaica. The two-foot square bottom plate will support an upright, pylon-style platform that will aid researchers in monitoring environmental conditions at the site when the station is completed in June 2006.

Instruments positioned along the pylon will measure a number of parameters including ultraviolet light, photosynthetically available radiation, sea temperature, salinity, wind speed and direction, and the partial pressure of carbon dioxide. Carbon dioxide data are critical for studies to determine the influence of a changing global climate on coral reef growth patterns, while sea temperature and light data will help determine the influence of a changing environment on the phenomenon of coral bleaching. Additionally, data gathered from the station will help establish long-term environmental trends and support ongoing and future regional studies of coral reef ecosystem dynamics.

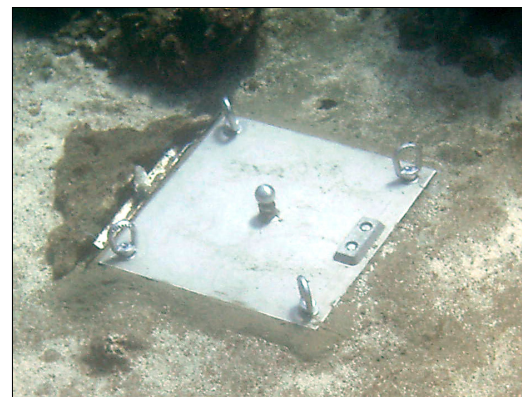
CREWS stations have already been installed and are operating in the Bahamas, St. Croix, and Puerto Rico. Data from these stations are transmitted hourly via satellite to AOML and posted on NOAA's Coral Health and Monitoring Program web site (www.coral.noaa.gov/crw/real_data.shtml).

Several additional sources of coral monitoring-related data, along with CREWS data, are currently being integrated at AOML using artificial intelligence software into a larger umbrella program, the Integrated Coral Observing Network (ICON). ICON is being developed to help managers, policy makers, scientists, and other stakeholders in their efforts to protect and preserve coral reefs by providing ecological forecasts of reef areas. ICON will also support research and modeling efforts to better understand coral reef ecosystem processes.

The Discovery Bay CREWS station is one of several coral monitoring platforms to be installed in the Caribbean, as well as at coral reef areas globally, in accordance with goals established by the U.S. Coral Reef Task Force and NOAA for monitoring and assessing the health of coral reefs. Its installation was facilitated by the Mainstreaming Adaptation to Climate Change project funded by the World Bank and the Global Environmental Facility, with personnel support from NOAA and other organizations.



Divers precisely position a two-foot square, stainless steel bottom plate on the ocean floor in 20 feet of water that will serve as the foundation for a new coral reef monitoring station in northern Jamaica.



Anchored securely to the ocean floor, the bottom plate will support a coral monitoring platform equipped with an array of instruments positioned above and below the ocean surface along an upright pylon.



Three large, secure, slotted bins that can accommodate all types of paper, including file folders, are located in the lobby behind the receptionist's station for document destruction. When the bins are full, a mobile unit is dispatched to shred the bin materials on site under AOML supervision. Certification of document destruction is provided and the shredded paper is then recycled.

It's a Girl²

Michael LaGier, a University of Miami Cooperative Institute for Marine and Atmospheric Studies (CIMAS) post-doctoral scientist with AOML's Ocean Chemistry Division, and his wife Adriana are the proud and happy parents of their first child, a daughter. Bridget Fiori LaGier was born in Miami on January 28, 2006. Baby Bridget and her parents are all doing just fine.



Craig Engler, a physical scientist with AOML's Physical Oceanography Division, and his wife Carolyn are the proud and happy parents of their first child, a baby girl. Elizabeth Engler was born in Miami on March 11, 2006 at 12:09 a.m. and weighed in at 8 lbs. Baby Elizabeth, Mom, and Dad are all doing well.

Congratulations

Chunzai Wang, an oceanographer with AOML's Physical Oceanography Division, has been appointed by the American Meteorological Society to serve as an Associate Editor for its semi-monthly publication *Journal of Climate*.

Miami Corporate Run

Join Team AOML...



Walkers, Joggers, and
Runners Welcome

May 11, 2006
Bayfront Park

6:45 p.m.

Contact Nancy Ash for more info
305-361-4544—Nancy.Ash@noaa.gov

Be on the Lookout for...Darwin!

An American crocodile that's become fond of swimming in the mangrove located on the northeast side of the AOML facility was honored recently by the bestowal of a name. A building-wide "Name the Croc" contest netted more than 25 possible sobriquets, but "Darwin" was chosen as the hands-down winner. Sonia Otero of the Hurricane Research Division is credited with submitting the award-winning name.

Employees should exercise caution when entering and exiting the facility. South Florida is the only area in the U.S. where the American crocodile, an endangered species, is currently found.



Photo by Armando Cuervo

Goldenberg Featured at National Science Conference

AOML meteorologist Stanley Goldenberg was a featured guest speaker on April 7th at the 54th National Conference on Science Education in Anaheim, California. His presentation, *Hurricanes—Researching the Greatest Storms on Earth, in the Air, on the Ground, and on the Computer*, was one of several special sessions designed to highlight the latest research in science and technology.

Goldenberg is a 20+ year veteran with AOML's Hurricane Research Division who has participated in numerous science and reconnaissance missions aboard NOAA's hurricane hunter aircraft, including the Hurricane Katrina landfall mission in late August 2005. He has examined various climatic factors that affect the variability of hurricane activity in the Atlantic ranging from intraseasonal to multi-decadal time scales.

"Speaking at the conference was a great experience," said Goldenberg. "I felt honored to participate in this type of outreach activity and got to have lots of interactions with science teachers of all grade levels who were interested in learning more about hurricanes." Goldenberg himself once taught 5th, 6th, and 7th grade mathematics and science at a private school.

Goldenberg presented a review of the record-setting 2005 hurricane season and discussed how data collected from storms contribute to better forecasting skill and the understanding of tropical cyclone dynamics. He also provided evidence for how the primary cause for the recent increased Atlantic hurricane activity is from the natural Atlantic multi-decadal signal rather than anthropogenic global warming. Drawing upon his professional and personal experiences with hurricanes, Goldenberg provided information for how individuals, schools, and communities can better prepare to cope with these storms in the future.

The annual event was sponsored by the National Science Teachers Association. More than 12,000 science educators from across the nation attended.



After more than a year of negotiations with the Miami Transit Authority, the bus shelter along Rickenbacker Causeway in front of AOML has finally been restored. Many thanks to Stanley Goldenberg for his persistence in seeing this effort through to completion. AOML's growing number of public transit users are now assured protection from the elements.



Photo by Armando Cuervo

Travel

Yeun-Ho Daneshzadeh, Gustavo Goni, and Claudia Schmid attended the Second Argo Science Workshop in Venice, Italy on March 13-18, 2006.

Nancy Ash, Peter Black, John Gamache, John Kaplan, Frank Marks, Shirley Murillo, and Mark Powell attended the 60th Interdepartmental Hurricane Conference in Mobile, Alabama on March 20-24, 2006.

Robert Atlas met with colleagues at NOAA Headquarters, NOAA's National Center for Environmental Prediction, and NASA's Goddard Space Flight Center in Washington, D.C. on March 27-31, 2006.

Judith Gray attended sessions of NOAA's Leadership Competencies Development Program V in Silver Spring, Maryland and Charlottesville, Virginia on April 4-8, 2006.

Rick Lumpkin and Christopher Meinen attended the 2006 General Assembly of the European Geosciences Union in Vienna, Austria on April 2-7, 2006.

Robert Molinari attended a U.S. African Monsoon Multidisciplinary Analysis (AMMA) meeting in Washington, D.C. on April 3-4, 2006.

Rik Wanninkhof was an invited guest of the Pohang University of Science and Technology in Pohang, South Korea, where he presented a lecture about the ocean carbon cycle and served as a thesis committee member on April 4-8, 2006.

Stanley Goldenberg was a featured speaker at the 54th National Conference on Science Education in Anaheim, California on April 7, 2006.

Sim Aberson, Peter Black, Jason Dunion, Frank Marks, Mark Powell, Robert Rogers, and Eric Uhlhorn attended the American Meteorological Society's 27th Conference on Hurricanes and Tropical Meteorology in Monterey, California on April 24-28, 2006.

Jeffrey Absten, Louis Florit, Lewis Gramer, James Hendee, Christopher Langdon, and Doran Mason attended the Integrated Coral Observing Network-Coral Reef Early Warning System Science Meeting in La Parguera, Puerto Rico on April 24-28, 2006.

Recent Publications*

ABERSON, S.D., and J.B. Halverson, 2006: Kelvin-Helmholtz billows in the eyewall of Hurricane Erin. *Monthly Weather Review*, 134(3):1036-1038.

ABERSON, S.D., J.P. DUNION, and F.D. MARKS, 2006: A photograph of a wavenumber-2 asymmetry in the eye of Hurricane Erin. *Journal of the Atmospheric Sciences*, 63(1):387-391.

Hausman, S.A., K.V. OYAMA, and W.H. Schubert, 2006: Potential vorticity structure of simulated hurricanes. *Journal of the Atmospheric Sciences*, 63(1):87-108.

Hood, R.E., R.J. Blakeslee, M. Goodman, D.J. Cecil, D.M. Mach, F.J. LaFontaine, G.M. Heymsfield, F.D. MARKS, and E.J. Zipser, 2006: Classification of tropical oceanic precipitation using high altitude aircraft microwave and electric field measurements. *Journal of the Atmospheric Sciences*, 63(1):218-233.

Jiang, H., P.G. BLACK, E.J. Zipser, F.D. MARKS, and E.W. UHLHORN, 2006: Validation of rain-rate estimation in hurricanes from the Stepped Frequency Microwave Radiometer: Algorithm correction and error analysis. *Journal of the Atmospheric Sciences*, 63(1):252-267.

McFarquhar, G.M., H. Zhang, G.M. Heymsfield, J.B. Halverson, R.E. Hood, J. Dudhia, and F.D. MARKS, 2006: Factors affecting the evolution of Hurricane Erin (2001) and the distributions of hydrometeors: Role of microphysical processes. *Journal of the Atmospheric Sciences*, 63(1):127-150.

Plattner, S., D.M. MASON, G.A. Leshkevich, D.J. Schwab, and E.S. Rutherford, 2006: Classifying and forecasting coastal upwellings in Lake Michigan using satellite-derived temperature images and buoy data. *Journal of Great Lakes Research*, 32(1): 63-76.

Shen, B.-W., R. ATLAS, J.-D. Chern, O. Reale, S.-J. Lin, T. Lee, and J. Chang, 2006: The 0.125 degree finite-volume general circulation model on the NASA Columbia supercomputer: Preliminary simulations of mesoscale vortices. *Geophysical Research Letters*, 33(5):L05801, doi:10.1029/2005GL024594.

Sun, W., M. Cetin, W.C. THACKER, T.M. Chin, and A.S. Willsky, 2006: Variational approaches on discontinuity localization and field estimation in sea surface temperature and soil moisture. *IEEE Transactions on Geoscience and Remote Sensing*, 44(2):336-350.

WANG, C., W. Wang, D. Wang, and Q. Wang, 2006: Interannual variability of the South China Sea associated with El Niño. *Journal of Geophysical Research*, 111(C3):C03023, doi:10.1029/2005JC003333.

ZHANG, J.-Z., and C.J. FISCHER, 2006: A simplified resorcinol method for direct spectrophotometric determination of nitrate in seawater. *Marine Chemistry*, 99(1-4):220-226.

*Names of AOML authors appear in capital letters.

A forklift operation and safety training class was offered at AOML on Tuesday, March 14th by AOML's Facility Manager, Gregory Banes (center). Peter Black (left) of the Hurricane Research Division and Jeffrey Absten (right) of the Ocean Chemistry Division attended. They proudly display their forklift operator certificates after learning the ins and outs and ups and downs of safely operating a forklift vehicle.



Keynotes is published bi-monthly by the Atlantic Oceanographic and Meteorological Laboratory. Contributions and/or comments are welcome and may be submitted via email (Gail.Derr@noaa.gov), fax (305) 361-4449, or mailing address: NOAA/AOML, *Keynotes*, 4301 Rickenbacker Causeway, Miami, FL 33149.

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