

Panel Selects AOML's Best Scientific Papers

This past July, a panel comprised of scientists from AOML's four research divisions reviewed and selected the best AOML-authored scientific papers published in 1997-1998. As a result of the panel's selection, winners of the 1999 AOML Outstanding Paper of the Year Awards are:

- Black, R.A., and J. Hallett, 1998: The mystery of cloud electrification. *American Scientist*, 86, 526-534.

- Enfield, D.B., and D.A. Mayer, 1997: Tropical Atlantic sea surface temperature variability and its relation to El Niño-Southern Oscillation. *Journal of Geophysical Research*, 102(C1), 929-945.

- Peng, T.-H., R. Wanninkhof, J.L. Bullister, R.A. Feeley, and T. Takahashi, 1998: Quantification of decadal anthropogenic CO₂ uptake in the ocean based on dissolved inorganic carbon measurements. *Nature*, 396, 560-563.

- Thacker, W.C., and R. Lewandowicz, 1997: A comparison of low-dimensional representations of sea-surface temperature anomalies in the North Atlantic. *International Journal of Climatology*, 17, 953-967.

AOML is proud of its award-winning authors and congratulates them on their accomplishments.

In addition to winning the AOML competition, AOML's top four scientific papers have been submitted to the Environmental Research Laboratories (ERL) for consideration in the 1999 ERL-wide Outstanding Scientific Paper Award Competition. Results of the ERL competition will be announced in early FY-2000.

NOAA Scientists Survey Warm Water Eddy for Hurricane Intensification

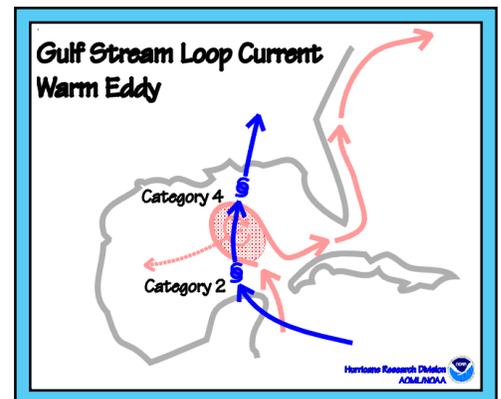
This hurricane season, National Oceanic and Atmospheric Administration and University of Miami scientists will study rapid intensification caused by evaporation from a large warm-water eddy in the Gulf of Mexico. Rapid intensification of hurricanes just before landfall presents a serious problem to National Hurricane Center (NHC) forecasters and regional emergency managers. Hurricanes that pass over deep warm-water pools can become grave threats to human life and property, as happened when 1995's Opal intensified from a category 2 to a category 4 hurricane in only 14 hours.

Beginning August 3, Dr. Peter Black of NOAA's Atlantic Oceanographic and Meteorological Laboratory (AOML) and Dr. Lynn Shay of the University of Miami's Rosenstiel School for Marine and Atmospheric Science (RSMAS) will direct a joint effort to study the warm eddy by deploying expendable ocean sensors from NOAA airplanes flying over the Gulf of Mexico. The August 3-5 aircraft flights will take the eddy's pulse, deploying probes funded by the National Science Foundation to measure ocean currents, density, and temperature to a depth of 3,000 ft.

"Major hurricanes (winds stronger than 115 mph) cause 80% of all hurricane-related damage, and rapid intensification causes major hurricanes. What we don't know are all the factors that can cause rapid intensification," says Dr. Hugh Willoughby, Director of the Hurricane Research Division at AOML, "But what we do know is that warm eddies were a factor in some memorable Gulf storms."

The reason the eddies cause rapid hurricane intensification in the Gulf of Mexico is that they are pockets of heat energy stored in the warm ocean waters. Black and Shay want to study the deep warm water eddy now forming from the Loop Current, a stream of warm Caribbean water that enters the Yucatan Straits, meanders northward almost to the Gulf Coast, and exits into the Florida Straits after a sharp turn around the Florida Keys (see figure).

"We believe that eddies like this one were the cause of rapid intensification in Opal (1995), Camille (1969), and several other Gulf hurricanes," said Black. "Should a hurricane cross this year's eddy, we will measure not only the change in eddy characteristics, but measure the physical characteristics of the atmospheric environment around the storm. In this way we hope to discover the relative importance of the (continued on page 2)



Warm-water eddy in the Gulf of Mexico and its effect upon hurricane intensification.

(continued from page 1)

ocean eddy and environmental wind shear in determining hurricane intensity change.”

A warm eddy such as the one present in the Gulf this summer is a tremendous source of energy to a storm that passes over it. The hurricane winds draw heat from the water to fuel the storm, mixing the warm upper water with the cooler waters below as the storm passes by. Because the layer of warm water is so deep in the eddy, the ocean surface there is less susceptible to storm-induced cooling than it is outside the eddy.

Black and Shay hope that data gathered during this study will enhance knowledge and predictability of major hurricanes, which translates to increased warning time and better coastline preparedness.

“We look at a major hurricane in the Gulf with mixed emotions. It can’t get out without destroying some coastal real estate. On the other hand, the only way to learn exactly how the ring affects rapid intensification requires that a hurricane passes over the eddy,” said Willoughby.

The study will entail several flights in WP-3D aircraft, operated by NOAA’s Aircraft Operation Center. Dropwindsonde instruments launched in the storm’s environment from NOAA’s new Gulf Stream-IV jet surveillance aircraft will measure atmospheric winds, pressure, temperature, and humidity as they fall to the ocean’s surface.

Official NOAA press release of August 2, 1999. Contact: Erica Van Coverden (coverden@aoml.noaa.gov or 305-361-4541)

DAILY TROPICAL WEATHER DISCUSSION



**12:30 P.M. (WEEKDAYS)
4TH FLOOR MAP ROOM
APPROX. 20 MINUTES**

In support of the Hurricane Research Division’s annual Hurricane Field Program, join us for daily map discussions about tropical cyclones around the world, with a focus on Atlantic hurricanes. Each week a new volunteer will lead the discussions. For more information, contact Chris Landsea (landsea@aoml.noaa.gov or 305-361-4357).

AOML Research Yields Rainy Season Prediction

In early March 1999, scientists at the University of Costa Rica successfully predicted an early onset of the lower Central American 1999 rainy season (May–November). The prediction was an outgrowth of research by David Enfield (AOML) and Eric Alfaro (University of Concepción, Chile) that used daily rainfall data from over Central America to estimate the annual rainy season onset and end dates. They found that sea surface temperature anomalies (SSTAs) in both the tropical Atlantic and tropical east Pacific Oceans were associated with changes in onset dates for the rainy season, but in opposite ways. That is, for example, an early onset was associated with a warmer Atlantic and a cooler Pacific.

The scientists were tipped off to the possibility of an early rainy season onset by studying the condition of the Atlantic and Pacific SSTAs during the months preceding the rainy season. Following the 1997–1998 El Niño, the tropical North Atlantic SSTA index (NATL) had warmed up, as typically occurs during several seasons following El Niño events. Meanwhile, the Pacific index (NINO 3.4) had gone from warm to cool with the transition from El Niño to La Niña (see Fig. 1). Together, these events placed the two oceans into a dipole configuration favoring the early onset: Atlantic warm, Pacific cool.

Prompted by this rainy season outlook, scientists from the Instituto Meteorológico Nacional de Costa Rica (IMN-CR) examined a sequence of recent years (1971, 1974, 1989) in which Atlantic/Pacific SSTAs were similar to those of 1999 to verify the historical evidence. The three years examined were all found to have had an early onset of the rainy season along the Pacific slope of Costa Rica. In Costa Rica, the rainy season typically begins in the middle of May but can start as early as the middle of March during favorable years. This verified expectation for an earlier onset was communicated by means of an internal memorandum to a governmental office, the Comisión Nacional de Emergencia, and subsequently published in the Costa Rican national newspapers.

The 1999 rainy season in fact began in early April, at least two to three weeks in advance of its normal onset (see Figure 2). The early onset prediction was used by coffee bean farmers who planted their crops earlier in the spring. This had a high economic impact because coffee is one of Costa Rica’s main export products. The forecast also allowed for fast-track approval of an emergency law in the Costa Rican congress which expedited government assistance to farmers.

The research of Enfield and Alfaro was funded by the National Science Foundation under one of the first Initial Science Projects (ISP-1) of the Inter-American Institute for Global Change Research (IAI). Their research results have been published in two recent journal articles (Alfaro *et al.*, 1998, *Investigaciones Marinas*, 26:59-69; Enfield and Alfaro, 1999, *Journal of Climate*, 12:2093-2103) and are presently being used by IMN-CR scientists for their research tasks.

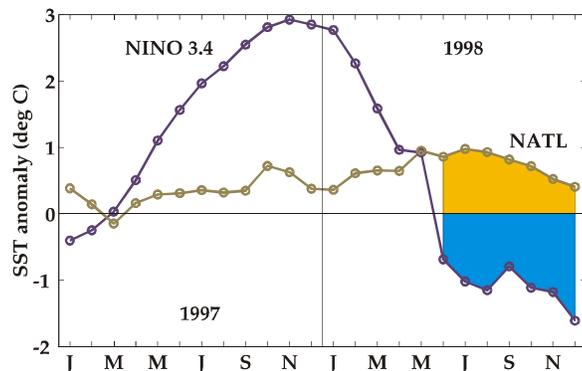


Figure 1. 1997-1998 sea surface temperature anomaly index for the Atlantic and Pacific Oceans.

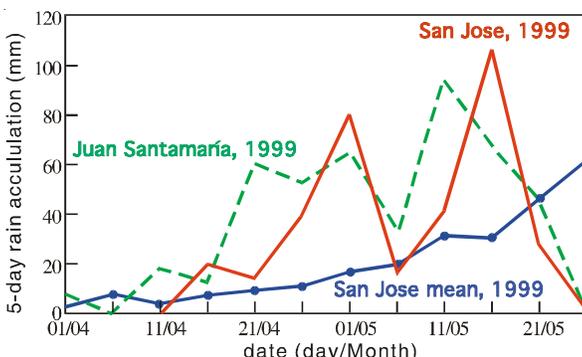


Figure 2. Five-day rainfall accumulations for two measuring stations during the spring of 1999: San Jose (continuous line) and Juan Santamaria Airport (dashed line). The climatological curve for San Jose is plotted in the line with dots, for comparison. Both stations are in the Central Valley of the Costa Rican Pacific Slope.

Sam Returns!

Sam Houston, meteorologist with the Hurricane Research Division, returns to AOML in early August after a one-year sabbatical at the University of Hawaii at Manoa. Sam spent the last year fine tuning his skills and obtaining knowledge to pursue research in boundary layer processes and air-sea interaction in hurricanes.



Welcome Aboard

Christopher Kelble, a 1998 marine science/biology graduate of the University of Miami, joins the staff of the Ocean Chemistry Division to assist Dr. Jia-Zhong Zhang in performing nutrient chemical analysis of the Florida Bay.

Information about installing and creating hurricane shutters, as well as information about Miami-Dade's building codes, can be found at the Hurricane Research Division's "Hurricane Shutters" web page at www.aoml.noaa.gov/hrd/shutters.

Informal Research Report

Dr. David Palmer
(Office of the Director)

August 31, 1999

3:00 p.m.

First-Floor Conference Room

"Path collapse in wave propagation with lessons learned from the Acoustic Thermometry of Ocean Climate Project, the Shoemaker-Levy 9 collision with Jupiter, and the quantum mechanical hydrogen atom."

Summer Interns Perform Valuable Services

College undergraduates and Marine Academy and Science Technology (MAST) high-school students joined the ranks of AOML's staff this summer as interns. Summer interns performed a variety of tasks that supported AOML's scientific research programs, as well as its administrative, computer services, and library operations. Through their involvement with AOML, interns had the opportunity to enhance computer and mathematical skills, receive training, and, in some instances, learn research methods and techniques. As summer draws to an end, AOML congratulates its interns for their exceptional work performance. Here is a listing of AOML's summer interns and a brief description of the tasks they performed:

- **Kristopher Bedka**, a senior at Northern Illinois University majoring in meteorology, assisted Sim Aberson of the Hurricane Research Division on multi-model ensemble track and intensity forecasts, prediction of model performance, and historical performance of numerical track forecasting.

- **Nick Carrasco**, a computer engineering/computer science major in his junior year at the University of Miami, assisted Dr. Mark Powell of the Hurricane Research Division. As a member of the H*WIND project team, Nick's activities included preparing and developing decoders for meteorological data, maintaining and developing H*WIND JAVA applications, and maintaining the H*WIND computer network. Nick will continue working on this project during the 1999-2000 academic year.

- **Noel Charles**, a sophomore at Florida International University, assisted Dr. Chris Landsea of the Hurricane Research Division with general administrative tasks, data entry, and web page design, and also assisted Howard Friedmen with preparation of HRD's annual Hurricane Field Program Plan manual.

- **Sean Cheaney**, a sophomore at MAST Academy, assisted Doug Wilson and Ryan Smith of the Physical Oceanography Division with maintenance and updates to the Oceanography of the Intra-Americas Seas web page.

- **Douglas Chermak**, a chemistry major at the University of Florida, completed his second summer as an intern with Dr. Tom Carsey of the Ocean Chemistry Division. Doug worked with a variety of tools, instruments, and techniques in support of atmospheric chemistry research.

- **Roberto Lee**, a junior majoring in computer science at the University of Florida, assisted Computer Networks and Services Division staff by installing software programs on PCs, running fiber optic cable, and maintaining and repairing printers and copiers.

- **Sara Marks**, a junior studying religion at Florida International University, assisted Library personnel with cataloging, map collection, and data scanning.

- **Carolina Mayrinck**, a senior at MAST Academy, assisted Office of the Director staff with a variety of administrative and accounting tasks.

- **Melissa Morris**, a sophomore attending Wellesley College, worked with Jim Hendee of the Ocean Chemistry Division on referencing the coral data bases in support of the Coral Health and Monitoring Program.

- **Carl Sandin**, a senior at MAST Academy, assisted Dr. Frank Marks of the Hurricane Research Division on a study of atmospheric boundary layer windfield structure in landfalling hurricanes using the WSR-88D Doppler radar data. This is Carl's second summer working at AOML.

- **Lauren Selevan**, a MAST Academy junior, worked with Dr. John Gamache of the Hurricane Research Division to determine rainfall statistics from NEXRAD hourly digital precipitation data. Lauren's work is a cooperative mentored effort with the possible goal of entry into the Intel Science Talent Contest.

- **Summer Spisak**, a junior at Mt. Holyoke College majoring in both politics and English, worked with Dr. Mark Powell of the Hurricane Research Division as a member of the H*WIND group. Summer's duties included developing a project web page design supplement and JAVA tutorial. Summer is a former MAST Academy intern with HRD.

- **Russell St. Fleur**, a sophomore majoring in mechanical engineering at Florida International University, worked with Dr. Mark Powell of the Hurricane Research Division as a member of the H*WIND group. Russell assisted with projects that focused on hurricane dropsonde data, web page design, and JAVA tutorials.

- **Jeffrey Wood**, entering his freshman year at Florida State University, worked for the Physical Oceanography Division's Global Ocean Observing System (GOOS) Center. Jeff assisted Warren Krug in the preparation and shipping of drifters to various destinations, helped prepare SEAS training manuals, and monitored drifter deployments via a VAX computer system.

Travel

Michael Farmer attended a Laboratory Safety and Environmental Management Conference sponsored by the Environmental Protection Agency in Philadelphia, Pennsylvania on July 26-29, 1999.

Paul Willis will travel to Kwajalein, U.S. Marshall Islands to participate in the Tropical Rainfall Measuring Mission's KWAJEX Experiment as a principal investigator for cloud physics aboard the NASA DC-8 aircraft from July 26-September 6, 1999.

Silvia Garzoli will travel to Woods Hole, Massachusetts to participate in the Massachusetts Institute of Technology/Woods Hole Oceanographic Institution's Joint Program as an invited Steinbach Scholar on July 27-August 6, 1999.

David Bitterman will attend the SEAS 2000 Meeting in Washington, D.C. on August 11-12, 1999.

Judy Gray will visit NOAA's Coastal Service Center in Charleston, South Carolina to attend a SURA (Southeastern Universities Research Association) Marine Science/Coastal Research Workshop on August 16-17, 1999. The workshop will focus on developing cooperative plans for integrated coastal marine observing systems in the southeast.

Robert Molinari and Douglas Wilson will attend the North Atlantic World Ocean Circulation Experiment (WOCE) Meeting in Kiel, Germany on August 22-28, 1999.

Sim Aberson will attend a NOAA Diversity Council Meeting in Silver Spring, Maryland on August 26-27, 1999.

Keynotes is published monthly by the Atlantic Oceanographic and Meteorological Laboratory. Contributions are welcome and should be submitted prior to the last week of each month to ensure inclusion in the following month's edition. Please address all correspondence to: Office of the Director, 4301 Rickenbacker Causeway, Miami, FL 33149. Contributions may also be submitted by fax (305-361-4442) or by email (derr@aoml.noaa.gov).

Editor – Kristina Katsaros
Publishing Editor – Gail Derr

AOML Visitors

Mr. Peter Hollemans from NOAA's CoastWatch Program in La Jolla, California visited AOML from July 7-August 20, 1999 to complete the installation of a high resolution picture transmission (HRPT) antenna, install processing software, and create a CoastWatch web page for AOML.

Ms. Betty Hess (OAR Headquarters) and Ms. Bridget Byrne (MASC) visited AOML on July 21-23, 1999 to train supervisors and rating officials in using the Personnel Demonstration system to maximize its effectiveness. They also held a session open to all employees to further explain the system. Personnel resources are available at <http://ohrm.doc.gov> and <http://www.masc.noaa.gov>.

Dr. James Carswell of the Microwave Remote Sensing Laboratory at the University of Massachusetts visited AOML for a two-week period in late July-early August 1999. Dr. Carswell collaborated with Hurricane Research Division scientists to install a dual-frequency scatterometer aboard one of NOAA's WP-3D aircraft located at the Aircraft Operations Center in Tampa, Florida. The specially-equipped WP-3D will be used for hurricane reconnaissance flights in support of HRD's Hurricane Field Program Plan (August-October 1999).

Mr. Todd Kimberlain of Colorado State University will visit AOML from August 8-October 8, 1999 to continue his graduate studies research with Chris Landsea of the Hurricane Research Division.

CoastWatch Program Comes to AOML

With the installation of a high resolution picture transmission satellite antenna on the roof of the AOML facility, AOML assumes operational management for the Caribbean node of NOAA's CoastWatch program. CoastWatch provides near real-time remotely sensed environmental data to federal and state decision makers and researchers in a timely, accessible manner.

The program focuses on environmental events of regional and/or national interest such as toxic phytoplankton blooms (red tides), beach strandings of marine mammals and sea turtles, and turbidity events caused by flooding, hurricanes, and oil spills. Satellite imagery and data is disseminated by seven regional



CoastWatch satellite antenna installed on the roof of the AOML facility (before addition of protective dome).

nodes located throughout the country. The Caribbean node will, among other things, produce satellite imagery of coastal areas both before and after hurricane passage to evaluate the impact of hurricanes at landfall.

CoastWatch is a cooperative effort involving all the major NOAA components, including the National Weather Service (NWS), National Ocean Service (NOS), National Environmental Satellite, Data and Information Service (NESDIS), Office of Oceanic and Atmospheric Research (OAR), and National Marine Fisheries Service (NMFS).

Keynotes can be viewed online in PDF format at the following Internet web site address:
<http://www.aoml.noaa.gov/keynotes>