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Miami, Florida

July-August 2006 | Atlantic Oceanographic and Meteorological Laboratory | Volume 10, Number 4

Updated Hurricane Forecast Calls for Fewer Storms

NOAA issued an updated forecast for the 2006 Atlantic hurricane season in early August, slightly lowering the number of named storms expected to develop. Despite the reduced number of storms predicted, the remainder of the season is still forecast to produce an above normal level of storm activity.

In May, NOAA predicted 13-16 named storms would form. The updated forecast calls for between 12-15 named storms, with seven to nine of these storms developing into hurricanes. Three to four hurricanes are projected to become major hurricanes with winds above 110 mph.

Since the start of the Atlantic hurricane season on June 1st, three tropical storms (Alberto, Beryl, and Chris) have formed. An additional nine to 12 named storms are, therefore, expected to develop before the season ends on November 30th.

Previous recent seasons that have produced similar levels of activity to what is being forecast for 2006 include 2000 and 2001. Most of the hurricanes for these years developed in September and October. Hence, it is not unusual to have had no hurricanes develop even through late August.

A "slow" start has no bearing on the potential destructiveness of a particular season. It only takes one storm to devastate a community. Coastal residents are urged to prepare and remain vigilant.

NOAA's seasonal hurricane forecasts are a collaborative effort of specialists with the Climate Prediction Center, National Hurricane Center, and Hurricane Research Division of AOML (Stanley Goldenberg).

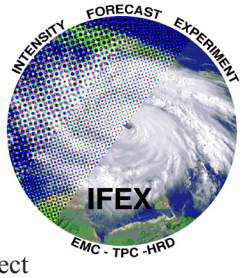
2006 Hurricane Field Program Focuses on Intensity Change

Jason Dunion, Hurricane Research Division/Hurricane Field Program Director

AOML's Hurricane Research Division (HRD) is pleased to once again partner with NASA and other collaborators in the field to coordinate our research of Atlantic hurricanes. Coordinated aircraft research efforts between NOAA and NASA began in 1998, and this year's field campaign represents the fourth joint collaboration since then. The prior three collaborations have been extremely fruitful, and we expect the same success this summer.

NOAA's Gulfstream-IV jet (foreground) and WP-3D Orion turboprop (background) "hurricane hunter" aircraft are critical to HRD's annual field program. These specially-instrumented airborne observing platforms gather data from the inner core of tropical cyclones and their surrounding environment.

The field activities that are planned for September 2006 will provide a unique opportunity to study an area of the ocean basin that is infrequently sampled by aircraft, yet generates numerous tropical waves that represent the seedlings for many tropical cyclones each year. In fact, these seedlings account for ~60% of all tropical cyclones and ~85% of all major hurricanes that occur in the Atlantic. And yet, only about one in ten of these tropical waves actually forms into a named storm. The reasons for this are still not fully understood.



Over the past several decades, NOAA's National Hurricane Center forecasts of hurricane track have steadily improved by ~1% per year. However, NOAA's advancements in predicting hurricane intensity lag behind those of track by ~15-20 years. Simply put, predicting how a hurricane will strengthen or weaken is a difficult task. Scientists are still attempting to fully understand the many complex factors in the atmosphere and ocean that can affect hurricane intensity. For these reasons, NOAA's main focus this summer will be to closely examine hurricane intensity change by conducting its Intensity Forecasting Experiment (IFEX) during the 2006 hurricane field program. The main goals of IFEX include:

• Collecting observations that span the tropical cyclone life cycle in a variety of environments;

• Developing and refining measurement technologies that provide improved real-time monitoring of tropical cyclone intensity, structure, and environment; and

• Improving our understanding of the physical processes important in intensity change for a tropical cyclone at all stages of its life cycle.

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Know the Plan!

AOML's Hurricane Preparedness and Recovery Plan (http://nuwave/intrapdf/hurrprep2006.pdf) provides a course of action for securing the grounds and facility for severe weather. Should a tropical storm or hurricane threaten the south Florida area, the Plan will be implemented. A Coordination Team is tasked with carrying out all operational aspects of the Plan during both preparatory and recovery phases for their respective Division or group. AOML staff are expected to cooperate with and assist team members in fulfilling their responsibilities. Team members include:

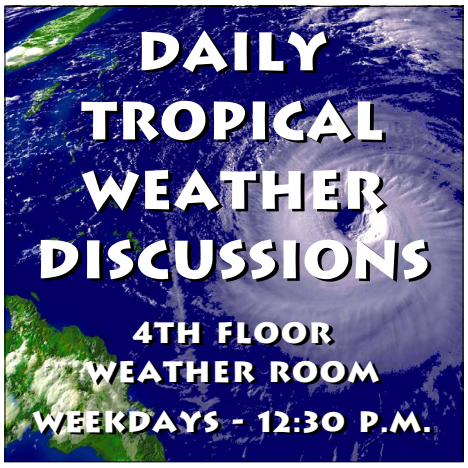
Hurricane Research Division
- Neal Dorst
- Joseph Griffin (alternate)
- Shirley Murillo (alternate)

Ocean Chemistry Division
- Thomas Carsey
- Jules Craynock
- Michael Shoemaker
- Joseph Bishop (alternate)

Physical Oceanography Division
- Ulises Rivero
- Robert Roddy
- Pedro Pena (alternate)

Computer Networks and Services
- Robert Kohler
- Thomas Heeb

Office of the Director
- Nancy Ash
- Gregory Banes
- Judith Gray
- Manuel Fraga (alternate)



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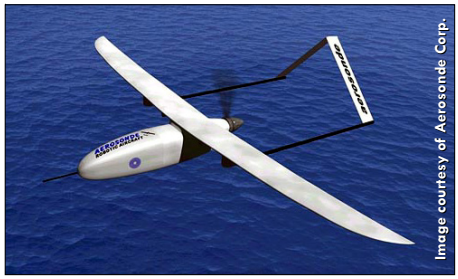
NOAA will conduct several aircraft research experiments in support of its IFEX program this summer. These experiments include:

- Investigating how Saharan dust storms affect hurricane development and intensity change;
- Using remote controlled drone aircraft called Aerosondes to study the very lowest regions of the hurricane environment;

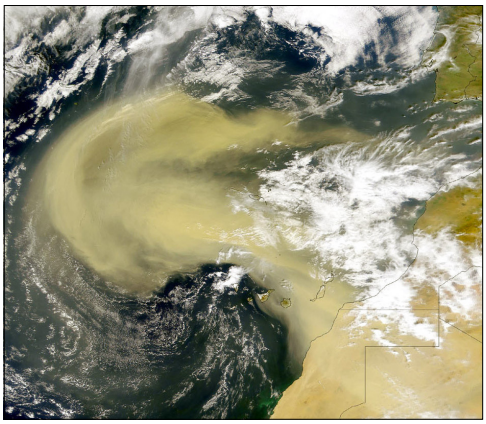


Aerosonde aircraft can obtain observations from the turbulent hurricane environment just above the ocean surface, an area too dangerous for manned aircraft to observe directly.

- Investigating the structure and evolution of hurricanes that make landfall and eventually decay over land;
- Studying how incipient tropical disturbances develop into hurricanes; and
- Furthering our understanding and interpretation of current and future satellite platforms that use microwave frequencies to measure surface winds over the world's oceans.

Two of these NOAA research experiments will be directly coordinated with NASA's African Monsoon Multidisciplinary Analyses (NAMMA) project this summer:

Saharan Air Layer Experiment or SALEX: This experiment will use NOAA's WP-3D Orion turboprop and Gulfstream-IV high altitude jet to investigate how dry, dusty Saharan dust storms that contain strong jets of air can suppress hurricane development in the North Atlantic and Caribbean Sea. This feature, also known as the Saharan Air Layer, or SAL, moves out from the Sahara Desert into the Atlantic every three to five days in the summer and early fall, can cover an area roughly the size of the lower 48 U.S. states, and often travels as far west as Central America, the Gulf of Mexico, and south Florida. NOAA's plans include operating its aircraft from Barbados, St. Croix, and Bermuda to carry out this summer's Saharan Air Layer experiments.



Researchers will continue their investigation of how Saharan dust storms impact the development and intensity of tropical cyclones.

Tropical Cyclogenesis Experiment, or GENEX: This experiment will use NOAA's WP-3D Orion turboprop and Gulfstream-IV high altitude jet to improve our understanding of how a tropical disturbance forms (or doesn't form) into a hurricane. The processes in the atmosphere and ocean that lead to hurricane formation (or non-formation) are complex and not well understood by scientists. This experiment is designed to help unlock some of those mysteries.

This year's NOAA-NASA field campaign will monitor storms from seedlings over Africa to mature hurricanes that might affect the U.S. coastline several days later. NASA will focus its efforts to study incipient tropical disturbances and the Saharan Air Layer over Africa and the eastern North Atlantic. As the "baton is passed" east to west from NASA to NOAA, NOAA (operating from Barbados, St. Croix, or Bermuda), will continue monitoring these same tropical systems, their possible genesis into hurricanes, and their interactions with the Saharan Air Layer. This summer's NOAA-NASA partnership will provide the most geographically expansive aircraft monitoring of tropical cyclones that has ever been carried out across the North Atlantic and Caribbean Sea. The NAMMA and IFEX programs will also enable scientists to closely monitor disturbances that originate over Africa and eventually impact the U.S.

NOAA and NASA scientists will use the data that is collected this summer to help unlock some of the mysteries related to hurricane intensity change in the Atlantic. Data that is collected will be incorporated into NOAA and other operational forecast models around the world to help improve forecasts of hurricane track and intensity.

AGU Highlights Hurricane Katrina Intensity Paper

A paper co-authored by AOML Director Dr. Robert Atlas was chosen recently by the editors of *Geophysical Research Letters,* an American Geophysical Union (AGU) journal, as an AGU journal highlight.

Shen, B.-W., R. Atlas, O. Reale, S.-J. Lin, J.-D. Chern, J. Chang, C. Henze, and J.-L. Li, 2006: Hurricane forecasts with a global mesoscale-resolving model: Preliminary results with Hurricane Katrina (2005). *Geophysical Research Letters,* 33(13):L13813, doi:10.1029/2006GL026143.

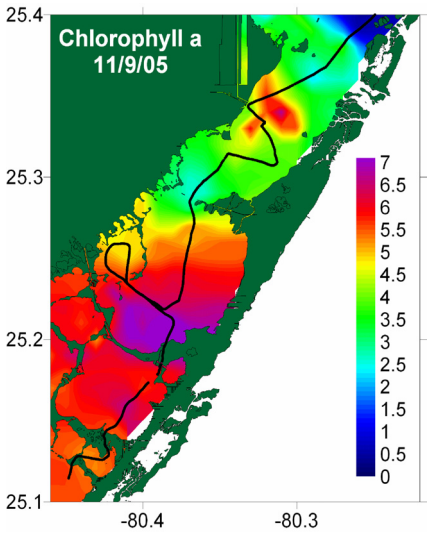
Shen *et al.* obtained improved intensity simulations for Hurricane Katrina using NASA's Columbia supercomputer. The following summary of the paper appears on the AGU Journal Highlights website (www.agu.org/sci_soc/prrl/jh060724.html):

Although hurricane track forecasts have been steadily improving over the past few decades, progress on hurricane intensity forecasts has been slow, mainly because most general circulation models (GCMs) lack sufficient resolution to simulate near-eye structure and other factors. Recent advances in the capabilities of high-end supercomputers have allowed a few GCMs, including the mesoscale-resolving finite-volume GCM (fvGCM) developed by NASA, to overcome previous modeling failures. Using the fvGCM, Shen et al. modeled Hurricane Katrina, which in late August 2005 underwent two stages of rapid intensification, becoming the sixth most intense hurricane in modern history to have developed over the Atlantic Ocean. Six five-day simulations of Hurricane Katrina at two different scale resolutions (0.125° and 0.25°) show that data modeled at fine spatial scales more accurately predict actual hurricane intensity, producing calculations of hurricane center pressure with a high degree of accuracy. The fine-scale runs also produce better near-eye wind distributions and a more realistic average intensification rate. The authors expect that such research in predicting hurricane intensity will aid in future disaster mitigation efforts.

AOML Scientists Investigate Biscayne Bay Algal Bloom

Christopher Kelble and Peter Ortner, Ocean Chemistry Division/South Florida Program

Scientists with the South Florida Program (SFP) based at AOML have been monitoring an unusual algal bloom in southern Biscayne Bay (Manatee Bay, Barnes Sound, and Blackwater Sound). The bloom first came to the attention of SFP scientists in the fall of 2005 when regularly monitored stations in the area began to display elevated chlorophyll-*a* and soluble reactive phosphate concentrations. In fact, chlorophyll concentrations reached levels not seen in the preceding five or more years of monitoring and did so over a comparatively large area. The bloom has prevailed ever since with elevated chlorophyll-*a* concentrations still observable this June.



Estimated chlorophyll-*a* biomass, measured via in situ fluorometry, around the algal bloom in southern Biscayne Bay. Measurements were taken during a SFP monitoring cruise conducted on November 9, 2005.

This algal bloom is composed primarily of a non-toxic, blue-green algae commonly found in nearby areas of Florida Bay. Nonetheless, damaging environmental effects are still possible since such a bloom absorbs the light required by adjacent seagrass beds. Seagrass beds provide a critical habitat for numerous fishes and invertebrates.

SFP scientists are collaborating with investigators at the South Florida Water Management District, Florida International University, and Florida Fish and Wildlife Conservation Commission to determine the cause of the bloom. Analysis to date suggests that there are at least three possible causes: (1) nutrients leaching into the system due to the method of road construction being used along the adjacent section of U.S. Highway 1; (2) sediment resuspension and advective mixing associated with the passage of Hurricanes Katrina, Rita, and Wilma in 2005; and (3) water releases associated with the passage of the same three hurricanes.

The present concensus of understanding is that a combination of these factors resulted in the initiation and propagation of the bloom. One reason for thinking so is that while the bloom is most intense near the area of road construction, it began shortly after the passage of the hurricanes rather than when road construction began. Moreover, the algal bloom extended more widely than might be the case if the only cause was leaching of nutrients from the roadbed.

Since road construction is a factor within management control, the interagency group is concentrating on quantifying the role it may play. Based upon this understanding, the group hopes to make recommendations on appropriate construction practices to minimize environmental impacts of future construction projects in this and other similar wetland areas.

Dr. Kyu-Kui Jung of the Korean Oceanographic Data Centre, Republic of Korea, spent the month of June visiting with AOML's Physical Oceanography Division. Dr. Jung worked with staff from the Division's Global Drifter and Argo Data Center groups to learn about data processing for drifting buoys and Argo floats, quality control procedures, and database management. As part of his learning experience, Dr. Jung participated in the deployment of a cluster of four drifters that were part of a study to compare the performance of different manufacturers' instruments. The deployment of the cluster took place on June 29th in the Florida Straits aboard the M/V *Miss Britt.*

Recent Publications*

Cahine, M.T., T.S. Pagano, H.H. Aumann, R. ATLAS, C. Barnet, J. Blaisdell, L. Chen, M. Divakarla, E.J. Fetzer, M. Goldberg, C. Gautier, S. Granger, S. Hannon, F.W. Irion, R. Kakar, E. Kalnay, B.H. Lambrigtsen, S.-Y. Lee, J. Le Marshall, W.W. McMillan, L. McMillin, E.T. Olsen, H. Revercomb, P. Rosenkranz, W.L. Smith, D. Staelin, L.L. Strow, J. Susskind, D. Tobin, W. Wolf, and L. Zhou, 2006: AIRS: Improving weather forecasting and providing new insights on greenhouse gases. *Bulletin of the American Meteorological Society,* 87(7):911-926.

LUEGER, H., R.H. WANNINKHOF, D.W.R. Wallace, and A. Kortzinger, 2006: CO_2 fluxes in the subtropical and subarctic North Atlantic based on measurements from a volunteer observing ship. *Journal of Geophysical Research,* 111(6): C06024, doi:10.1029/2005JC003101.

MANZELLO, D., J.C. HENDEE, D. Ward, and Z. Hillis-Starr, 2006: An evaluation of environmental parameters coincident with the partial bleaching event in St. Croix, U.S. Virgin Islands, 2003. *Proceedings, 10th International Coral Reef Symposium,* Okinawa, Japan, June 28-July 2, 2004. Japanese Coral Reef Society, 709-717.

Park, G.-H., K. Lee, R.H. WANNINKHOF, and R.A. Feely, 2006: Empirical temperature-based estimates of variability in the oceanic uptake of CO_2 over the past two decades. *Journal of Geophysical Research,* 111(C7):C07S07, doi:10.1029/2005JC003090.

Shen, B.-W., R. ATLAS, O. Reale, S.-J. Lin, J.-D. Chern, J. Chang, C. Henze, and J.-L. Li, 2006: Hurricane forecasts with a global mesoscale-resolving model: Preliminary results with Hurricane Katrina (2005). *Geophysical Research Letters,* 33(13):LI3813, doi:10.1029/2006GL026143.

STABENAU, E.R., J.C. HENDEE, and L. FLORIT, 2006: Techniques for the automated assessment of intense light and high sea temperature on coral response. *Proceedings, 10th International Coral Reef Symposium,* Okinawa, Japan, June 28-July 2, 2004. Japanese Coral Reef Society, 702-708.

Takahashi, T., S.C. Sutherland, R.A. Feely, and R.H. WANNINKHOF, 2006: Decadal change of the surface water pCO_2 in the North Pacific: A synthesis of 35 years of observations. *Journal of Geophysical Research,* 111(C7):C07S05, doi:10.1029/2005JC003074.

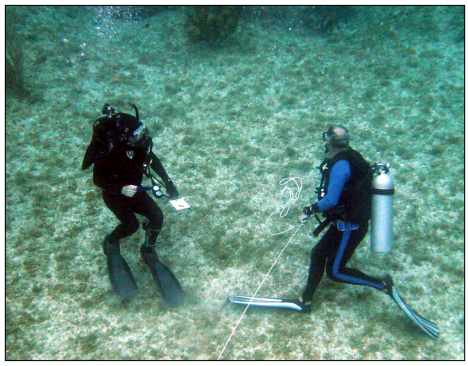
WANG, C., 2006: An overlooked feature of tropical climate: Inter-Pacific Atlantic variability. *Geophysical Research Letters,* 33(12):LI2702, doi:10.1029/2006GL026324.

WANG, C., D.B. ENFIELD, S.-K. LEE, and C.W. Landsea, 2006: Influences of the Atlantic warm pool on western hemisphere summer rainfall and Atlantic hurricanes. *Journal of Climate,* 19(12):3011-3026.

*Names of AOML authors appear in capital letters.

New Sites Augment Coral Reef Monitoring Network

Scientists with the Coral Health and Monitoring Program (CHAMP) at AOML recently selected the sites for two new Integrated Coral Observing Network (ICON) stations. Once constructed and operational, the ICON stations at Puerta Morelos, Mexico and Little Cayman Island will become part of an expanding network of environmental monitoring platforms that provide researchers with near real-time data and information about coral health and climatic conditions at coral reefs.



NOAA-AOML divers conducting a site survey offshore of Little Cayman Island.

The site of the future Puerta Morelos station is located within a marine protected area and was established in conjunction with staff at the Universidad Nacional Autonoma de Mexico. It is anticipated that this new site will support joint government and academic studies focused on coral bleaching and local ecological effects, coral reef connectivity and large-scale ecological processes, remediation/restoration efforts, and other related topics. The site survey was funded by a Department of State/NOAA Whitewater-to-Bluewater initiative.

A grant from NOAA's Coral Reef Conservation Program funded the site survey near Little Cayman Island, conducted in partnership with the Central Caribbean Marine Institute. The Little Cayman Island site is located in 20 feet of water a short distance from a world famous dive site, Bloody Bay Wall. A beautiful reef just 225 feet north of this new site features a rich diversity of corals and sponges.

ICON data are transmitted to AOML in near real-time via GOES satellites, analyzed by expert systems that use artificial intelligence technology, and posted on the CHAMP web site (www.coral.noaa.gov/crw/real_data.shtml). Long-term ecological trends are assessed by environmental managers and researchers to make informed and timely decisions about coral reefs. Near real-time feedback allows sites to be visited and sampled if the modeled conditions for bleaching or other significant events are met.

Collaborative Study Set for CO_2 Dynamics in the Arctic and Antarctic

Drs. Wei-Jun Cai and Rik Wanninkhof on the bridge of the icebreaker *Xue Long (Snow Dragon)* in Shanghai, China.

As part of NOAA's involvement in the International Polar Year (IPY), AOML scientist Rik Wanninkhof and Professor Wei-Jun Cai of the University of Georgia's Department of Marine Science will be collaborating with scientists from the Polar Research Institute of China and the Third Institute of Oceanography of the State Oceanic Administration to study ocean carbon dynamics in the Arctic and Antarctic oceans. The focal point of the collaborative effort will be installation of automated systems to measure surface water carbon dioxide levels, chlorophyll, and oxygen on the Chinese icebreaker *Xue Long* (*Snow Dragon*).

Drs. Wanninkhof and Cai traveled to China at the end of July to discuss the efforts with officials at the Chinese Arctic and Antarctic Institute in Beijing, the Polar Research Institute of China in Shanghai, and the Third Institute of Oceanography in Xiamen. The icebreaker was inspected in Shanghai, and plans were made to install an uncontaminated scientific seawater line on the ship. On the last stop in Xiamen, an agreement was signed formalizing the interaction. Dr. Wanninkhof also presented two lectures on the global ocean carbon cycle in Xiamen.

Congratulations

Craig Engler, a physical scientist with AOML's Physical Oceanography Division, helped raise $32,000 for the American Cancer Society this past June by paddling from Key Biscayne to Key West, Florida with his Castaways Against Cancer kayaking teammates. The 10-member team successfully completed the 150-mile journey in seven days. For more information about their trip, visit the Castaways Against Cancer website at www.castawaysagainstcancer.com.

David Palmer, a physicist with AOML's Ocean Chemistry Division, was elected to Fellowship in the Acoustical Society of America this past June during the Society's 151st meeting in Providence, Rhode Island. Palmer, a long-time member of the Society, was made a Fellow in recognition of his contributions to sound propagation in the oceans through the development and application of acoustic imaging techniques.

Dr. Kristina Katsaros, former AOML Director, was an honoree at the 2006 Celebration of Distinction hosted by the University of Washington's College of Arts and Sciences this past May. Katsaros was recognized for her leadership, research, and many years of affiliation with the University's Department of Atmospheric Sciences. The framed caricature she holds was drawn by David Horsey, an award-winning political cartoonist with the *Seattle Post-Intelligencer* newspaper based in Seattle, Washington. It celebrates her years with NOAA.

Farewell

Armando Cuervo, an administrative specialist, resigned in August after working with AOML's Office of the Director for almost nine years. Cuervo has accepted a position with the Sponsored Programs Group at the University of Miami's Rosenstiel School of Marine and Atmospheric Science. Best wishes to Armando for his continued success.

Doran Mason, a marine ecologist, returned to NOAA's Great Lakes Environmental Research Laboratory (GLERL) in Ann Arbor, Michigan, after spending more than a year working with scientists in AOML's Ocean Chemistry Division to develop a partnership for coastal ecology research between GLERL, AOML, and the National Marine Fisheries Service. While at AOML, Mason also worked to develop state-of-the-art acoustic sensing devices for measuring plumes in the ocean and for assessing seafloor surfaces, as well as instrumentation for gathering real-time data from buoys.

Welcome Aboard

Dr. Denis Pierrot joined the staff of the Ocean Chemistry Division's Ocean Carbon Group in August as a CIMAS assistant scientist to lead the effort in establishing a global surface ocean CO_2 observing system. He will also maintain and expand the CO_2 measurements campaigns on volunteer observing ships. Dr. Pierrot received his doctoral degree at the University of Miami's Rosenstiel School, where he has worked for the past three years on instrument development and CO_2 data interpretation.

Travel

Judith Gray, Robert Kohler, and M. Catherine Steward attended the Office of Oceanic and Atmospheric Research's (OAR) Management Conference in Longmont, Colorado on July 17-20, 2006.

Michael Black and Shirley Murillo were invited participants of the National Geographic's Educational Outreach Program in Washington, D.C. on July 18-21, 2006.

Robert Atlas presented a seminar and met with colleagues at NASA's Jet Propulsion Laboratory in Pasadena, California on July 21-25, 2006.

Chunzai Wang attended the American Geophysical Union's 2006 Western Pacific Geophysics Meeting in Beijing, China on July 24-27, 2006.

Robert Molinari attended the U.S. CLIVAR Summit meeting in Breckenridge, Colorado on July 26-28, 2006.

Rik Wanninkhof met with collaborators at the Polar Research Institute of China in Shanghai, China and the Third Institute of Oceanography in Xiamen, China on July 26-August 5, 2006.

Mark Powell attended a Florida Commission on Hurricane Loss Projection Methodology meeting in Tallahassee, Florida on July 27, 2006.

Robert Atlas attended the OAR/National Weather Service Summit in Baltimore, Maryland on August 14-15, 2006 and the NOAA U.S. Weather Research Program (USWRP) Executive Committee meeting on August 18, 2006.

Peter Ortner was an invited guest speaker at an Environmental and Land Use Law Section of the Florida Bar seminar in Jacksonville, Florida on August 24-26, 2006.

Tsung-Hung Peng attended a NOAA Leadership Seminar in Warrenton, Virginia on August 28-31, 2006.

Jeffrey Absten, Hector Casanova, Jules Craynock, James Hendee, Michael Jankulak, and Scott Stolz re-installed and deployed an upgraded Integrated Coral Observing Network (ICON) station in Salt River Bay National Historical Park and Ecological Preserve, St. Croix on August 28-September 8, 2006.

July-August Informal Research Reports*

July 18 ***OSSEs for Pedestrians***

Dr. Carlisle Thacker
Physical Oceanography Division

July 26 ***Transport Variability Along the Subtropical Atlantic Western Boundary: Implications for Monitoring the Meridional Overturning Circulation***

Dr. Christopher Meinen
Physical Oceanography Division

July 27 ***Progress in Understanding the Intra-Americas Sea and its Role in Climate***

Dr. David Enfield
Physical Oceanography Division

August 2 ***Drifter Observations of the Gulf of Mexico during Passage of Category 5 Hurricane Rita***

Dr. Rick Lumpkin
Physical Oceanography Division

August 3 ***Water Quality Observations in Biscayne Bay and Adjacent Coastal Waters, 2002 to 2006***

Dr. Elizabeth Johns
Physical Oceanography Division

August 8 ***The Meridional Heat Transport in the Atlantic Ocean: Data Versus Models***

Dr. Molly Baringer
Physical Oceanography Division

August 9 ***The Florida Area Coastal Environmental (FACE) Program***

Drs. John Proni and Thomas Carsey
Ocean Chemistry Division

August 10 ***On the Time-Variant Heat Budget in the Tropical Atlantic: Elimination of Vertical Heat Transport***

Dr. Claudia Schmid
Physical Oceanography Division

***Presentations are held in the first-floor conference room.**

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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