

# AOML Keynotes

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Atlantic Oceanographic and Meteorological Laboratory

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## Coral Reef Sites Identified as Ocean Acidification Hot Spots

A study published in the January 2010 issue of the journal *Limnology and Oceanography* indicates that coral reefs in the eastern tropical Pacific Ocean may be the first and most seriously impacted by the effects of ocean acidification.

Derek Manzello, a coral reef researcher with AOML's Ocean Chemistry Division, assessed seawater carbon dioxide (CO<sub>2</sub>) system dynamics at reef sites offshore of Panama and in the Galapagos Islands. Manzello analyzed seawater chemistry and satellite-derived sea surface temperature data over a five-year period for the Panama reefs and for two separate years for reefs in the Galapagos. Reefs in these areas are habitually impacted by deep, CO<sub>2</sub>-enriched waters that reach the surface through upwelling.

Since the Industrial Revolution, the oceans have absorbed an estimated one-third of all CO<sub>2</sub> discharged into the atmosphere. Ocean acidity has subsequently increased, making it more difficult for corals to build the structures in which they live.

Manzello found that Galapagos reefs are naturally exposed to the highest CO<sub>2</sub> levels documented for any coral reef in the world. This pre-existing high CO<sub>2</sub> makes these reefs particularly vulnerable to increases in CO<sub>2</sub>, predisposing them to being ocean acidification hot spots.

MANZELLO, D.P., 2010: Ocean acidification hot spots: Spatiotemporal dynamics of the seawater CO<sub>2</sub>-system from eastern Pacific coral reefs. *Limnology and Oceanography*, 55(1): 239-248.

## Repeat Hydrography Cruise Samples Transect Across Pacific

Scientists from 12 research institutions boarded the RV *Melville* this past November to take part in the U.S. CLIVAR/CO<sub>2</sub> Repeat Hydrography Program's P06 cruise from Brisbane, Australia to Valparaiso, Chile. The transect across the Pacific was undertaken to track the changing uptake patterns of carbon dioxide (CO<sub>2</sub>) in the ocean, as well as to assess changes that have occurred in the biogeochemical and physical properties of the ocean over the past several years.

The *Melville* departed Brisbane, Australia on November 21, 2009 and completed leg 1 of the transect on January 2, 2010 with a port stop in Papeete, Tahiti, French Polynesia. The second leg was occupied between January 5-February 11, 2010 from Papeete, Tahiti, French Polynesia to Valparaiso, Chile. Dr. Shenfu Dong, a CIMAS assistant scientist with AOML's Physical Oceanography Division, served as the co-chief scientist during leg 1. Esa Peltola of AOML's Ocean Chemistry Division (OCD) and Andrew Stefanick of AOML's Physical Oceanography Division were also part of the scientific staff who participated in leg 1. Robert Castle of OCD was aboard the RV *Melville* during leg 2.

The *Melville* followed the track of two previous cruises along 32.5°S, the RV *Knorr* in 1992 and RV *Mirai* in 2003. Although well measured near the coasts and over steep topography, both of these earlier occupations included large interior portions where station spacing sometimes exceeded 70 nautical miles. The two legs of the current P06 effort (44 and 38 sea days, respectively) were planned to bring the station spacing to no more than 30 nautical miles anywhere along the transect.

Sampling operations included deployment of a CTD (conductivity-temperature-depth) rosette to gather temperature, salinity, oxygen, and current measurements in the water column, as well as continuous underway sampling of CO<sub>2</sub> to monitor the exchange of CO<sub>2</sub> between the ocean and atmosphere. Water samples were collected to measure nutrients, carbon system parameters, halocarbon tracers, and trace metals (mainly iron and aluminum).

Transect reoccupations through the Repeat Hydrography Program provide the means for comparing present data with earlier data sets, i.e., data obtained from the *Knorr* and *Mirai* cruises, to assess changes in the storage and transport of (continued on page 2)



Karen Stamieszkin, Liz Burakowski, Keith Shadle, and Shenfu Dong (of AOML) during leg 1 of the Repeat Hydrography P06 cruise pose with a CTD rosette deployed to gather water samples from just below the ocean surface to about 15 m from the ocean floor.



AOML is an environmental research laboratory of NOAA's Office of Oceanic and Atmospheric Research located on Virginia Key in Miami, Florida



### AOML Assists Haitian Relief Efforts

A powerful magnitude 7.0 earthquake devastated Port-au-Prince, Haiti on January 12th, toppling buildings and burying thousands in the rubble. AOML staff were quick to respond to the crisis by organizing efforts to gather food, water, and other needed supplies.



Russell St. Fleur and Armando Cuervo of AOML, along with Melanie and Michelle Cuervo, deliver bottled water obtained from AOML staff donations to a local high school to assist with relief efforts in Haiti.

Armando Cuervo, a management support specialist with AOML's Office of the Director, organized a bottled water drive in response to his daughters' concerns for how they could help the people of Haiti. More than \$200 was collected towards the purchase of water in addition to contributions from staff of bottled water. The water was taken to a local high school where it helped fill a 20-foot long shipping container that was subsequently sent to Haiti for distribution.

LTJG Madeleine Adler, a NOAA Corps officer at AOML, organized a food, first-aid supplies, and clothing drive in the lobby. AOML staff, along with staff from NOAA's Southeast Fisheries Science Center, generously contributed. Proceeds were retrieved on two separate occasions and shipped to Haiti in support of relief efforts.



LTJG Madeleine Adler and Dr. Renellys Perez of AOML load relief supplies onto a truck for transport to Haitian earthquake victims.

(continued from page 1)

heat, fresh water, CO<sub>2</sub>, and other parameters. Data gathered from the present reoccupation also supports the development of models that will more skillfully predict the role of the oceans in global climate change.

The Repeat Hydrography Program is jointly funded by the Climate Observation Division of NOAA's Climate Program Office and the National Science Foundation. The effort supports both the U.S. CLIVAR (Climate Variability and Prediction) and U.S. Carbon Cycle Science programs.

Researchers spent 44 days at sea participating in leg 1 of the RV *Melville's* P06 sampling operations across the Pacific. The cruise from Brisbane, Australia to Valparaiso, Chile was undertaken in support of the Repeat Hydrography Program's efforts to monitor natural and anthropogenic changes occurring in the ocean.

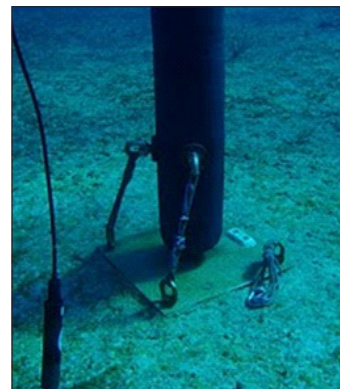


### Little Cayman Coral Monitoring Station Sustains Damage

In January, researchers with NOAA's Coral Health and Monitoring Program at AOML learned the Integrated Coral Observing Network (ICON) station offshore of Little Cayman Island in the Caribbean had been damaged. Colleagues at the Little Cayman Research Centre (LCRC) first noticed the damage following several weeks of strong winds and heavy swells and a magnitude 5.9 earthquake that was felt in the Cayman Islands on January 20th. An AOML team consisting of NOAA Corps officer Lecia Salerno and Mike Jankulak visited the station in late January to inspect and document the damage, as well as to install hardware and software for establishing a radio link between LCRC and the ICON station.

Above the water, the station's pylon was observed to have a noticeable lean to the left when viewed from land. Tears in the heavy black rubber sheet that wraps around the station at the waterline were also observed. The damage appeared to be due to wind and waves and the sharp edges of the metal hose clamps, which had come loose. Despite the lean, the station remained upright and continued transmitting its data.

Below the surface, one of four pins that secures the station pylon to its 2-foot square base plate anchored to the ocean floor had snapped and broken off. Additionally, one of the station's peripheral anchoring pins had suffered some cracking of its concrete bed. These structural damages are possibly related to the recent earthquake in the Caribbean and its aftershocks. Efforts are now underway by LCRC staff and associates to repair the damage.



View of the Little Cayman Island ICON station's base plate showing where one of its four anchoring pins has snapped and broken off.



The concrete bed beneath one of the Little Cayman Island ICON station's peripheral anchoring pins appears to have sustained damage through cracking, attributed to the recent earthquake and aftershocks in the Caribbean.



NOAA's Office of Oceanic and Atmospheric Research (OAR) has introduced a new communications tool for OAR staff. *The Exchange* is an anonymous blog site comprised of two parts: *Just the Facts*—where OAR leadership can post factual and authoritative information important to OAR and *On Your Mind*—where OAR staff are invited to raise issues relevant to the OAR community and respond to each others' comments and concerns. *The Exchange* can be accessed from the OAR web site ([www.oar.noaa.gov](http://www.oar.noaa.gov)) by clicking on the "For OAR Employees" link located in the upper right-hand corner on the home page.

## Coral List Server Reaches Benchmark of 6,000

Are you a coral researcher, ecologist, manager, student, teacher, or enthusiast who loves to discuss current coral-related topics, the latest findings, and the hottest debates? If so, chances are you are one of the now 6,000 subscribers to the Coral List list-server administered by AOML coral researcher Jim Hendee. This very popular list server recently marked the milestone of 6,000 subscribers and is growing larger every day.

Hendee and Louis Florit established the Coral List list-server in 1995 when the Internet and e-mail systems were still in their early years. Its purpose was to provide a forum for researchers worldwide to communicate on topics ranging from bleaching events, outbreaks of coral diseases, international meetings and symposia, research initiatives, and more.

Working with his CIMAS colleagues, Lew Gramer and Mike Jankulak, Hendee oversees items posted to the list and has become quite savvy at determining when a healthy debate is in progress or when a subscriber has breached etiquette protocols and intervention is needed to maintain the integrity of the exchange. In a message Hendee recently posted marking the 6,000th subscription, he noted, "You are a great community of minds that have helped shaped the future of coral reef research, conservation, outreach, and diving. Keep up the great work!"

Congratulations, Jim, for advancing coral reef science and conservation worldwide. The Coral List list-server can be accessed at [www.coral.noaa.gov/lists/](http://www.coral.noaa.gov/lists/).

### 2010 Federal Holidays

New Year's Day .....	January 1
Martin Luther King's .....	January 18 Birthday
Washington's Birthday .....	February 15
Memorial Day .....	May 31
Independence Day .....	July 5
Labor Day .....	September 6
Columbus Day .....	October 11
Veterans Day .....	November 11
Thanksgiving Day .....	November 25
Christmas Day .....	December 24

## Study Highlights Out-of-phase Relationship between Tropical Cyclones in the North Atlantic and Eastern Pacific

Chunzai Wang, *Oceanographer, Physical Oceanography Division*

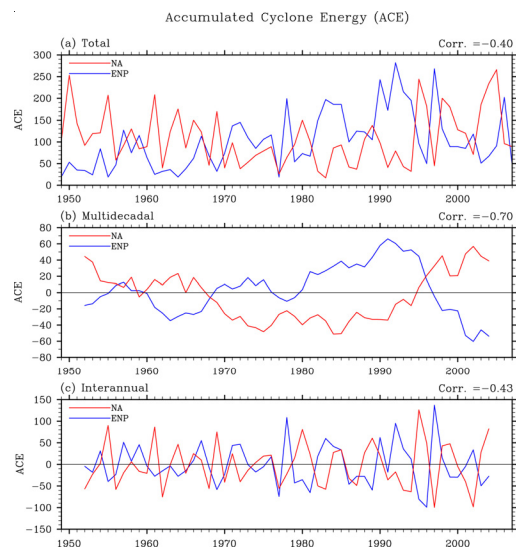
In the Western Hemisphere, tropical cyclones (TCs) can form and develop in both the tropical North Atlantic and eastern North Pacific oceans, which are separated by the narrow landmass of Central America. In comparison with TCs in the North Atlantic, TCs in the eastern North Pacific have received less attention although TC activity is generally greater in the eastern North Pacific than in the North Atlantic. Needless to say, few studies have focused on the relationship between TCs in the North Atlantic and eastern North Pacific oceans.

A new study, published in the journal *Geophysical Research Letters* by AOML principle investigators Chunzai Wang and Sang-Ki Lee, shows that TC activity in the North Atlantic varies out-of-phase with that in the eastern North Pacific on both interannual and multidecadal time scales. That is, when TC activity in the North Atlantic increases (decreases), TC activity in the eastern North Pacific decreases (increases). An important implication is that seasonal hurricane outlooks could be improved by considering the North Atlantic and eastern North Pacific together.

This study investigates what causes the out-of-phase relationship between TC variability in the North Atlantic and eastern North Pacific. The regression analyses show that both vertical wind shear and convective stability in the main development region of the North Atlantic are opposite to those in the eastern North Pacific. That is, when vertical wind shear and atmospheric convective stability in the hurricane main development region of the North Atlantic are reduced, the wind shear and atmospheric convective stability in the eastern North Pacific are enhanced. These opposite wind shear and convective stability patterns in the main development regions of the North Atlantic and eastern North Pacific result in the out-of-phase relationship between North Atlantic and eastern North Pacific tropical cyclones. Relative humidity and vorticity variations in the lower troposphere do not appear to cause the out-of-phase relationship.

It is also shown that oceanic conditions contribute to the out-of-phase relationship: an active (inactive) North Atlantic TC year is associated with a cold (warm) tropical eastern Pacific and a warm (cold) tropical North Atlantic. A further calculation shows that the distribution of sea surface temperatures on interannual timescales result in a La Niña-like pattern in the Pacific and a warm tropical North Atlantic or a large Atlantic warm pool. On multidecadal timescales, the regression pattern of sea surface temperatures resembles the distribution of the Atlantic Multidecadal Oscillation (AMO), with a warming of the North Atlantic and eastern tropical Pacific. Thus, a combination of a La Niña (El Niño) year, a warm (cold) year in the tropical North Atlantic, and a warm (cold) phase of the AMO will greatly increase the probability of an active (inactive) hurricane season in the North Atlantic and an inactive (active) season in the eastern North Pacific.

Wang, C., and S.-K Lee, 2009: Co-variability of tropical cyclones in the North Atlantic and the eastern North Pacific. *Geophysical Research Letters*, 36:L24702, doi:10.1029/2009GL041469.



**Time series of accumulated cyclone energy (ACE;  $10^4$  kt<sup>2</sup>) in the North Atlantic and eastern North Pacific oceans from 1949-2007 depicting total, multidecadal, and interannual variations. The ACE index is one of the most commonly used indices to measure TC activity, which takes into account the number, strength, and duration of all TCs in a season.**

### Argo Meetings Seek to Improve Quality and Distribution of Data

Claudia Schmid and Elizabeth Forteza of AOML's Physical Oceanography Division participated in the 10th Argo Data Management Team Meeting, the 4th Delayed Mode Quality Control Workshop, and the 3rd Argo Regional Center Meeting in Toulouse, France in October 2009.

The meetings focused on important aspects impacting the quality and distribution of Argo data. These aspects included the distribution of data and information important to users, the improvement of quality control procedures applied in real-time and delayed-mode, the coordination of deployments to maintain good data coverage, and new float technologies and developments in the satellite communication systems.

The Argo Project is a major component of the climate observing system. It maintains a global array of profiling floats that measure temperature and salinity to a depth of 2000 meters and report the data in real time. Argo is an important element of the Global Climate Observing System (GCOS), the Global Ocean Observing System (GOOS), the Climate Variability and Predictability Experiment (CLIVAR), and the Global Ocean Data Assimilation Experiment (GODAE).

The U.S. Argo Data Assembly Center at AOML is responsible for processing and distributing data received from floats belonging to several institutions in the United States. The U.S. contribution to Argo represents about 57% of the array.

Data provided by Argo are invaluable for a wide range of uses. They allow the analysis of the state of the ocean and its variability in unprecedented detail. The data are also widely used in the modeling community for data assimilation and model verification. The Argo array supports NOAA's mission goal to serve society, especially through supporting the goal to improve our understanding of climate variability and change, but also provides crucial information for the weather and water goal.

## AOML Treated to Treats on National Weatherperson's Day

Representatives from Blue Bell Creameries visited AOML on Friday, February 5th, to host an early afternoon ice cream party in honor of National Weatherperson's Day. AOML staff happily obliged Blue Bell's generous invitation to sample a variety of its ice cream flavors, all for the cause of recognizing those who provide our nation with weather forecasts and warnings.

February 5th commemorates the birthday Dr. John Jeffries, a physician and one of America's first weather observers, who was born in Boston, Massachusetts in 1745. Jeffries began recording daily weather conditions in the Boston area in 1774 and is credited with having taken some of the earliest known upper-level air observations—temperature, barometric pressure, and humidity—while drifting in a hydrogen gas balloon over London in November 1784.

Blue Bell is a company that considers weather an essential part of its business. Its drivers often commute to the same store locations daily to keep grocery freezers stocked with ice cream. While enroute, they rely on weather reports to keep them safe. According to Bill Weiss, Blue Bell's south Florida public relations director,

*"National Weatherperson's Day is a time for Blue Bell to show appreciation for the hard work of those who forecast the weather. We honor them because they provide crucial information for our daily operation. Our delivery drivers rely heavily on their forecasts to ensure their safety on the roadways. Each weather warning keeps our drivers safe and guarantees the safe delivery of Blue Bell ice cream. Giving Blue Bell ice cream to weatherpeople is our way of saying thank you for helping us do our job. We hope the treats are enjoyed in appreciation for what they do."*

The event was well attended, much appreciated, and brought a smile to the faces of all who participated. Thanks to Blue Bell Creameries for making National Weatherperson's Day a memorable occasion at AOML.



Blue Bell staff hard at work as they serve up an assortment of ice cream flavors for sampling in the AOML lobby.



Jennifer Calderon-Diaz, Shirley Murillo, and Lourdes Arteta enjoy a sweet treat in honor of National Weatherperson's Day.



AOML staff wait in line for ice cream in celebration of National Weatherperson's Day. Despite the large turnout, Blue Bell generously dished out more than enough of the tasty treat to satisfy everyone.

Hurricane Research Division meteorologist Jason Dunion (back row, standing) spoke to more than 750 middle school students about hurricanes this past November in West Virginia. Dunion's presentations were made at six Glenville State College (GSC) Hidden Promise Consortium schools in support of the JASON Project's Monster Storms program sponsored by the National Geographic Society. The GSC Hidden Promise Consortium was established in 2006 to help students excel academically and to boost high school graduation, college attendance, and college graduation rates in West Virginia. The JASON Project brings researchers to classrooms to inspire and motivate students to learn more about science.



## Program Eases Hunger in South Florida

Using lessons learned from leading the AOML Holiday Giving program for more than 10 years, AOML scientist Evan Forde founded the "Feed the Need" program at a church in North Miami Beach during the spring of 2008. The program, which relies on cash contributions from the church and community members, uses donations to purchase food in bulk from local food banks and food wholesalers.

The Feed the Need program is thriving and currently feeds approximately 300 families a month by allowing them to shop for free at its pantry. The program supplements families' non-perishable food items with bread and produce that are purchased or donated daily by local grocery stores. In addition to the registered families it feeds, the program served over 600 meals this past Thanksgiving and several hundred more this past Christmas Day.



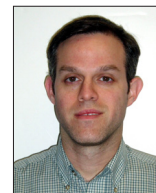
One of several Feed the Need community meals served this past Thanksgiving.

According to Forde, a large part of the program's success comes from its ability to purchase food at wholesale rates. He estimates that as little as \$30 can feed a family of three for an entire week. All Feed the Need workers and cooks are unpaid volunteers, and 100% of donations go directly to the purchase of food. AOML employees continue to help maintain the program through their regular donations.

Forde, who imparted the idea for the highly successful "Hands for Hunger" program in the Bahamas two years ago, has used the blueprint from the Miami-based Feed the Need program to start a similar program in Jacksonville, Florida. For additional information, or if you would like to make a donation to the Feed the Need program, contact Forde at [Evan.Forde@noaa.gov](mailto:Evan.Forde@noaa.gov).

## Farewell

Dr. Ernesto Muñoz, a CIMAS post-doctoral associate with AOML's Physical Oceanography Division, departed in January to assume new duties as a Research Scientist with the New Mexico Consortium in Los Alamos, New Mexico in collaboration with climate scientists from the Los Alamos National Laboratory. During Muñoz's two years at AOML, he conducted research on the ocean-atmosphere interactions in the Atlantic warm pool, and also on the representation of the Meridional Overturning Circulation from ocean reanalyses.

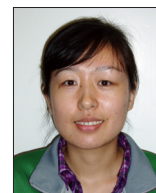


## Welcome Aboard

Tao Meng joined the staff of AOML's Hurricane Research Division in January as a CIMAS research associate to work with the Division's Modeling team and Developmental group. Meng will mainly work on a project aimed at expanding HRD's web portal to host its large collection of observational data sets gathered over the years from operational flights into tropical storms and hurricanes. He is currently pursuing a doctoral degree in electrical engineering from the Department of Electrical and Computer Engineering at the University of Miami.



Dr. Dianting Liu joined the staff of AOML's Hurricane Research Division in January as a CIMAS research associate to work with Dr. Mark Powell's Hurricane Surface Wind Analysis (H\*WIND) group, as well as the Developmental group. Liu holds Ph.D. in mechanical engineering in China and is currently working on a doctorate in electrical engineering from the University of Miami's Department of Electrical and Computer Engineering. Among her duties, Liu will help develop the latest version of the Division's web portal for its observational data sets.



Dr. Paul Reasor joined the staff of AOML's Hurricane Research Division (HRD) in December 2009 as a Federal research meteorologist. Reasor comes to HRD from Florida State University where he served as an assistant professor in the Department of Meteorology. He received his Ph.D. in atmospheric science from Colorado State University, and then worked at HRD as a National Research Council post-doctoral fellow from 2000-2001. Reasor will collaborate with HRD researchers in the analysis of Doppler radar observations in conjunction with numerical modeling and development of dynamical theory pertaining to hurricane structure and intensity change.



AOML welcomes Achim Stroeh for a three-month visit to the Laboratory's Physical Oceanography Division. Achim is currently a Ph.D. graduate student at the University of Bremen, in Bremen, Germany, where he works with Dr. Monika Rhein in studying the North Atlantic Current. During his time at AOML, Achim will work with Drs. Silvia Garzoli and Christopher Meinen to learn processing and analysis techniques for inverted echo sounders and bottom pressure sensors that are used to monitor the transport of oceanic currents.



Dr. Michelle Wood joined the staff of AOML in January as the new director of the Laboratory's Ocean Chemistry Division (OCD). Wood comes to AOML from the University of Oregon where she served as a professor in the Department of Biology for many years and as the Director of the University's Center for Ecology and Evolutionary Biology. As the incoming director for OCD, Wood will oversee and tend to OCD's broad array of scientific research programs, as well as to administrative, fiscal, and personnel responsibilities.



## Travel

Kelly Goodwin attended the Southern California Marine Mammal Workshop in New Port Beach, California on January 9-10, 2010.

Robert Atlas, George Halliwell, Mark Powell, Eric Uhlhorn, and Tomislava Vukicevic attended the American Meteorological Society's 90th Annual Meeting in Atlanta, Georgia on January 17-21, 2010.

Michael Jankulak and Lecia Salerno performed site maintenance and upgraded software at the ICON/CREWS station in Little Cayman Island, Cayman Islands on January 25-29, 2010.

Robert Rogers attended the Genesis and Rapid Intensification Processes (GRIP) science meeting in Los Angeles, California on January 26-29, 2010.

Robert Atlas represented NOAA's Office of Oceanic and Atmospheric Research at the Management Oversight Board meeting for the Joint Center for Satellite Data Assimilation in Camp Springs, Maryland on February 5th; attended a NOAA workshop on the next steps to advance Climate Services and strengthen NOAA's science base in Boulder, Colorado on February 9-12th; and attended the Developmental Testbed Center Hurricane Workshop in Boulder, Colorado on February 22-23, 2010.

Pamela Fletcher attended the National Water Conference on Hilton Head Island, South Carolina on February 21-25, 2010.

Frank Marks and Sundararaman Gopalakrishnan attended a Developmental Testbed Center Joint Weather Research Forecasting Hurricane Workshop in Boulder, Colorado on February 22-23, 2010.

Diana Aranda, Tania Casal, Shenfu Dong, Silvia Garzoli, Maribeth Gidley, Gustavo Goni, Kelly Goodwin, Lewis Gramer, George Halliwell, Kevin Helmle, Christopher Kelble, Rick Lumpkin, Derek Manzello, Christopher Meinen, Tsung-Hung Peng, Renellys Perez, Christopher Sinigalliano, Jack Stamates, Chunzai Wang, Rik Wanninkhof, Michelle Wood, and Jia-Zhong Zhang attended the American Geophysical Union's 2010 Ocean Sciences Meeting in Portland, Oregon on February 22-26, 2010.

## Recent Publications\*

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\*The names of AOML authors are denoted by blue bolded letters.

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