

2009 Annual Report: Cooperative Institute for Climate and Ocean Research (CICOR)

A 1998 agreement between WHOI and NOAA (the National Oceanographic and Atmospheric Administration) established a unique center at WHOI for climate research: CICOR, the Cooperative Institute for Climate and Ocean Research. For over a decade, CICOR has drawn on the leadership and research excellence at WHOI to serve NOAA's mission and goals.

With its founding agreement renewed in 2001, CICOR served as a global and national resource for scientists and strengthened the relationship between WHOI and NOAA, enabling long-term research partnerships in key areas of climate observations and analyses, marine policy, seafloor mapping and harmful algal bloom research. CICOR served as a catalyst and incubator of ideas for collaborative climate, coastal and ecosystems research.

In 2009 CICOR supported 72 projects, totaling nearly \$8.1 million in funding. Since 1998, CICOR has supported more than 188 research, education, outreach and program development projects, bringing its eleven-year funding total to more than \$61.7 million.

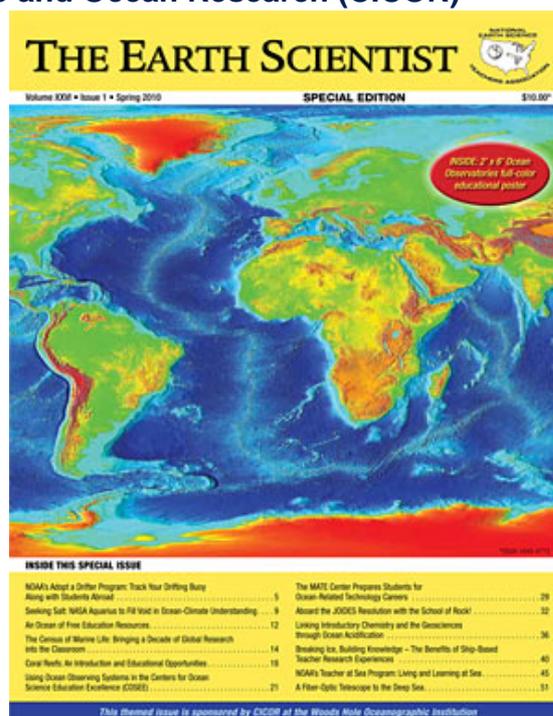
NOAA decided in 2008 to replace CICOR with a new, multi-institutional, regional cooperative institute. The new WHOI-led institute, CINAR, the Cooperative Institute for North Atlantic Research, began in mid-2009, continuing the WHOI/NOAA collaboration. During the transition phase, funding for some projects has continued via CICOR until June 2010 with a no-cost extension having been approved through June 2011. This allows CICOR to maintain its administrative support and oversight of ongoing projects in the process of completing work funded under previous awards.

CICOR is proud of its contribution to NOAA and to WHOI. CICOR principal investigators (PIs) and WHOI researchers have deepened their familiarity with NOAA strategic goals for the region, and have strengthened collaborative relationships with NOAA officials and colleagues from other institutions to further these goals. CICOR scientists are actively engaged in ocean observing and regional coordination in the Northeastern U.S. and around the globe. CICOR PIs from WHOI participated in the international "OceanObs'09" workshop in Venice, Italy that worked to lay the groundwork for future global ocean observations.

The strong partnerships between WHOI and NOAA are expected to continue well into the future. Below are some highlights of how CICOR science furthered NOAA's goals during 2009.

HIGHLIGHTS

- With funding from CICOR, the U.S. Program In Marine Biotoxins and Harmful Algae office at WHOI under Don Anderson (WHOI Biology Department) provides rapid reaction to unexpected or unusual harmful algal outbreaks in different parts of the country. In 2009, the program responded to the first documented presence of diarrhetic shellfish poisoning (DSP) toxins in shellfish within the US, and a massive regional red tide in New England.
- CICOR PIs Carin Ashjian and Mark Baumgartner (both Biology) observed considerable inter-annual covariability in physical and biological oceanography during the three years of their observations (this work and the two years of the Study of the Northern Alaskan Coastal System project). Their work sheds light on the inter-annual variability in whale prey and how it is associated with larger scale atmospheric and oceanographic conditions. This in turn has implications for the success and resilience of Iñupiat subsistence whaling at Barrow and for a better understanding of how to protect and manage the Western Arctic bowhead whale population.
- Janet Fredericks (WHOI Applied Ocean Physics & Engineering Department) has led a community of data providers, I.T. specialists and domain experts working together to describe ocean sensors and quality

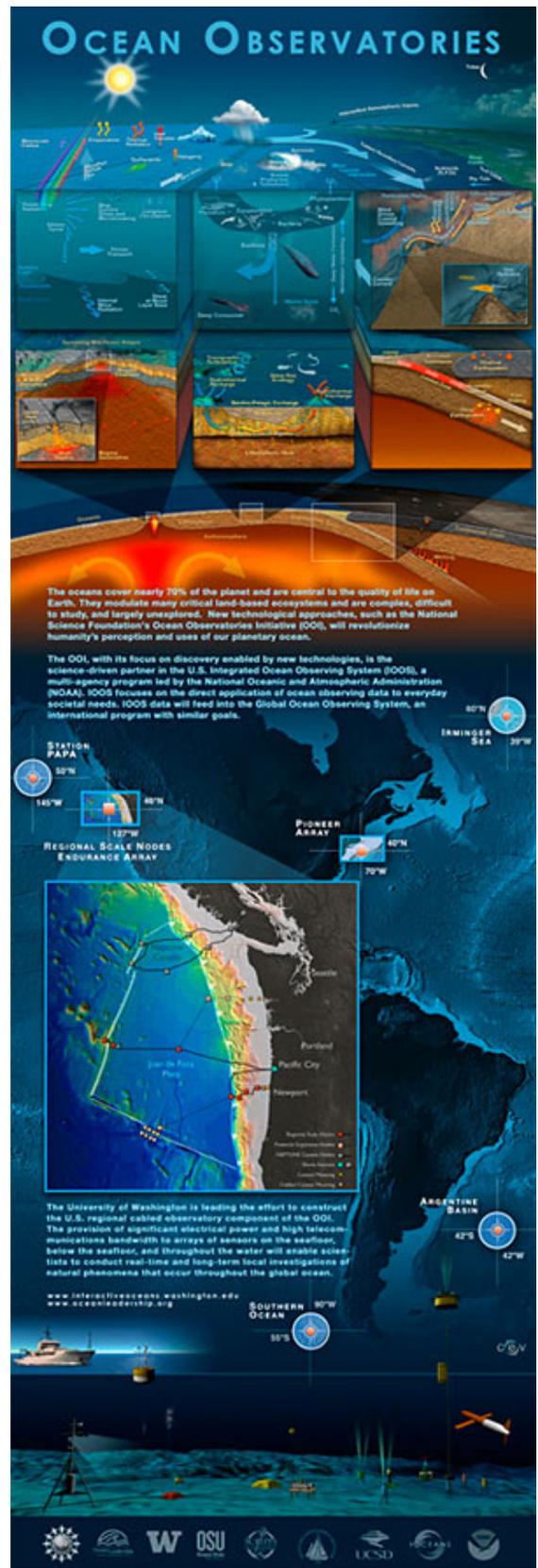


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CICOR sponsored an special edition issue of *The Earth Scientist*, a publication of the National Earth Science Teachers Association, on ocean observatories.

control procedures for ocean data. This group is working on QA/QC practices for observations of waves, currents, temperature, salinity, and dissolved oxygen. As we move towards greater machine-to-machine exchange of information, a common expectation of data quality standards and practices will assure a broader trust in the data and enable interdisciplinary research.

- The Upper Ocean Processes group led by Robert Weller, Albert Plueddemann and David Hosom (all WHOI Physical Oceanography Department) and funded through CICOR by the NOAA Climate Observation Program have led the development and implementation of hardware and software that greatly increases memory capacity while simultaneously reducing memory cost for the ASIMET (Air-Sea Interaction Meteorological) systems. A new ASIMET module processor/controller board was designed to improve low-temperature operation for the next generation of ASIMET electronics. The long-term goal of the “portable standard” ASIMET package is to provide climate quality meteorology from the oceanographic research fleet.
- Led by Weller, Plueddemann and Hosom, the Volunteer Observing Ship (VOS) Program continued field operations to maintain automated meteorological AutoIMET systems on two VOS routes in the Pacific and provided documentation and engineering consulting to STAR Engineering (licensee for IMET fabrication and sales) for the transfer from development to production of an ASIMET sonic anemometer wind module. Also designed, fabricated, and tested was a third-generation Iridium communication controller, Seabird SIM interface, and Benthos acoustic modem interface for inductive and acoustic telemetry of underwater instruments. The long-term goals of this work are to improve in-situ observations of marine boundary layer meteorology and air sea fluxes in order to improve understanding and prediction of the earth’s climate.



Included in the issue of the CICOR sponsored issue of *The Earth Scientist* was a full-size 2' x 6' educational poster on observatories created by the Center for Environmental Visualization at the University of Washington. (Center for Environmental Visualization at the University of Washington)

Related Links

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- In his work on marine resource industries, regulation and waterfront land use change in New England Fishing communities, Di Jin (WHOI Marine Policy Center) found a strong spatial relationship between local fish stocks and local employment in the fishing and related industries. The study will improve our understanding of the interactions between changes in fish stocks and waterfront land uses and fishing communities' economic conditions.
- In another study on the development of commercial fishing vessel cost models, also through CICOR, Jin developed three sets of models: annual vessel fixed cost, annual labor cost, and vessel trip variable cost. Analysts often work on similar issues but in different contexts—vessel types often overlap across Fisheries Management Plans (FMPs) and protected species actions. Having standardized and pre-tested cost models has a number of benefits. It increases the likelihood of cost models being used in regulatory analyses; it reduces the workload on analysts; and it fosters an agreed-upon “best practice” approach to this aspect of fisheries modeling.
- Hauke Kite-Powell's (Marine Policy Center) research on the economics of observations of ocean surface vector winds indicates that a significant fraction of the approximately \$500 million/year risk to commercial maritime transportation from severe storms in the North Atlantic and North Pacific oceans can be avoided with ocean surface vector wind observations and forecasts. This research contributes to the understanding of the economic value of ocean observing systems, specifically ocean surface vector wind observing instruments on satellites.
- Alison MacDonald's (Physical Oceanography) NOAA-funded research through CICOR found that the ocean inventory of bomb-produced radiocarbon (^{14}C) is directly related to air-sea CO_2 exchange and thereby provides a powerful constraint on the exchange rates. The large amount of high-quality radiocarbon data collected during the World Ocean Circulation Experiment WOCE program provides the opportunity to improve our estimate of these air-sea CO_2 exchange rates and make the results available to the modeling community.
- Robert Pickart's (Physical Oceanography) work investigated for the first time the dynamics of the flow of Pacific water through Herald Canyon. Winter water entered the canyon on the western side, but switched to the eastern wall of the canyon as it flowed northward. The Russian-American Long-term Census of the Arctic (RUSALCA) program represented a fruitful collaboration of Russian and US scientists, making use of shared resources and expertise. The results from the study enhanced our knowledge of a critical part of the Arctic system, enabling us to better predict the impacts of variable inflow through Bering Strait as a result of climate change.
- Andrew Solow's (Marine Policy Center) NOAA-funded work provides further evidence that at least part of the long-term increase in the observed number of North Atlantic tropical cyclones can be attributed to incompleteness in the early part of the record. In order to manage risks associated with long-term changes in hurricane activity and intensity, society needs to understand how such risks are changing and are likely to change in response to on-going climate change. A central problem in using the observational record of hurricanes to advance this understanding is bias due to under-sampling. The work conducted under this project is aimed at developing and applying methods that can account for such under-sampling.
- Breck Owens (Physical Oceanography) reports that the WHOI contribution to the Argo Float Program has significantly accelerated and improved the performance of the floats. Improvements in both the communications system and the calibration procedures have been implemented. A significant error in the data reported from these floats has been identified and the procedures to correct the data have been developed and implemented. The through-flow of data to the final quality controlled values has also significantly increased.
- Work on the Ocean Reference Stations (ORS) funded by the NOAA Climate Program led by Plueddemann and Weller shows that two Ocean Reference Stations (Stratus, WHOTS) are now collecting pCO_2 data in addition to surface meteorology. Stratus is also collecting surface-wave data. A third Ocean Reference Station (NTAS) serves as the development site for near real-time delivery of surface meteorology and upper-ocean properties via Iridium telemetry. The Upper Ocean Processes Group web site, which serves the ORS meteorological data, has been extensively revised and re-organized. Near real-time WHOI ORS data are also available through NDBC. Six years of surface heat fluxes from the Stratus ORS site were merged and evaluated, pointing to significant errors in the ECMWF ERA-40 and NCEP-2 reanalyses. The long-term goals of this work are to improve in-situ observations of marine boundary layer meteorology and air-sea fluxes in order to improve understanding and prediction of the earth's climate.

—[Robert Weller](#), Institute Director

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Mail: Woods Hole Oceanographic Institution, 266 Woods Hole Road, Woods Hole, MA 02543, USA.

E-Contact: info@whoi.edu; press relations: media@whoi.edu, tel. (508) 457-2000

Problems or questions about the site, please contact webdev@whoi.edu