MEETINGS

IPRC Annual Symposium

IPRC held its 10th Annual Symposium at the East-West Center on May 27. This year's symposium had a novel "all-poster" format, featuring four separate poster sessions extending from morning, through the afternoon, to the evening. Before each poster session, the presenters briefly talked about their poster, giving them a chance to advertise their work and giving the audience an idea of what they were about to see. In addition to the standard posters, the staff of the Asia-Pacific Data-Research Center (APDRC) used IPRC's Magic Planet spherical projection system and a large-screen video display to show off their data server and data products.

Yanping Li, Axel Lauer, Prasanth Appukuttan Pillai, and H. Annamalai during the IPRC Annual Symposium.

Assistant Researcher Kazuyoshi Kikuchi talks about his study with Postdoctoral Fellow Prasanna Venkatraman.

Participants at the 10th IPRC Annual Symposium.

Showing remarkable energy, IPRC scientists still engaged in vigorous scientific discussions at the conclusion of the symposium, at 7:30 pm. Participants agreed the experience was intense, but enjoyable.

All in all there were 42 posters. Organized and chaired this year by IPRC Director **Kevin Hamilton**, the program for the symposium is available at http://iprc.soest.hawaii.edu/meetings/workshops.php.

Tim Li studies poster of Assistant Researcher June-Yi Lee.

Clouds, Chemistry, and Climate

When two valued colleagues – **Hitoshi Irie**, research scientist at JAMSTEC's Research Institute for Global Change, and **Ralf Bennartz**, professor in the Department of Oceanic and Atmospheric Sciences at the University of Wisconsin – visited the IPRC in April, IPRC Director **Kevin Hamilton** took the opportunity to organize the mini-symposium "Clouds, Chemistry and Climate." The symposium featured talks by Irie and Bennartz as well as by IPRC's Assistant Researcher **Axel Lauer** and University of Hawai'i colleagues **Tony Clarke**, **John Porter**, **Cameron McNaughton** and **Vaughan Phillips**.

The presentations covered a wide range of topics on the measurements and modeling of aerosols, clouds and climate. They included results from flights of the VAMOS Ocean-Cloud-Atmosphere-Land Study to measure the aerosol entrained from the free troposphere into the marine boundary layer and to study the role of this aerosol as cloud condensation nuclei; results from aerosol measurements taken in the Western Arctic during ARCTAS/ARCPAC in 2008; a proposal for multi-platform measurements in the Hawai'i Region to determine direct and indirect aerosol effects; an overview on the cloud microphysical modeling capabilities at the University of Hawai'i with a case study of the impact of biological aerosols on deep convection; and an overview of current satellite products to evaluate climate model simulations. Discussions on further IPRC–JAMSTEC collaborative research on clouds, aerosols, and atmospheric trace gases rounded out the symposium. The agenda is at http://iprc.soest.hawaii.edu/meetings/workshops/10_04_Clouds,_Chemistry_Climate.html

Participants at the mini-symposium "Clouds, Chemistry, and Climate." Seated around the table from left Tony Clarke, Cameron McNaughton, Axel Lauer, Kevin Hamilton, Barry Huebert, Ralf Bennartz, John Porter, and Hitoshi Irie.

Aquarius Satellite Mission to Boost Climate Research

The Aquarius partnership between NASA and Argentina's Comisión Nacional de Actividades Espaciales is a new satellite mission dedicated to providing weekly global measurements of salinity distribution at the ocean surface. Sea surface salinity (SSS) variations drive the deep ocean conveyor belt, and impact air–sea interactions and the global water cycle, which all affect the ocean's capacity to store and transport heat and regulate Earth's climate. The information from the Aquarius mission will help scientists determine the combined effects of evaporation, precipitation, ice melt, river runoff, advection by currents, and vertical mixing on SSS at seasonal and interannual time scales, and the impact on the global distribution and availability of freshwater.

IPRC scientists are looking forward to this mission as they hope it will provide them with much needed global SSS observations at high temporal resoultion. **Nikolai Maximenko**, **Peter Hacker**, **Jim Potemra**, **Tangdong Qu**, and **Oleg Melnichenko** are members of the NASA Ocean Salinity Science Team. Thus when Principal Investigator of Aquarius, **Gary Lagerloef**, visited the IPRC in August, Maximenko organized the mini-symposium "Ocean Salinity and the Global Water Cycle" during which the scientists talked with Lagerloef about how the Aquarius mission will expand our knowledge of SSS and how the new data might help particular research projects.

Axel Timmermann, for example, showed the impact of salinity on paleo-ocean circulation and climate. When the Laurentide Ice Sheet melted about 17,000 years ago and sent massive quanities of freshwater into the North Atlantic, it shut down the thermohaline circulation. As the western North Pacific grew saltier, it began to take over partly the driving of the thermohaline circulation.

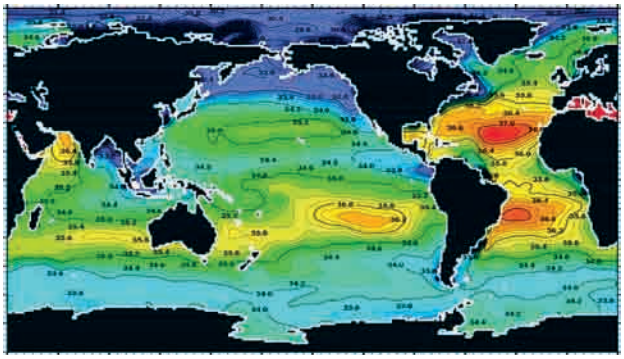
Around the table from left, Guihua Wang, Bo Qiu, Kevin Hamilton, Nikolai Maximenko, Gary Lagerloef, Tangdong Qu, and Axel Timmermann.

Tangdong Qu, who is working on the Salinity Processes in the Upper Ocean Regional Study (SPURS), showed that in the ECCO model the highest ocean salinity is seen in the mid-Atlantic around 24°N, yet the difference between evaporation and precipitation is greatest to the south. Thus SPURS is looking at what maintains the salinity maximum. Where does the excess salt go? In the ECCO model, it appears that a major portion of the salty water is subducted into the thermocline and from there poleward rather than, as has been thought, toward the equator. The Aquarius data will help settle this issue.

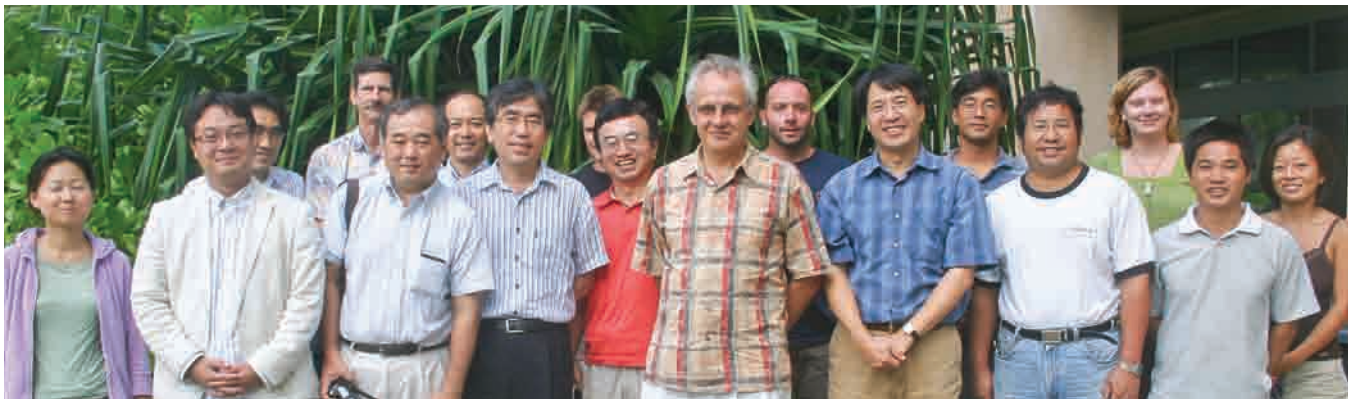
Aquarius may also provide data to validate the Wave and Anemometer-based Sea-surface Wind (WASWind) dataset that **Hiroki Tokinaga** has constructed from ship-based observations of wind speed and wind-wave height (see p. 13 this issue). The new data set, which spans 1950 to 2008, suggests that the increasing precipitation trend over the maritime continent in the ERA-40 product is spurious.

Finally, **Oliver Timm**, who is studying rainfall trends in the Hawaiian Islands, thought Aquarius could benefit rainfall prediction in Hawai'i. Obtaining measurements of surface salinity in the ocean surrounding the Hawaiian Islands could help constrain the variability and trends seen in the rain-gauge-based island rainfall measurements.

For the full workshop program, please visit the IPRC website http://iprc.soest.hawaii.edu/meetings/workshops/2010/2010_Ocean_Salinity.html



Annual mean sea-surface salinity (SSS): red = high salinity, blue = low salinity.



Participants at the "Multi-scale Circulation Variability in the Tropical Western Pacific Ocean" meeting. Workshop organizers Kelvin Richards and Bo Qiu center front.

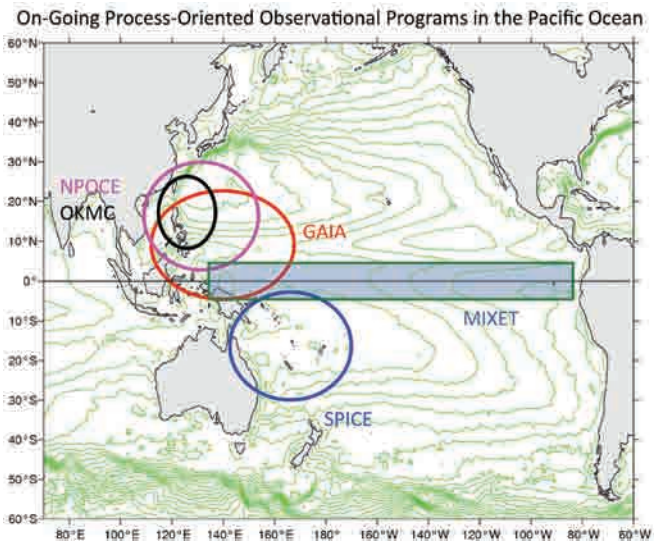
The Western Tropical Pacific under Scrutiny

By Bo Qiu

The tropical western Pacific Ocean has a complicated circulation system with intensive, multi-scale air–sea interactions. It is a crossroad and major pathway where different water masses from mid- and high-latitudes converge, and where waters of Southern and Northern Hemisphere origin interweave. It is also the region where such major oceanic currents as the Kuroshio, the North Equatorial Countercurrent (NECC) and the Indonesian Throughflow (ITF) originate. Oceanic disturbances generated in the region's interior ocean accumulate and amplify in its western basin. These accumulated and amplified oceanic variations can significantly impact conditions in the marginal seas and elsewhere in the ocean.

The IPRC and the UH Oceanography Department hosted in August 2010 the workshop "Multi-scale Circulation Variability in the Tropical Western Pacific Ocean." Scientists from the Japan Agency for Marine-Earth Science and Technology (JAMSTEC), Korea Ocean Research and Development Institute (KORDI), the IPRC, and the Oceanography Department reviewed existing, and presented new observational and modeling results on the tropical western Pacific circulation and variability. They discussed the need for scientific and logistical coordination of future observational and modeling activities, and they further explored the designs of experiments and the timing and plans for research cruises. **Kelvin Richards** (IPRC) and **Bo Qiu** (Department of Oceanography, University of Hawai'i Mānoa) organized the workshop. The agenda is at: http://iprc.soest.hawaii.edu/meetings/workshops/10_8_multiscale_circulation.pdf.

It was a timely workshop because several multi-national and multi-institutional observational programs that focus on the tropical western Pacific Ocean circulation and climate are underway or starting up. These programs include the Northwest Pacific Ocean Circulation and Climate Experiment (NPOCE) led by China, the Southwest Pacific Ocean Circulation and Climate Experiment (SPICE) led by France, the Tropical Western Pacific Climate Experiment (GAIA) led by Korea, the Tropical Ocean Climate Study (TOCS) led by Japan, and the two US initiatives: Origin of Kuroshio and Mindanao Currents (OKMC) and Mixing in the Equatorial Thermocline (MIXET) (see figure below). A number of scientists from IPRC and UH Department of Oceanography are investigators in the US programs and are contributors and collaborators to the international programs.



Improving Ocean Models: Update on the NASA Ocean-Mixing Project

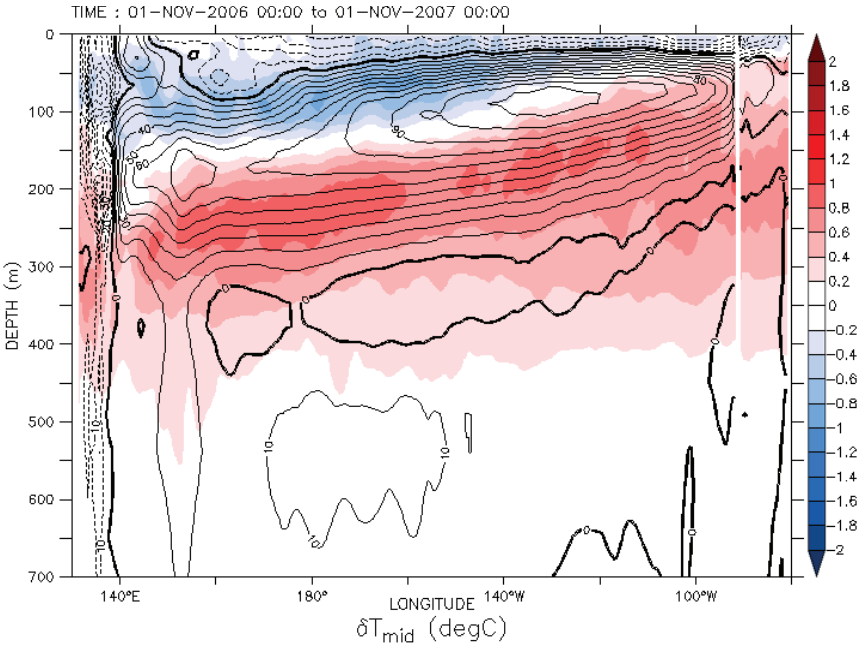
By Ryo Furue

The IPRC has been the meeting place for the NASA-funded project aimed at improving climate models by understanding better the role of ocean mixing and by determining the best estimates of mixing parameters in the large-scale circulation of the tropical Pacific (see *IPRC Climate*, vol. 10, no. 1). Investigators on the project, **Detlef Stammer** and **Chuanyu Liu** (U. Hamburg); **Bruce Cornuelle** and **Nidia Martinez** (Scripps Insitution of Oceanography, SIO); **Jay McCreary**, **Niklas Schneider**, **Yanli Jia**, and **Ryo Furue** (IPRC); and **Peter Müller**, **Roger Lukas**, and **Eric Firing** (UH) met again in October 2010 to discuss their progress and to plan future research steps.

Since the initial planning meeting in March 2010, the Hamburg group has been optimizing its coarse-resolution, global model by adjusting forcing and mixing parameters; the SIO group has configured an eddy-permitting model of the tropical Pacific and has been looking at adjoint sensitivity of selected oceanic variables to various forcing and mixing parameters; and the UH group has been using the SIO model to carry out preliminary, forward sensitivity runs.

Liu presented results from the Hamburg group. On a global scale, the Gent-McWilliams thickness diffusion is found to be the most effective in improving the model field. In the tropical Pacific, however, it is vertical diffusivity that is the most important. Martinez explored the "adjoint sensitivity" of the mean mixed-layer to such parameters as sea-surface height (SSH), wind stress, and vertical diffusivity in the Niño-3 region. These sensitivity fields indicate how changes in the parameters propagate to affect the target variable (in this case, the Niño-3 temperature). Furue described results on the response of the SIO eddy-permitting model to changes in background vertical diffusivity. The off-equatorial vertical diffusivity is found to be most effective in changing the upper-ocean stratification on the equator.

Based on these findings, the group decided the following: the SIO group will use the Hamburg group's distribution of the vertical mixing coefficient in their eddy-permitting model to see if the ocean state improves; the Hamburg group will investigate how and why their vertical mixing field brought about improvements in their model; the UH group will select target variables suitable for exploring their sensitivity to vertical diffusivity; and the SIO group will compute the adjoint sensitivity of those variables to vertical diffusivity, which the UH group, in turn, will use to conduct their forward sensitivity runs.



This plot from the Ocean-Mixing Project shows the sensitivity of the equatorial temperature field in the eddy-permitting, tropical Pacific model. Color: annual-mean temperature difference (°C) between a reference run and one in which background vertical diffusivity is increased poleward of 5° latitude. Contours: zonal velocity (cm/s) along the equator of the reference run (in 10 cm/s intervals). Fields are averages over the final year of four-year integrations. Increased off-equatorial vertical diffusivity lowers (raises) temperature on the equator above (below) the core of the Equatorial Undercurrent (the subsurface core of eastward velocity indicated by the contours). Off-equatorial vertical diffusion is found to impact the equatorial temperature field more than local vertical diffusion.

3rd OFES International Workshop in Japan

By Tangdong Qu

Since the Earth Simulator began operation in Japan in 2002, a series of quasi-global, eddy-resolving ocean simulations using the Ocean General Circulation Model for the Earth Simulator (OFES) have been conducted. Scientists around the world are now analyzing the outputs from these OFES integrations. The research ranges from studies of the behavior of individual meso-scale eddies to global energy analysis of the ocean.

In order to exchange information, generate new research ideas, and encourage further cross-cutting research-partnerships, the 3rd OFES International Workshop was held on 4–5 November 2010 in Yokohama, Japan. Over 50 scientists from seven countries participated. Climate Variation Predictability and Applicability Research Program Director **Yukio Masumoto** opened the workshop and JAMSTEC Executive Director **Shiro Imawaki** gave a welcoming speech. Two keynote presentations provided an overview of the recent progress in numerical modeling. **David Webb**, National Oceanography Centre, Southampton, presented an overview of developments in computational resources, modeling, and analysis techniques over the past two decades. He recounted how high-resolution modeling had revealed the importance of processes previously not realized. He suggested future climate modeling may parallel the developments in ocean modeling. In his keynote address **Lie–Yauw Oey**, Princeton University, presented a historical account of nested-grid ocean modeling and reviewed recent research on uncovering processes in the western North Atlantic and Pacific.

Four sessions followed during which 26 scientists presented their recent analyses of OFES or other model outputs and observations on the following topics: processes of the mid-latitude ocean, the tropical ocean, and the coupled ocean-atmosphere; and ocean dynamics. With IPRC as a co-organizer, IPRC scientists were well represented: **H. Annamalai**, **François Ascani**, **Ali Bel Madani**, **Miho Ishizu**, **Jim Potemra**, **Tangdong Qu**, **Kelvin Richards**, **Yoshinori Sasaki**, and **Niklas Schneider**, most of whom gave presentations.

Hideharu Sasaki chaired the final closing discussion. Scientists from the different institutions and different countries agreed to continue collaboration in model development and interpretation and suggested that the 4th OFES International Workshop be hosted by the IPRC next year in Honolulu.

The workshop was organized and sponsored by JAMSTEC's Earth Simulator Center, Research Institute for Global Change, and Application Laboratory on Climate Variation Studies, and the IPRC. The workshop schedule together with PDFs of the talks are available at http://www.jamstec.go.jp/esc/event/ofes-workshop3/schedule.html/.

Participants at the "3rd International OFES Workshop" at the JAMSTEC Yokohama Institute for Earth Sciences. Image courtesy JAMSTEC.