

MEETINGS



Participants at the workshop on computationally intensive modeling gather around IPRC's Magic Planet. Photo credit: Jian Ma.

Computationally Intensive Modeling of the Climate System

The advent of the JAMSTEC Earth Simulator in 2002 represented a major leap in computational power available for environmental research, and it inspired important developments in climate modeling and related areas. At JAMSTEC itself, an array of models has been developed for climate simulation. Notable among these models are the Ocean General Circulation Model for the Earth Simulator (OFES), the Atmospheric General Circulation Model for the Earth Simulator (AFES), the Coupled General Circulation Model for the Earth Simulator (CFES), the Multi-Scale Simulator for the Geoenvironment (MSSG), and the Nonhydrostatic ICosahedral Atmospheric Model (NICAM) for cloud system resolving global simulations. Published results obtained with these models have helped inspire interest in the area of high-resolution atmosphere and ocean simulation. In the US and elsewhere, the success of the Earth Simulator has

helped to motivate development of major supercomputers intended, at least in part, for climate research applications.

From the early days of the Earth Simulator Center (ESC), IPRC scientists have been privileged to collaborate with their JAMSTEC colleagues on computationally intensive research using the results from the Earth Simulator. Perhaps the most significant contributions from IPRC have been in the analysis of very high-resolution global ocean and atmosphere model simulations conducted at JAMSTEC.

The close cooperation in this area was recognized when IPRC was invited by JAMSTEC to co-sponsor the August 2008 “OFES International Workshop” in Yokohama (see *IPRC Climate*, vol. 8, no. 2). After the very successful OFES workshop, and with the strong support of ESC Director-General **Kunihiko Watanabe**, plans were made to hold a 2009 sequel in Honolulu. Given the breadth of the phenomena being modeled by both JAMSTEC and IPRC scientists, the scope of this second meeting was expanded. Convened by ESC's **Wataru Ohfuchi** and IPRC's **Kevin Hamilton**, the “Second OFES Interna-

tional Workshop and ESC–IPRC Joint Workshop on Computationally-Intensive Modeling of the Climate System” was held December 9–10, 2009, at the East-West Center.

The meeting attracted over 70 participants from the University of Hawai'i and elsewhere, including 15 JAMSTEC researchers, and colleagues from the University of Tokyo, Kobe University, the University of Alaska, and the Institut Français de Recherche pour l'Exploitation de la Mer (IFREMER). Presentations discussed results from a wide range of simulation and data assimilation models applied to understand various phenomena in the ocean and atmosphere. Abstracts of the presentations are at <http://www.jamstec.go.jp/esc/event/ofes-workshop2/>.

In connection with the workshop **Jan TenBruggencate** of the *Honolulu Advertiser* interviewed Hamilton about the IPRC collaboration with the ESC. This interview appeared in the *Advertiser's* science and environment blog *Raising Islands* on December 15, 2009 (<http://raisingislands.blogspot.com/2009/12/uh-climate-collaboration-uses-raw.html>).



Participants at the “Face-to-Face” meeting of the JAMSTEC-IPRC Initiative in Yokohama. Photo credit: Shiro Matsugaura, JAMSTEC

IPRC – JAMSTEC Science Partnership Meeting

The IPRC theme leaders of the JAMSTEC-IPRC Initiative (JII) travelled to Yokohama for a “Face-to-Face” meeting with their JAMSTEC JII partners and other researchers on November 2, 2009. This second JII Face-to-Face meeting, which was held almost exactly 3 years after the 2006 meeting

that established the partnership, provided an excellent opportunity to review progress and to plan future research directions. The opening plenary session consisted of presentations of research highlights by IPRC theme leaders and a subsequent general discussion. Several parallel breakout sessions on the individual research themes followed. At the closing plenary session, the scientists summarized the outcomes of the indi-

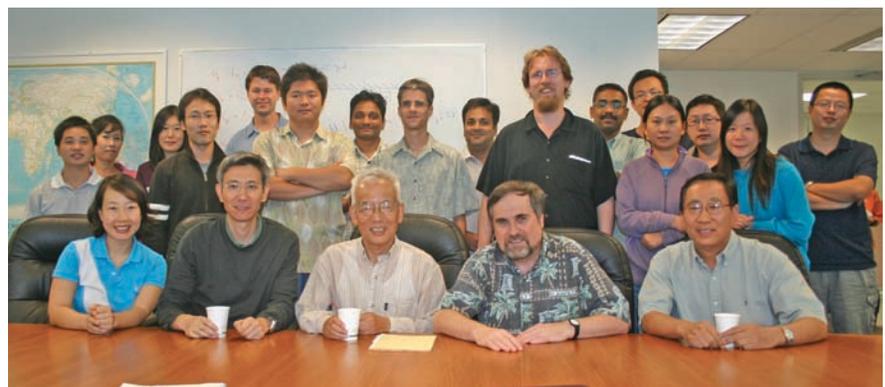
vidual sessions. The meeting attracted almost 50 JAMSTEC scientists. It is gratifying to find that many younger JAMSTEC researchers are interested in participating in JII activities. After the meeting, the theme leaders began work on revising the original JII document to reflect the new directions explored during the meeting.

Miniworkshop on Climate Change: Modeling and Analysis

Syukuro (“Suki”) Manabe, currently senior meteorologist in the Atmospheric and Oceanic Sciences Program at Princeton University, visited IPRC on February 26. Manabe, whom many regard as the “Father of Global Climate Modeling,” was on his way back to Princeton from a trip to Japan, where he had been honored by being among the first three people to

be inducted into the new Kyoto Earth Hall of Fame. IPRC scientists took the opportunity of Manabe’s visit to discuss the latest research in atmospheric modeling with him and held a meeting,

“Climate Change: Modeling and Analysis.” Organized by IPRC faculty member **Shang-Ping Xie**, the miniworkshop featured presentations from IPRC faculty, researchers, and students.



Suki Manabe (center front) with participants at the Climate Change Miniworkshop.

Improving Ocean Models: The NASA Project on Ocean Mixing

For over a decade now, oceanographers have been trying to develop models that realistically capture such essential large-scale ocean features as surface and subsurface currents and temperature patterns. They have had success, but they have struck a wall—ocean mixing. “Although ocean mixing significantly impacts the large-scale ocean circulation and surface fluxes, it is among the least well understood phenomena in climate modeling. The processes directly responsible for mixing occur at such small spatial and temporal scales that they must be parameterized by representing small-scale effects on large scales *in terms of large-scale variables*,” wrote **Ryo Furue** after an IPRC mini-workshop on ocean mixing in March 2009 (*IPRC Climate*, vol. 9, no. 1). From that meeting emerged a proposal for a project to investigate ocean mixing processes more closely.

Recognizing the importance of ocean mixing, NASA funded the project, which may serve as a model for future ocean-mixing studies. During a second meeting at the IPRC, in March 2010, a research plan was developed and a list of products to emerge from the project was drawn up. IPRC members of the team are **Jay McCreary**, **Kelvin Richards**, **Niklas Schneider**, and **Ryo Furue**. Joining them are **Bruce Cornuelle** and **Nidia Martinez** from Scripps Institution of Oceanography, **Detlef Stammer** and **Armin Köhl** from the University of Hamburg, **Peter Müller** and **Eric Firing** from the University of Hawai‘i, and **Ren-Chieh Lien** from the University of Washington.

The plan is to use two versions of the ocean MITgcm to test the sensitivity of the ocean state to various mixing parameters. The first version is a global ocean model version adapted by the Hamburg scientists, who will continue to work on their model version to gain further insight into how data assimilation works in estimating mixing parameters. The second version is the high-resolution version adapted at Scripps to a limited Pacific Ocean domain. The Scripps group will continue to develop their eddy-permitting assimilation model.

The scientists at the University of Hawai‘i will first test the initial results on flow fields from the Scripps model and improve them in discussion with the whole team as needed. The UH group will then explore the sensitivity of the tropical Pacific Ocean state in some 10 to 20 experiments. Sensitivity parameters to be explored include vertical diffusivity, fresh water flux, wind stress, and viscosity impact on SST, surface and subsurface currents, and mixed layer heat budget. The parameter changes are to be introduced singly and at a single region so that the physics causing the change can be pinpointed and the “best parameterization” for a particular region can be estimated. The idea behind this approach is that some of the small-scale changes in ocean mixing introduced in the experiments will bring large-scale features in the model closer to observations.

To Bruce Cornuelle falls the final major task of using the many results from the separate experiments to develop an assimilation procedure that yields a model producing flow fields and other large-scale ocean features that best fit observations.



Wrestling with ocean-mixing processes, around the table from the left: Ryo Furue, Jay McCreary, Niklas Schneider, Bruce Cornuelle, Peter Müller, Yoshinori Sasaki, Armin Köhl, Detlef Stammer, and Eric Firing.



Members of the JAMSTEC “DrC” and of IPRC’s Asia-Pacific Data-Research Center gather in IPRC’s conference room to discuss how to best serve climate data.

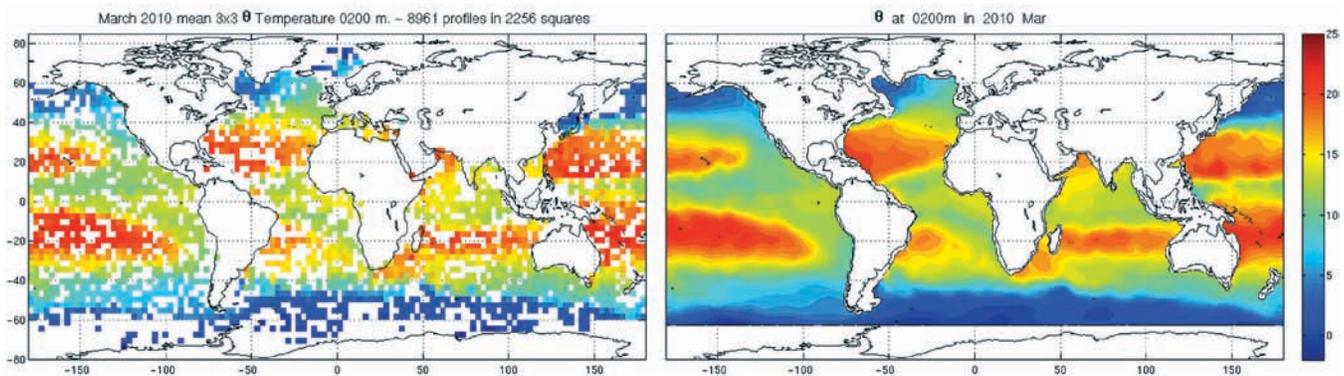
JAMSTEC Data Research Center Staff Meets with IPRC

A team from JAMSTEC’s new Data Research Center for Marine-Earth Sciences (“DrC”), headed by Director-General **Toshiyuki Awaji**, met on March 10 with IPRC colleagues to share and discuss their work on analyzing and serving the huge and diverse climate data available to scientists.

JAMSTEC scientists talked about their important work on data assimilation in the coupled atmosphere-ocean system, as well as about application of data and models to such issues as temperature trends in the abyssal ocean and inter-annual rainfall variability in East Africa.

IPRC scientists presented results on Hawai’i regional ocean modeling and Argo data analysis, and they gave a description of the new Surface Current from Diagnostic model (SCUD) data set recently released to the public. The meeting concluded with a detailed discussion of technical issues related to data management and data serving at JAMSTEC and at IPRC. Visiting with Awaji from JAMSTEC were **Yasunori Hanafusa**, **Nozomi Sugiura**, **Shuhei Masuda**, **Hideaki Hase**, **Hiromichi Igarashi**, **Yoshihisa Hiyoshi**, and **Takahiro Toyoda**.

Held in the IPRC Conference Room, the meeting was organized and chaired by IPRC’s **Jim Potemra**, acting manager of the Asia-Pacific Data-Research Center (APDRC).



An example of Argo plots that can be created at the APDRC project website (<http://apdrc.soest.hawaii.edu/>). This sample shows potential temperature at a depth of 200 m for March 2010: (left) as observed by Argo floats averaged over 3-degree bins and (right) the interpolated IPRC product (unit is °C).