

MEETINGS

“ENSO Dynamics and Predictability”

Summer School

The interdisciplinary summer school “ENSO Dynamics and Predictability” took place in the lush jungle of Puna on the Big Island of Hawai‘i, June 14–24, 2008. IPRC’s **Axel Timmermann**, who is CLIVAR (Climate Variability and Predictability) Pacific Panel co-chair, organized the school, bringing together budding young scientists from diverse scientific fields to study the El Niño–Southern Oscillation (ENSO) climate phenomenon. Sixteen graduate students in oceanography, meteorology, and geology from 12 countries gathered to learn about a broad swath of ENSO-related topics from experts in the field: ENSO theory (**Fei-Fei Jin**, University of Hawai‘i, USA), ENSO phenomenology (**Michael McPhaden**, PMEL, NOAA, USA), ENSO predictability (**Magdalena Balmaseda**, ECMWF, UK), **Richard Kleeman** (Courant Institute, USA) and ENSO’s sensitivity to past and future climate change (**Scott Power**, CSIRO, Australia, and Axel Timmermann). Energized by fresh goat milk kefir, exotic local fruit smoothies, and island-style cuisine, the students listened daily to the three- to four-hour-long lecture marathon and then worked on research projects. In teams, they examined the effects of ENSO on the Antarctic Peninsula, the rapid end of the 2008 La Niña event, the dynamics of warm pool El Niño events, the effects of Atlantic multidecadal SST variability on ENSO, the role of equatorial waves in the ENSO recharge mechanism, the geographical reaches of a tropical

mega drought about 4,200 years ago, and more. The students applied in their research projects the concepts taught during the lectures, such as the recharge oscillator paradigm, ENSO frequency entrainment, equatorial waves, basin modes, teleconnection patterns, and multiplicative noise.

Understanding ENSO-past requires understanding the coupled instability mechanisms of ENSO and the annual cycle in the eastern equatorial Pacific. Many simulations with coupled general circulation computer models have demonstrated that for certain ENSO regimes a less pronounced annual cycle corresponds to stronger ENSO variability. This means that the underlying mechanism of frequency entrainment has not been fully understood. To reconstruct the ENSO-past, the computer model-derived outcomes need to be compared with such paleo-proxy data as corals, lake and ocean sediments, speleothems, and tree rings.

The benefit of the interdisciplinary nature of the summer school is shown in the student-team project of **Intan Nurhati** (Georgia Tech, USA) and **Gabriel Bayona** (EAFIT, Medellín, Colombia). As geology students, they were fascinated by the geographical extent of the 30–50-year-long megadrought that occurred about 4,200 years ago and affected the civilizations of Egypt and Mesopotamia. By compiling and synthesizing such paleo-data as speleothems, lake sediments, and ice cores, they drew a map that shows the tropic-wide extent of the drought (Figure 1). To determine what may have

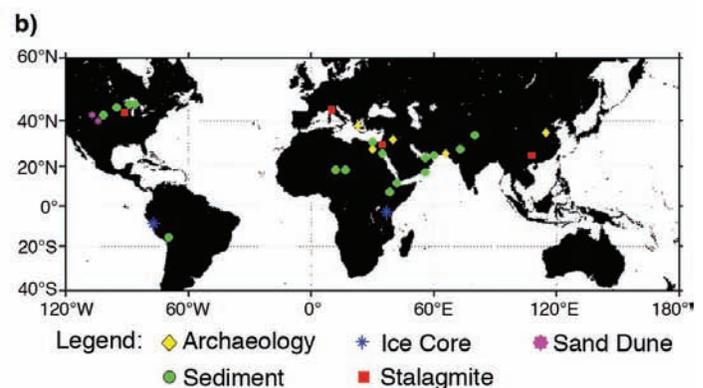
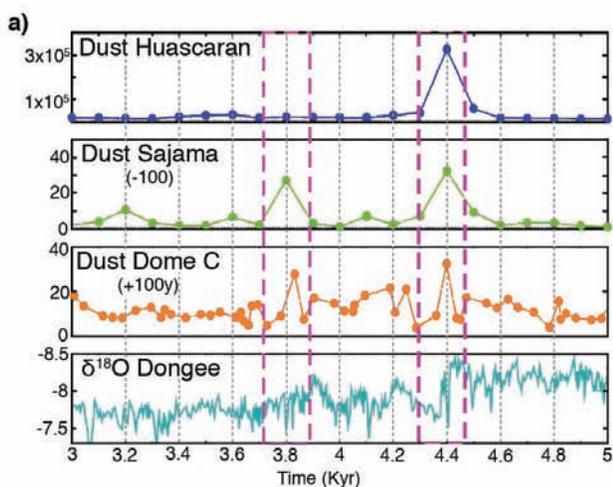


Figure 1: (a) Time series of dust fluxes at Huascarán (Peru), Sajama (Bolivia), EPICA, Dome C (Antarctica) and $\delta^{18}\text{O}$ from Dongee Cave (China) indicating major drought periods around the tropics (purple boxes). (b) Extent of the 4.2-kyr-drought event, as derived from different paleo-archives.

caused this drought, they analyzed cosmogenic isotope variations and temperature variability. Results are still inconclusive.

The summer school projects illustrate the value of joint events between CLIVAR and Past Global Changes (PAGES), which was launched in 1991 to support research on Earth's past environment in order to predict future climate. Climate modelers need paleorecords to validate their models, and paleo-climate scientists profit from the dynamical insights provided by climate modeling experiments. The summer school was generously supported by PAGES, CLIVAR, the World Climate



Research Programme (WCRP), the National Oceanic and Atmospheric Administration (NOAA), the Australian Research Council Research Network for Earth System Science (ARCNESS), and the International Pacific Research Center.

Students and faculty of the ENSO Summer School at the Mauna Loa Observatory. Axel Timmermann, summer school organizer, is second from the left.

Research for Agricultural Risk Management

In August the IPRC hosted a meeting of scientists from various departments of the University of Hawai'i at Manoa and from the East-West Center to consider research efforts to support the development of practical tools for risk management of agriculture in Hawai'i. IPRC scientists are expected to play an important role in this effort since agricultural risk is driven largely by variability of weather on various timescales.



Participants of the Agricultural Risk Management Meeting: from left, Nancy Lewis (East-West Center), Tom Giambelluca (UH Geography Department), Xiouhua Fu (IPRC), Melissa Finucane (East-West Center), Xuyang Ge (IPRC), Goro Uehara (UH College of Tropical Agriculture), Richard Ogoshi (UH College of Tropical Agriculture), Pao-Shin Chu (UH Meteorology Department), Kevin Hamilton (IPRC).





Participants of the OFES International Workshop at the JAMSTEC Yokohama Institute for Earth Science.

First OFES International Workshop

Since the arrival of Japan's powerful computer Earth Simulator in 2002, scientists at the Earth Simulator Center have been conducting simulations of the ocean circulation using the Ocean General Circulation Model for the Earth Simulator (OFES), a nearly global, eddy-resolving ocean model. Output from the OFES hindcast of the ocean state during 1950–2006 and from subsequent simulations with chlorofluorocarbon tracers and biological processes are being studied by scientists worldwide. In order to exchange experiences and results from analyses of the model runs, to stimulate new ideas for research, and to encourage collaborations for future work, the first OFES International Workshop was held in the Miyoshi Memorial Auditorium of the JAMSTEC Yokohama Institute for Earth Science, Yokohama Japan, on August 25–26, 2008.

Much of the analysis of OFES data has been performed in collaborative projects between the Earth Simulator Center and the IPRC. This collaboration extends to data management issues, as IPRC's Asia-Pacific Data-Research Center (APDRC) serves OFES data to the worldwide research commu-

nity. The central role of the JAMSTEC-IPRC partnership for OFES analysis was reflected in the participation of eight IPRC scientists: **Hidenori Aiki, Nikolai Maximenko, Oleg Melnichenko, Mototaka Nakamura, Kelvin Richards, Niklas Schneider, Shang-Ping Xie, Sachiko Yoshida**, as well as three IPRC "alumni" now employed at JAMSTEC or elsewhere: **Masami Nonaka, Bunmei Taguchi, and Yan Du**. The IPRC was an official organizer of this OFES workshop along with the Earth Simulator Center, the Frontier Research Center for Global Change, and the JAMSTEC Application Laboratory on Climate Variations Studies.

The keynote presentation was given by **Kirk Bryan** of Princeton University, who together with **Mike Cox**, was the architect of perhaps the most influential ocean general circulation model, the Bryan and Cox model, which is at the core of a number of present-day ocean GCMs including OFES. Professor Bryan noted that, although the computer technology 30–40 years ago was inadequate to allow ocean models to capture much of the important physics, the pioneering efforts of those times provided the foundation for our

ability to run ocean models that now have a striking degree of realism. The challenge for the future will be to explore the rich physics revealed at these high resolutions.

The papers presented at the meeting covered an impressive array of topics: from decadal variability to small scale physics, from regional dynamics to the dynamics of the marine ecosystem. The vast majority of the results were based on analyses of the output from runs of OFES. The talks were grouped into sessions on the mid- to high-latitude ocean, the marine ecosystem, ocean dynamics, and the tropical ocean. Rather than highlight individual talks, we direct the reader to the workshop web page for a full list of talks together with abstracts (www.jamstec.go.jp/esc/event/ofes-workshop/).

The future is bright. Reports at the workshop were given on two new developments. The first is an even higher resolution version of OFES. At 1/30 degree, the Pacific basin version will have enough resolution to capture sub-mesoscale physics, a topic of much recent interest. The second is the use of OFES in a high-resolution coupled model (CFES). These tools will help the research community meet Professor Bryan's challenge.

The workshop was convened by **Yukio Masumoto**, group leader in the Climate Variations Research Program of JAMSTEC's Frontier Research Center for Global Change, and **Hideharu Sasaki**, scientist at the JAMSTEC Earth Simulator Center.

IPRC Participates in PaCIS

IPRC's **Kevin Hamilton** and **Jim Potemra** participated in a meeting of the Working Groups of NOAA's Pacific Climate Information System (PaCIS), which was held at the East-West Center from August 5 to 7, 2008. PaCIS is a new initiative to provide a framework for the development of an integrated program of climate observations, research, forecasting, operational services, assessment, data management, and education to meet the needs of the people of the Pacific Islands. The meeting attracted almost 60 participants from governmental, academic, and other groups across the Pacific. IPRC will be an important partner with PaCIS, particularly in the research



Attending PaCIS: (from left) **Howard Diamond** (NOAA/NESDIS), **Jim Potemra**, **Jim Weyman** (PaCIS Executive Director), **Eileen Shea** (PaCIS Steering Committee Chair), and **Kevin Hamilton**.

and data management aspects of its activities. For more information about PaCIS, please visit www.ideademo.org/pacis/.

Pacific Climate Data Meetings

At the end of October and beginning November, three meetings took place at the University of Hawai'i that related to the work of IPRC's Asia-Pacific Data-Research Center (APDRC). The first meeting, the Global Temperature and Salinity Profile Project (GTSP) took place at the East-West Center on October 27 and was organized by **Charles Sun**, director of GTSP. An international effort of the NOAA National Oceanographic Data Center, GTSP is constructing a high-quality temperature and salinity profile database for all oceans. Different institutes are working to quality-control historical data from the different ocean basins. These data will be included in the GTSP data set. The APDRC has participated in the quality control of both the Pacific and Indian Ocean historical data sets.



PI-GOOS steering team, from left, **Phil Parker** (Bureau of Meteorology, Australia), **Keisuke Mizuno** (JAMSTEC), **Dean Roemmich** (Scripps), **Jim Potemra** (IPRC), **Steve Piotrowicz** (NOAA Program Manager for US Argo), **Alan Butler** (CSIRO Australia and PI-GOOS ST Chair), **Howard Diamond** (NOAA Program Manager for PI-GCOS, PI-GOOS, and IPRC), **Paul Eastwood** (SOPAC, PI-GOOS coordinator).

the Argo data. IPRC researchers **Nikolai Maximenko**, **Konstantin Lebedev**, **Peter Hacker**, and **Jim Potemra** described the APDRC data servers and APDRC Argo products.

The steering team meeting of the Pacific Islands Global Ocean Observing System (PI-GOOS), a regional alliance of GOOS among the Pacific Islands, was held at the IPRC on November 1. The APDRC has provided data server systems to SOPAC as part of the PI-GOOS activity. With the emerging US contribution to the Pacific Islands Ocean Observing System (PacIOOS), more collaboration will take place between the SOPAC-led PI-GOOS and the University of Hawai'i-led PacIOOS.

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