

# MEETINGS

## Informal Workshop on Climate Feedbacks

IPRC scientists took the opportunity of the visit of Professor **Teruyuki Nakajima**, Director of the University of Tokyo Center for Climate System Research, to hold an informal workshop that dealt with research efforts in climate modeling on the accurate determination of climate system feedbacks to large-scale radiative forcings.

In his opening remarks, IPRC's **Kevin Hamilton** noted that the most important question related to anthropogenic impact on climate remains unanswered: scientists still do not know how much global surface temperature will rise in response to a given perturbation (such as doubling atmospheric carbon dioxide concentration). Current state-of-the-art climate models differ by more than a factor of two in

their global-mean response to specified perturbations.

Hamilton then reviewed his research with **Markus Stowasser** (IPRC) and **George Boer** (Canadian Centre for Climate Modelling and Analysis, CCCMA) using the concepts of local and global climate feedbacks to diagnose the responses of the NCAR Community Climate Model and the CCCMA model to climate perturbations in order to understand the very different global climate sensitivities of these two models. Hamilton also talked of the role of feedbacks in determining the response of the models to transient forcing perturbations, similar to those occurring in the real world after large volcanic eruptions.

**Axel Timmermann** discussed the



Teruyuki Nakajima during his Aug. 9, 2006, IPRC seminar, "A study of the effects of air pollution on the earth's climate using climate modeling and satellite remote sensing."

climate feedbacks during the last glacial termination in Antarctica (see p. 3 for details) and reviewed his research on what may happen to eastern Pacific climate and El Niño when the Atlantic Meridional Overturning Circulation (AMOC) collapses as a result of fresh water infusion into the North Atlantic. The collapse appears to have two quite different consequences: In the ocean, an oceanic wave is generated that moves southward along the Atlantic coast, across the equator, southward along the South African coast and into the Indian, and then the Pacific Ocean. This deepens the Pacific Ocean thermocline and essentially collapses El Niño variability (*IPRC Climate*, Vol. 5, No. 2). In the atmosphere, the cooler SST in the Caribbean generates stronger trade winds, setting up a wind-evaporation-cooling feedback loop in the eastern Pacific. This raises the thermocline and increases El Niño variability, overriding effects of the oceanic wave.

## Sixth IPRC Annual Symposium

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The Sixth Annual IPRC Symposium was held May 8 and 9, 2006, at the East-West Center in Honolulu. At this yearly event, IPRC scientists present the highlights of their research over the year. **Yuqing Wang**, associate professor of meteorology and IPRC scientist, organized and chaired the symposium.

This annual sharing is a time to pause and reflect upon the progress

that has been made in understanding climate phenomena, particularly those affecting the Asia-Pacific region. It is an occasion to solicit comments and suggestions from peers and to detect common research threads. The agenda is found at [iprc.soest.hawaii.edu/meetings/workshops/06-05\\_6th\\_iprc\\_annual\\_symposium.htm](http://iprc.soest.hawaii.edu/meetings/workshops/06-05_6th_iprc_annual_symposium.htm).

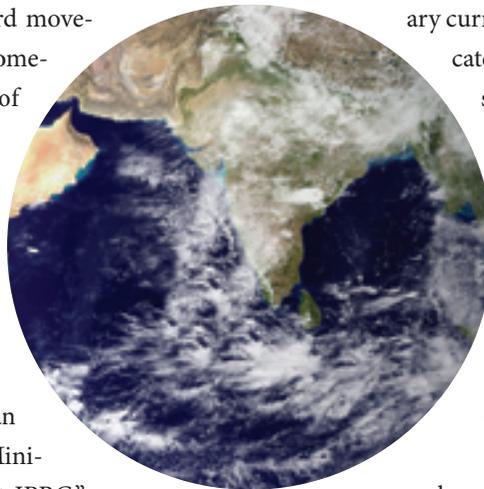
## Focus: The Tropical Indian Ocean

“The North Indian Ocean is a very special ocean. It is not connected to the poles, it is tropical, and it has very strong seasonal forcing, with a total reversal of winds and dramatic ocean current reversal. The time-dependence of flows from a week to months makes their monitoring a challenge.” With these words IPRC distinguished guest **Satish Shetye**, director of the National Institute of Oceanography in Goa, India, and expert on the physical oceanography of the Indian Ocean, introduced this past September his talk, *Local and Remote Wind-forcing of the West India Coastal Current*.

Shetye spoke about short-term variations seen in the currents along the Indian coastline. Recent observations of the West India Coastal Current off the coast of Goa, for example, show northward and southward movements with periods of a few days and somewhat longer periods. Using an analysis of observed currents, local winds, and sea-level fluctuations in two nearby estuaries, Shetye concluded that over shorter time periods (less than about 10 days) this coastal current is driven by local winds, and over longer time periods, mainly by remote winds.

Shetye’s talk on the complex Indian Ocean currents set the stage for the “Mini-Workshop on Indian Ocean Research at IPRC.” The workshop covered strategies for obtaining more accurate estimates of salinity, the challenge of modeling water exchange between the Arabian Sea and the Bay of Bengal, finding the source waters of the Leeuwin Current, and the impact of Indian Ocean sea surface temperature (SST) anomalies on the large-scale atmospheric circulation and climate.

The sharp contrast between the salty Arabian Sea, with its high evaporation rate, and the rather fresh Bay of Bengal, with its many river runoffs, is thought to impact climate. Direct rainfall measurements over the open ocean hardly exist and satellite-derived precipitation products have broad error ranges. IPRC researcher **Zuojun Yu** described the technique she and IPRC Director **Jay McCreary** developed to evaluate precipitation products used in climate studies. **Max Yaremchuk** showed how assimilation of sea surface salinity into a model can improve estimates of river discharge and rainfall over the Bay of Bengal.



The current reversal between the Arabian Sea and the Bay of Bengal due to the seasonal monsoon changes has been difficult to model. **Tommy Jensen** at IPRC has been using tracers and floats to study this reversal in a 4½-layer model: Arabian Sea water reaches the Bay of Bengal by flowing around Sri Lanka, but Bay of Bengal water tends to stay in the bay; no floats move around Sri Lanka and then north along the western coast of India as observed. Why is this? Perhaps the model does not capture the ocean’s response to the monsoon well enough for the wind-driven circulation to act on the flow?

Another puzzle tackled in the workshop was the source of the water in the Leeuwin Current off the west Australian coast. This remarkable current flows into the face of winds and is the only permanent poleward flowing eastern boundary current. **Jim Potemra** described the complicated current system in the equatorial and southern Indian Ocean from which the Leeuwin Current might draw its water: the Indonesian Throughflow, the tropical Indian Ocean water in the Eastern Gyral Current, or a spin-off from the South Equatorial Current. Altimeter data suggest that during part of the year the supply may even come from Madagascar.

**H. Annamalai** reviewed his numerical modeling research on the unusually high SST in the Southwest Indian Ocean during an El Niño and its persistence into the following summer. Teasing apart the effects of unusual SST patterns in the tropical Pacific and Indian Ocean, he showed that the unusually high SST in the Indian Ocean shifts the model’s Walker Circulation westward over the Indian Ocean. This causes subsidence and decreased rainfall in the tropical western Pacific. In the model, the anomalously warm SST in the southwestern Indian Ocean contributes to the Philippine anticyclone during and after an El Niño and to late onset of the monsoon rains over India; it may even alter atmospheric disturbances over Pacific North America triggered by El Niño.

Parts of Asia regularly experience anomalous weather during the summer after an El Niño. This is puzzling because the SST anomalies in the equatorial Pacific have disappeared. **Shang-Ping Xie** and his collaborators at the Ocean University of China show that this lingering influence of El Niño



Satish Shetye (left) with IPRC Director Jay McCreary.

is a manifestation of Indian Ocean warming that is due to the unusual El Niño conditions and persists through the next summer. Xie views the Indian Ocean as a “capacitor”. Once charged by El Niño, it feeds the anomalous summer circulation and precipitation patterns in the tropical Indo–western Pacific Ocean and East Asia.

In a final session, Shetye, presented an analysis of recently available high-resolution precipitation and SST products that points to the development of a north–south SST gradient in the Bay of Bengal just before a low-pressure system forms. When SST is 0.75°C or higher in the northern than the southern bay, the chance of rainfall and a low-pressure system developing in the northern part of the bay within one week is 78% during May–September. Shetye felt that here was a challenging problem for IPRC climate modelers: “Can this sequence of events be modeled to understand the processes that link these events?”

## Meteorology at the University of Hawai‘i Celebrates Its 50th Anniversary



The Meteorology Department chairs (from left): Gary Barnes (1996–1999), Kevin Hamilton (2004–present), Colin Ramage (1956–1988), Thomas Schroeder (1988–1989, 1993–1996, 1999–2004, and Duane Stevens (1989–1993).

On August 19, 1956, the U.S. Air Force signed a contract with the University of Hawai‘i to study “the formation, intensification and movement of typhoons” in the Pacific. **Colin Ramage** was then recruited from the Royal Observatory in Hong Kong to lead this effort, and meteorology as a discipline began at the University of Hawai‘i (UH). Four years later, the Department of Meteorology and Oceanography was created.

To celebrate the 50th anniversary of meteorology at UH, the Meteorology Department hosted the symposium “Tropical Meteorology and Climatology in the 20th and 21st Centuries — The View from Hawai‘i” on September 11, 2006, at the East-West Center. The symposium attracted well over a hundred participants, including current and retired faculty, current and alumni undergraduate and graduate students, colleagues in other UH departments, and professional meteorologists with the National Weather Service in Hawaii. The celebration was an important day for IPRC scientists, five of whom

are part of the Meteorology Department faculty.

**Kevin Hamilton**, Meteorology Department chair and an IPRC research team leader, organized and chaired the symposium. He opened the symposium with a speech that emphasized the key role for meteorological research in global warming and climate change. UH Manoa Interim Chancellor **Denise Konan**, School of Ocean and Earth Science and Technology Dean **Brian Taylor**, and Chief of the National Weather Service Honolulu Forecast Office **James Weyman** gave speeches, congratulating the department on this memorable occasion. Professor of Meteorology **Tom Schroeder** recounted the history of meteorology at the University of Hawai‘i.

The symposium was particularly fortunate that Professor Ramage returned to Hawai‘i for the celebration and spoke on “Hot Towers and Tropical Cyclones” and “Remembering Research.” **Richard Johnson** of Colorado State University, in his keynote address, “Fifty Years of Progress in Meteorol-

ogy: A Personal View,” gave a perspective on the field of tropical meteorology over the last 50 years with a focus on contributions by meteorologists at UH. The talks on present and future key research areas in the Meteorology Department were given by current faculty **Steven Businger**, **Gary Barnes**, **Kevin Hamilton**, and **Tim Li**.

A collection of documents including texts and figures from many of the talks, photos from the meeting, and a detailed narrative history of meteorology at UH are available at [iprc.soest.hawaii.edu/~kph/50th](http://iprc.soest.hawaii.edu/~kph/50th).

## Report on Weather and Climate Extremes in a Changing Climate

The US Climate Change Science Program (CCSP) provides the overall management direction for integrated U.S. government-supported research on climate and global change. The CCSP Strategic Plan calls for more than 20 synthesis and assessment reports over the next several years.

The IPRC hosted from October 30 to November 2 the workshop for drafting the assessment report that deals with the climate extremes. The infor-

mation will be based partly on findings from the Fourth Assessment Report of the Intergovernmental Panel on Climate Change and will include chapters on the following topics: why weather and climate extremes matter, observed changes in weather and climate extremes, attributing causes to changes in extremes, forecasts of future weather and climate extremes, and recommendations for improving the forecasts.

## Grappling with Global Climate Variability



Young scientists with the workshop organizers at the Multidecadal to Centennial Global Climate Variability Workshop.

To make predictions about future climate change, scientists must determine mankind’s impact on climate superimposed on the natural swings of climate in the past. This is not an easy thing to do because instrumental records are at the most 100 years old. To grapple with this issue, the IPRC co-sponsored with US-CLIVAR and the World Climate Research Program of the World Meteorological Organization the workshop Multidecadal to Centennial Global Climate Variability from 15 to 17 November at the East-West Center.

**Axel Timmermann** (IPRC) **Henk Dijkstra** (IMAU, Utrecht, the Nether-

lands), and **Fei-Fei Jin** (University of Hawai’i) organized the workshop.

At the workshop, over 50 scientists from 10 different countries exchanged ideas and presented new results on physical mechanisms that underlie the natural climate variability over periods of decades to centuries and that establish pan-oceanic climate connections. Scientists can extend the climate record backward in time through reconstructions of temperature and moisture in such environmental records as sediments, ice cores, and tree rings. Using such proxy data in their research, the presenters could identify a long-term climate variability in the North Atlantic

called the Atlantic Multidecadal Oscillation (AMO) that acts as a pacemaker for global climate, the El Niño–Southern Oscillation, the Asian summer monsoon, and possibly even for variations in Caribbean hurricane activity, and Sahel droughts.

The workshop had another mission: to provide a platform for 10 young scientists—graduate students and post-doctoral fellows from around the world—to present their latest work on global multidecadal variability issues and to discuss their findings with established experts in the field.

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