Monsoon Meetings at IPRC

During February, the IPRC hosted a series of monsoon-related meetings: The Seventh East Asian Climate Workshop and the Third Regional Climate Modeling Workshop on February 17, 2004, were followed by the International Asian Monsoon Symposium February 18–20. Sponsors of the meetings were the Japanese Frontier Research System for Global Change, the International Pacific Research Center, the Joint Institute of Marine and Atmospheric Research at the University of Hawai'i, and the State University of New York at Albany. The following pages feature highlights from these meetings.

Third Workshop on Regional Climate Modeling

Regional climate models are already showing their usefulness in studying real-world issues. Here are some highlights from the Third Regional Climate Modeling Workshop, held February 17, 2004, and from the regional climate modeling session at the International Monsoon Symposium, February 18.

Consistent with previous findings on general circulation models, a study with the PSU/NCAR mesoscale model MM5 shows that atmospheric aerosol radiative forcing over Southeast Asia is cooling the land surface over India and Southeast Asia up to 1°C; but the simulation also found that the Tibetan Plateau is warming due to reduced cloud cover. In another study, simulation with the new version of the Common Land Model coupled to the MM5 improved reconstruction of the 1998 East Asian summer monsoon by reducing the land-surface cold bias. A project with the high-resolution IPRC Regional Climate Model has found it useful for studying effects of topography on the South China Sea summer monsoon. The mountains along coastal Vietnam deflect the southwesterly monsoon flow, which turns into a narrow low-level jet over the ocean south of Vietnam and enhances coastal upwelling, thereby reducing regional rainfall. This local feedback may have effects on monsoon rainfall reaching as far as the South China Sea.

In northern Europe, changes over the past 40 years in regional storminess, ocean wave conditions, and storm surges are being reconstructed with a regional climate model of high temporal and spatial resolution. The model is also being used to determine the transport and deposition of harmful spills, and to help in designing ships.

A variable-resolution Conformal-Cubic Atmospheric Model, developed by the Australian Commonwealth Scientific & Industrial Research Organisation, has simulated fairly realistically aspects of regional climate in Australia and Southeast Asia. Compared to regional models, the variable-resolution global model has the advantage that lateral boundaries do not need specification, thereby eliminating a source of error.

Regional climate models that are run at resolutions below 10 km must take nonhydrostatic effects into account. This requires conversion of the governing equations. An analysis of five versions of fully compressible nonhydrostatic Eulerian equations established which set was the most accurate. This set is now available for developing new nonhydrostatic models.

Finally, the plans of the IPRC to conduct the Regional Atmospheric Inter-Model Evaluation (RAIME) were discussed. The aim of this project is to improve simulation of the regional cloud and precipitation diurnal cycles. Fourteen state-of-the-art regional climate models, together representing the physical parameterizations in models, will participate. The objectives are to 1) assess and analyze the diurnal cycle simulated in these regional climate models in order to identify common biases and disagreements; 2) improve understanding of the important physical processes that drive the diurnal cycle and to identify the factors necessary for realistic simulation of the diurnal cycle; and 3) guide development of physical parameterizations in climate models that will lead to more realistic simulation of the warm-season hydrological cycle. The proposed research may become a regional (East Asian monsoon region) perspective of the CEOP Inter-monsoon Model Validation Project (CIMVP), an initiative to assess, validate, and improve the ability of climate models to simulate physical processes in monsoon regions around the world.

Yuqing Wang, International Pacific Research Center and Associate Professor of Meteorology, University of Hawai'i

Seventh Workshop on East Asian Climate

The Seventh Workshop on East Asian Climate was hosted by the IPRC February 17, 2004. The one-day East Asian Climate workshop was filled with issue-driven short presentations, while presentations on East Asian climate observations and modeling were given at the International Asian Monsoon Symposium. The workshop focused on research needs in the following seven areas: recent climate changes over East Asia, observations and model simulations, seasonal climate prediction, intraseasonal oscillation, cloud-climate interaction, land-atmosphere interaction, and air-sea interaction. In all seven areas, research has progressed significantly since the last East Asian climate workshop. Particularly, model-observation comparisons, intermodel comparisons, and model sensitivity experiments have identified the weaknesses in existing climate models. Many uncertainties remain, however, and model predictions are still too poor to be useful for rainfall predictions. The workshop discussions pointed to the need for more in-depth diagnostic studies and model-observation comparisons in order to understand more fully the processes governing the East Asian monsoon. The Eighth East Asian Climate Workshop will be held in Taiwan and is tentatively scheduled for Fall 2005.

Wei-Chyung Wang, Professor,
Atmospheric Sciences Research Center,
State University of New York, Albany

International Asian Monsoon Symposium

The International Asian Monsoon Symposium, hosted by the IPRC February 18–20, 2004, did much to raise the profile of East Asian–Western North Pacific monsoon research. At least half of the presentations dealt with East Asian weather and climate variability, ranging from the diurnal cycle and intraseasonal oscillations to interannual and interdecadal

Participants of the International Asian Monsoon Symposium in the Japanese Gardens at the East-West Center.

Organizers of the three monsoon meetings (from left): Bin Wang (International Pacific Research Center, University of Hawai'i), Wei-Chyung Wang (State University of New York at Albany), Jerry Meehl (National Center for Atmospheric Research), Tetsuzo Yasunari (Nagoya University), Yuqing Wang (International Pacific Research Center, University of Hawai'i), and Takehiko Satomura (Kyoto University).

variations and ancient monsoons. Because the East Asian monsoon is an important component of the Asian-Australian monsoon system, this emphasis is a welcome change from the past, nearly exclusive, focus on the Indian monsoon. The East Asian monsoon covers the region roughly 105–160°E, 0–45°N, and climate research in this region is significant for both practical and scientific reasons. Rainfall over the last 50 years is uncorrelated with Indian summer monsoon so that this monsoon cannot be treated as the "tail" of the Indian monsoon. The monsoon of East Asia, moreover, flows over an east-west, land-ocean contrast downstream of the world's tallest mountains and between the largest ocean and continental mass. Finally, over 1.5 billion people live in this monsoon region, and the fast-changing environmental conditions are very likely to affect global climate.

The monsoon-ocean interaction is one of the significant physical processes governing monsoon variability in the Indian Ocean, Asian seas, and western Pacific. Atmosphere-land interaction has also caught the attention of climate researchers, with GAME providing a rich source of data and model experiments pinpointing the effects of soil moisture, albedo, and topography on the monsoon. The papers presenting the experiments on raising the Tibetan Plateau point out the role of this geographical feature in global climate. The intraseasonal oscillation, especially the monsoon oscillation, was another focus. According to the general consensus, air-sea coupling improves simulation of these oscillations and will be a research direction over the next 5–10 years. Monsoon predictability and prediction is a rapidly developing area, and multi-model ensemble forecasting has advanced. The East Asian summer monsoon, however, varies much more than the Indian monsoon, and the current state-of-the-art general circulation models do a much poorer job in simulating the former than the latter. The AMIP-type strategy of a two-tiered approach for climate prediction is simply inadequate for predicting monsoon rainfall. Regarding numerical modeling, high-resolution climate modeling (20 km for a two-year integration) by the Japan Meteorology Agency shows great promise for resolving the Meiyu/Baiu front, which has been a long-standing roadblock in climate modeling. This subtropical front is critical for the water supply of East Asia and its 1.5 billion people. Adaptive-grid global modeling is another appealing intermediate strategy for producing regional climate details.

In closing, the symposium drew the attention of the monsoon research community to the whole Asian-Australian monsoon system, and particularly to the neglected East Asian monsoon. This broader focus, I'm sure, will continue in the World Meteorology Organization Third International Monsoon Studies conference to be held in November 2004.

Bin Wang, Team Leader, International Pacific Research Center, and Professor of Meteorology, University of Hawai'i

Predicting Monsoon Rainfall?

Accurate prediction of summer rainfall in the region of the Asian-Australian monsoon system has been a long-standing aim, and this prediction problem is the research focus of many of the scientists who participated in the International Asian Monsoon Symposium, hosted by the IPRC February 18–20, 2004. In-Sik Kang (Seoul National University) reported at the symposium that, in spite of much effort, the general atmospheric circulation models used for prediction still have systematic biases. Bias corrections improve predictions, but leave them only somewhat better than predictions based on the long-term average seasonal rainfall.

The picture is not all glum, though. Several studies presented together paint a fascinating, coherent picture. For some time now, it has been known that conditions in the Pacific Ocean influence the monsoon and that summers following an El Niño may be dry in India. Only about half of the El Niño events in recent history, however, have been followed by such droughts. For example, the summer of the 1997 El Niño, dubbed the El Niño of the century, had slightly above normal monsoon rainfall. The moderate 2002 El Niño, on the other hand, was followed by a drought in which July rainfall was less than half the usual amount.

Recently, the Indian Ocean has been detected as a player in the yearly monsoon variations, and the number of studies that include or focus on Indian Ocean conditions has risen sharply. At the symposium, Ben Kirtman (George Mason University) presented research showing that when two-way interaction between atmosphere and ocean is allowed in models, the following interaction occurs among Pacific Ocean sea surface temperature (SST), Indian Ocean SST, and the strength of the monsoon and precipitation: Lower than average SSTs in the western Pacific cool the Indian Ocean the following summer. An overall cooler Indian Ocean produces less convective heating over the equatorial Indian Ocean, which then results in a weak monsoon and less rainfall over India. A weak monsoon, though, allows both the western Pacific and the Indian Ocean to warm, resulting in a stronger monsoon the next summer.

This sequence of events is akin to the flip-flop of the tropospheric biennial oscillation, which is a tendency for weak monsoons to follow strong monsoons, and strong monsoons to follow weak monsoons. But, Jerry Meehl (National Center for Atmospheric Research) pointed out, only about half of the monsoons follow this pattern. What other factors contribute to these monsoon variations? Conditions in the Indian Ocean and the Pacific, he noted, can vary independently and alter the flip-flop pattern. For example, the Indian Ocean occasionally shows a sharp SST gradient between western and eastern regions, an event called the Indian Ocean Dipole that appears to vary independently of the El Niño–Southern Oscillation. Information about the dipole alone, however, has also been found insufficient for useful monsoon rainfall prediction.

Sulochana Gadgil (Indian Institute of Science) has been pursuing a further aspect of varying Indian Ocean conditions, the atmospheric conditions during monsoons. Composites of El Niño and of La Niña show that the former events are associated with anomalous easterly, and the latter with anomalous westerly winds over the equatorial Indian Ocean. Gadgil noted that during the 1997 El Niño, the equatorial Indian Ocean winds were westerly, counteracting effects of the drought-producing El Niño, whereas in 2002, they were easterly, strengthening the El Niño effects. She has developed a composite index of SST conditions in the Pacific (NINO 3.4 Index) and atmospheric conditions in the Indian Ocean (east-west winds between 2.5°N and 2.5°S) and found, in reconstructions studies, the index to be an excellent predictor of extreme monsoons, those that are one standard deviation wetter or dryer than normal. This index should now be included in longer-range rainfall forecast models. If successful, a major step forward will have been taken in predicting these extreme conditions, at least for rainfall over India.

Gisela E. Speidel, Public Relations Specialist
International Pacific Research Center

The Fifth Decadal Climate Workshop

At what point does climate variation become climate change? This question must have been on the minds of many participants of the Fifth Decadal Climate Workshop, held February 23–26 at the Waikoloa Resort in Kona, Hawai'i. For four days scientists focused on climate variation occurring over decades or longer, its societal impacts, predictability, and processes. Among the 90 participants from around the world were representatives from the Intergovernmental Panel on Climate Change, the International Climate Variability and Predictability Project of the World Climate Research Programme, the White House Office of Science and Technology Policy, as well as NASA and NOAA program managers.

There is a recap of the meeting at the DecVar Auditorium (http://www.decvar.org/auditorium.php), which features in the form of Adobe Portable Data Files many of the 75 oral and poster presentations. A summary of workshop conclusions and recommendations will be published in the *Bulletin of the American Meteorological Society*. The Center for Research on the Changing Earth System and the IPRC were the workshop organizers; sponsors were the NASA–Oceanography Program, the NSF–Climate Dynamics Program, and the NOAA–Office of Global Programs. The Organizing Committee consisted of Tom Delworth (NOAA–GFDL), Chet Koblinsky (US Climate Change Science Program, NASA), Eric Lindstrom (Ocean.US, NASA), Zhengyu Liu (CCR, University of Wisconsin), Jay McCreary (IPRC, University of Hawai'i), Jerry Meehl (NCAR), Vikram Mehta (CRCES), and Jim O'Brien (COAPS, Florida State University).

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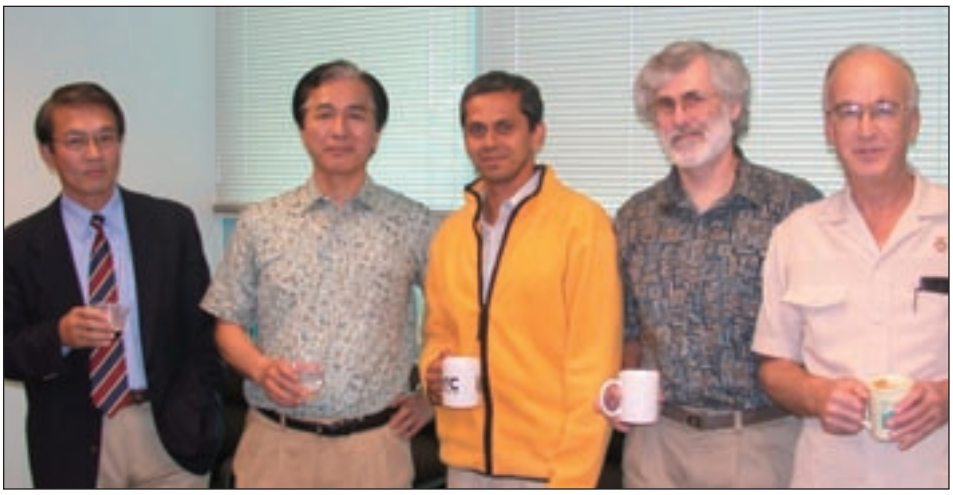

From left to right: *Hitoshi Hotta, Toshio Yamagata, Saji Hameed (who obtained his Ph.D. with Professor Yamagata), Julian McCreary, and Lorenz Magaard.*

Toshio Yamagata, Professor in the Department of Earth and Planetary Science, Graduate School of Science, University of Tokyo, and Director of Climate Variations Research, Frontier Research Program for Global Change, JAMSTEC, visited the IPRC in January 2004 after receiving the Sverdrup Gold Medal at the American Meteorological Society Annual Meeting in Seattle. At the IPRC, Yamagata gave a seminar, "The role of the Indian Ocean in climate forecasting with a particular emphasis on summer conditions in East Asia." A small gathering followed his talk.

Kevin Hamilton (left), team leader of the Impacts of Global Environmental Change research at IPRC, has been appointed Chief Editor for the book series *Atmospheric and Oceanographic Sciences Library* by Kluwer Academic Publishers. **Gert-Jan Geraeds**, the publishing editor of this publishing house, visited Hamilton in February 2004 to discuss plans for this scientific monograph series.