
MEETINGS

Minisymposium on Regional Climate

In July three esteemed colleagues from the University of Alaska visited the IPRC: **John Walsh**, Chief Scientist for the International Arctic Research Center (IARC), **Sarah Trainor**, Coordinator for the Arctic Center for Climate Assessment and Policy (ACCAP), and **Scott Rupp**, Director of the Scenarios Network for Alaska and Arctic Planning (SNAP). A minisymposium was arranged on the topic of “Regional Climate Change.” Three IPRC assistant researchers — **Hiroki Tokinaga**, **Axel Lauer** and **Oliver Elison Timm** — and long-term IPRC visitor from India **Senthilnathan Samiappan** presented. Tokinaga described his work on diagnosing long-term climate changes in the equatorial Atlantic (*IPRC Climate*, Vol.

11, No. 1); Lauer presented his results on modeling projected long-term climate changes over the eastern Pacific Ocean (*IPRC Climate*, Vol. 10, No. 2). Elison Timm discussed statistical approaches to downscaling climate change projections from global models for the Hawaiian Islands. Senthilnathan described his work on modeling climate change and its impacts on agriculture in the Tamil Nadu region of India (*IPRC Climate*, Vol. 10, No. 2).

Walsh ended the seminar with his discussion of the statistical downscaling approaches for Alaska being developed for application by ACCAP and SNAP. Although the IPRC presentations dealt with low-latitude regions, the discussion revealed that our high-latitude colleagues share with us many of the same challenges in their efforts to understand and predict the regional climate changes and their effects in Alaska.



Around the table from left: Hiroki Tokinaga, Senthilnathan Samiappan, Axel Lauer, Kevin Hamilton, John Walsh, Sarah Trainor, Scott Rupp, Ali Bel Madani, Nat Johnson, Oliver Elison Timm.

The IPRC Annual Symposium

The IPRC held its 11th Annual Symposium at the East-West Center on September 7. The very lively “all poster” format – so successful the previous year – was organized and chaired this year by a committee of the eight IPRC assistant researchers. At the beginning of each poster session, the scientists advertised their poster in 2-minute summaries, giving the audience an idea about what they were about to see. In

addition to the posters, the staff of the Asia-Pacific Data-Research Center showed off their data server and products on a large-screen video display. The symposium format made for energetic discourse and animated exchange of research ideas among the IPRC and other UH Mānoa scientists who attended. The stimulating discussion concluded after 6:00 pm, with pupus and refreshments.



At the IPRC Symposium. Program organizers are wearing leis.



From left front: Bin Wang, Jagadish Shukla, Rosina Bierbaum, Chin-Seung Chung, Soon-Chang Yoon, In-Sik Kang. Back row: Neil Plummer, Brian Taylor, Kevin Hamilton.

IPRC Hosts 2011 APEC Climate Symposium

The Asia-Pacific Economic Cooperation (APEC) Climate Center (APCC) held its 2011 Annual Symposium in Honolulu. IPRC hosted the meeting at the East-West Center from October 19 to 22.

APCC Director **Chin-Seung Chung** opened the meeting, stressing that this year's symposium theme, *Harnessing and Using Climate Information for Decision Making*, represents a new direction for the APCC, which will now include more research directly applicable to climate change adaptation efforts in the APEC economies.

IPRC Director **Kevin Hamilton** then welcomed participants on behalf of the IPRC, noting the close connections between the APCC and the IPRC since APCC's founding in 2005. IPRC scientists serve on the APCC Science Advisory Committee (SAC) and as APCC affiliate members. Moreover, the two centers share a common focus on climate change and variability in the Asia-Pacific region as well as a broad international orientation in their operations.

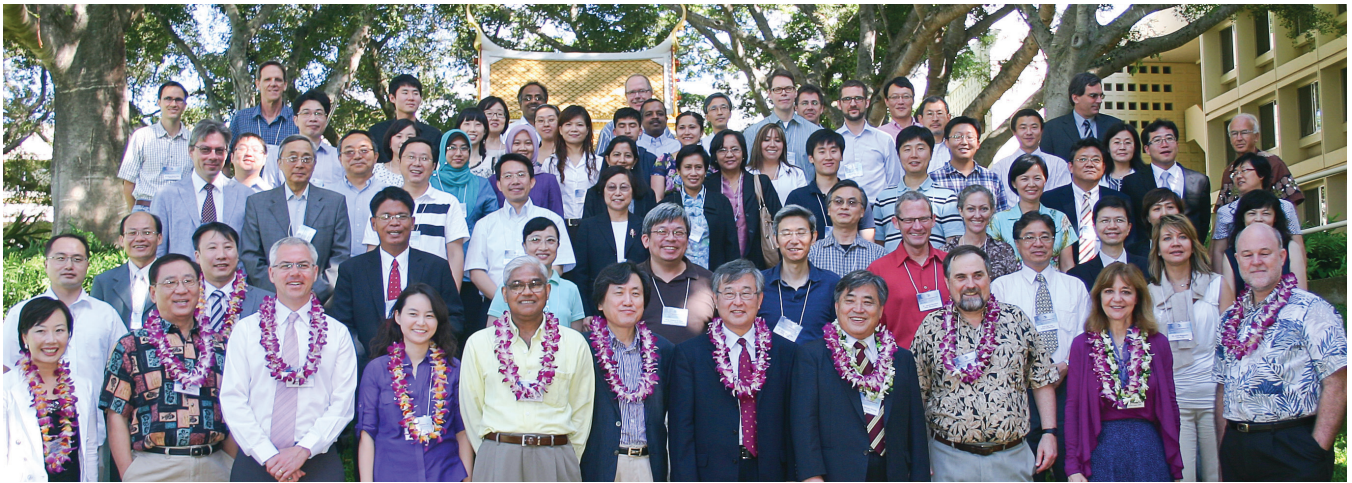
The Honorable **Brian Schatz**, Lieutenant-Governor of the State of Hawai'i, welcomed attendees to Hawai'i and commended both the APCC and the IPRC on their important work on climate change. SOEST Dean **Brian Taylor** welcomed participants on behalf of the University of Hawai'i. Chair of the APCC Science

Advisory Committee **Jagadish Shukla** made congratulatory remarks on behalf of the APCC SAC.

Rosina Bierbaum (University of Michigan), **In-Sik Kang** (Seoul National University), **Neil Plummer** (Australian Bureau of Meteorology), IPRC faculty member **Bin Wang**, and Jagadish Shukla gave keynote lectures. Oral and poster sessions followed, covering topics that ranged from a review of extended-range and seasonal climate prediction systems now operational in various APEC economies to workshops on climate effects related to agriculture, freshwater and energy resources in the Asia-Pacific region. Incorporated within the symposium was the *US–Korea Workshop on Use of High-Resolution Models for Prediction of Extreme Events* organized by **Emilia Jin** (NGMDC, Korea) and **Siegfried Schubert** (NASA Goddard Space Flight Center).



At the APCC reception from left: UH President M.R.C. Greenwood, Kevin Hamilton, Chin-Seung Chung, and Jagadish Shukla.



Symposium participants.

The meeting attracted over 100 registered participants, including representatives of each of the 21 APEC economies. Many students and researchers from the IPRC and other departments in the University also attended.

A highlight for the participants was a reception hosted by University of Hawai'i President **M.R.C. Greenwood** at the University's College Hill estate.

The symposium attracted considerable media attention with an extended TV news report broadcast in Chinese on

the *New Tang Dynasty* cable network as well as coverage in local TV news reports and in an *Associated Press* story. The *Honolulu Star-Advertiser* included both an October 19 news article and an October 21 editorial ("Don't Wait to Adapt to Global Warming") inspired by the symposium.

IPRC Assistant Researcher **June-Yi Lee** dealt with the many practical details of hosting the symposium. The full agenda for the meeting is available on the IPRC web page: <http://iprc.soest.hawaii.edu/meetings/meetings.php>

The Hot Spot Project in the Western North Pacific

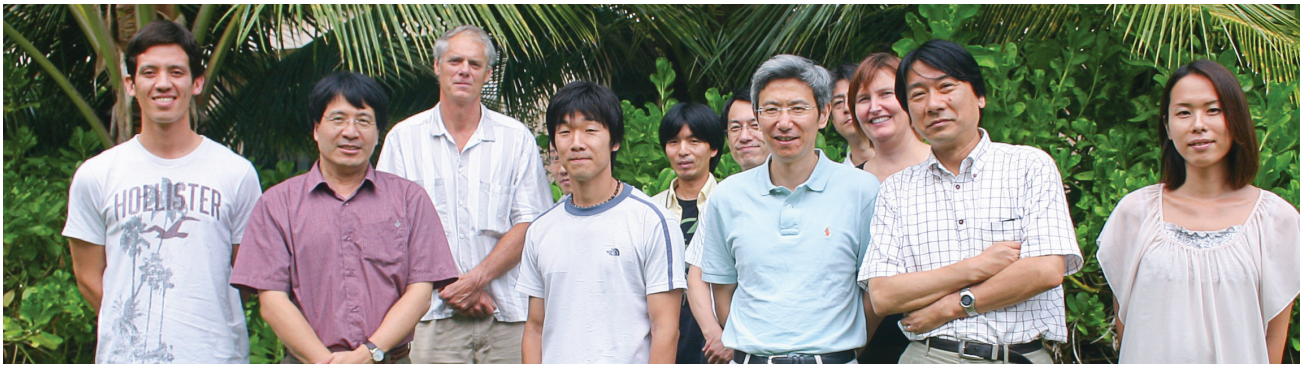
By Yu Kosaka

Recent studies show that the warm Kuroshio and Gulf Stream release strong fluxes of heat and moisture that penetrate deeply into the troposphere. Such strong and deep thermal forcing of the atmosphere may drive significant circulation changes, contradicting the conventional notion that for large-scale climate only the midlatitude ocean's passive response to atmospheric forcing needs to be considered. In fact, through such "hot spots" midlatitude air-sea interaction may well influence features of regional and global-scale climate such as the wintertime North Pacific storm track and the summertime Meiyu-Baiu rainband.

A nation-wide Japanese project on this "Hot Spot" in the climate system aims to understand the multi-scale air-sea interaction over the western North Pacific and its impact on large-scale climate and its variability. On September 15–16,

the IPRC held the workshop "Air-sea Interaction over the Northwest Pacific: Research Progress and Observation Campaigns" to exchange views with visiting Japanese colleagues and plan further work on this project.

Chief principal investigator of the "Hot Spot" project, **Hisashi Nakamura** (University of Tokyo and JAMSTEC), summarized the project and its current status. **Yoshimi Kawai** (JAMSTEC) reported a preliminary analysis of ship observations over the Kuroshio extension and the Subarctic Ocean. He had detected surface pressure minima over high sea surfaces temperature (SST) along the Kuroshio in a scale of ~100 km. **Ryuichiro Inoue** (JAMSTEC) introduced the Integrated Physical-Biogeochemical Observation Experiment (INBOX) led by **Toshio Suga** (Tohoku University and JAMSTEC), who joined the discussion via Skype. INBOX aims to examine effects of atmospheric and oceanic fronts on ocean ventilation and biogeochemical processes by observing subtropical mode water in the Northwest Pacific. **Meghan Cronin** (NOAA Pacific Marine Environmental Laboratory) described activities of the Kuroshio Extension



Hotspot Workshop participants.

Observatory (KEO), and **Nicholas Bond** (University of Washington) presented plans for aircraft observations of aerosol and cloud cover over the western North Pacific.

To plan fruitful observations, understanding of the dynamics and predictions of midlatitude air–sea interactions was shared. **Shoshiro Minobe** (Hokkaido University) discussed dynamics of atmospheric surface divergence/convergence along the oceanic frontal zone and indicated that pressure adjustment predominated over vertical momentum mixing. **Thomas Kilpatrick** (Department of Oceanography, UH Mānoa) described his study with IPRC’s **Niklas Schneider** that shows changes in surface-pressure gradient and vertical-momentum mixing over the Gulf Stream SST front impact the atmospheric Ekman layer. **Bo Qiu** (Department of Oceanography, UH Mānoa) discussed decadal prediction of the dynamical state of the Kuroshio extension, which switches between a stable and tight SST gradient and an unstable front with enhanced eddy activity. Qiu predicts, the stable state will continue until 2014 (after completion of intensive observation) and then shift to the unstable state.

IPRC’s **Shang-Ping Xie** talked about dynamics of mode-water ventilation and the Subtropical Countercurrent in the North Pacific. A coupled GCM study suggests the Subtropical Countercurrent will weaken under global warming. **Hiroki Tokinaga** (IPRC) presented his analysis showing that the western North Pacific CO₂ partial pressure varies inter-annually as a function of ENSO and Indian Ocean warming.

The observation plan was discussed on the second day. In addition to KEO and JKEO buoys administered by PMEL and Japan, a buoy is to be moored on the Kuroshio extension axis. With these three buoys, the pressure minimum and pressure-adjustment mechanism will be examined. Possible doppler-radar observations for ship cruises were discussed. Aircraft observations are planned for cloud sampling over the East China Sea in winter and the Kuroshio extension in the summer Baiu season. Xie described a Chinese research project to be launched on subtropical-mode-water formation and air–sea interaction over the western North Pacific that could be coordinated with the Hot Spot Project.

Mitigating the Impact of Tsunami Debris on Coastlines

The March 11 tsunami in Japan swept millions of tons of debris into the ocean. Visible from airplanes during the first weeks as distinct mats of complex composition, the debris drifted offshore, dispersed and became ef-

fectively invisible to observing systems. The model debris-path predictions made by IPRC’s **Nikolai Maximenko** and **Jan Hafner** have recently been confirmed by ship observations that showed end of September the leading edge of the debris only about 400 km northwest of Midway and the Papahānaumokuākea Marine Monument (see p. 14).

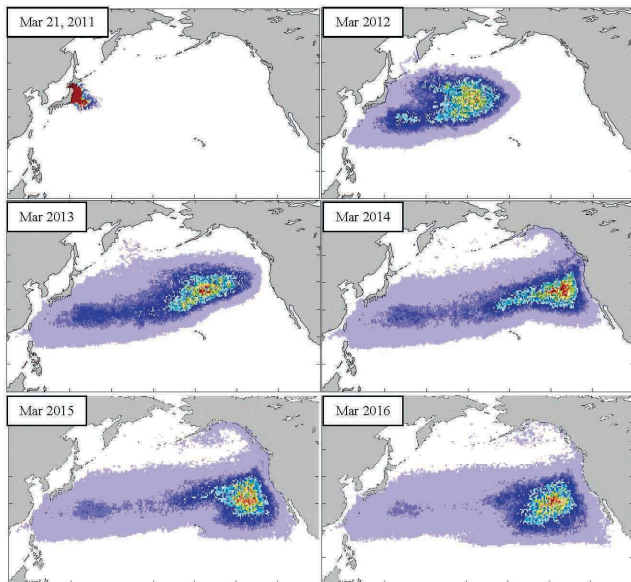
The workshop was convened at the IPRC on November 14 by Maximenko to discuss the necessity and feasibility of mitigating the tsunami debris impact and to propose a science-based plan for effective use of available limited resources to explore, monitor, and handle tsunami debris drifting toward Midway, the Hawaiian Islands, and the US/Canada West Coast. The workshop

was accessible live by WebEx, set up and monitored by Post-doctoral Fellow **Ali Bel Madani**, Assistant Researcher **Oleg Melnichenko**, and Computer Systems Manager **Ron Merrill**. Scientific Computer Programmer **Jan Hafner** ran demonstrations of computer movies on the Magic Planet and explained debris samples collected on Hawaiian beaches.

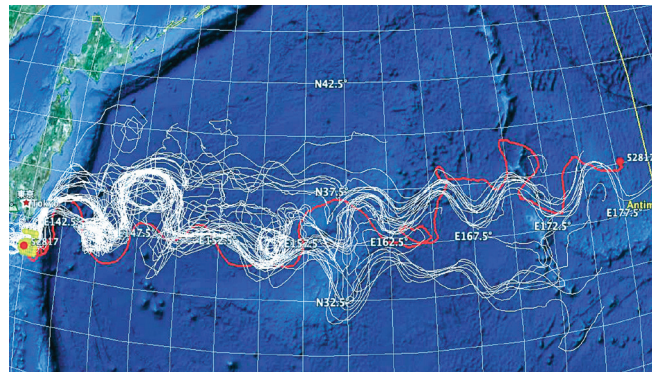
Robin Bond (Hawai'i Ocean Safety Team) opened the meeting with a first-hand account of the tsunami aftermath in Japan. Bond, who had been invited by the famous Hawai'i-born sumo wrestler **Konishiki Yasokichi** to visit the Sendai region 100 days after the tsunami to document in pictures the destruction and the cleanup, showed photos of once beautiful coastal towns from Fukushima to Hokkaido now as flat cement foundations. Other pictures showed huge mats of floating wood.

Rick Lumpkin (NOAA Atlantic Oceanographic and Meteorological Laboratory), presenting over WebEx, explained how drifter trajectories can be used to predict the paths of floating marine debris, a method used by Maximenko and Hafner to develop their models of the debris trajectory.

Maximenko reviewed the ten-year projection of the tsunami-debris field in his statistical model (see below) and then the results from the real-time diagnostic model called Surface Currents Diagnostic or SCUD model. Driven by satellite-measured winds and sea-level height, this latter model yields daily updates of the estimated location of the debris field. On its Honolulu-to-Vladivostok journey end of Sep-



The ten-year projection of the tsunamis-debris field in the statistical model. Image courtesy Maximenko and Hafner.



Observed drifter (red) and tracer paths in model run by Yi Chao. Image courtesy Yi Chao.

tember, the Russian Sail Training Ship *Pallada* encountered flotsam that was identifiable as tsunami debris in regions predicted by the model.

Using a different approach to projecting the debris path, **Yi Chao** (NASA Jet Propulsion Laboratory) over WebEx described a two tier system, in which nine-month forecasts of global atmosphere and ocean models are assimilated into the JPL Regional Ocean Modeling System to predict how the debris will spread. “Drifters” introduced into this model-system in April 2011 have a similar trajectory as in Maximenko’s diagnostic model, some of which have already crossed the Date Line.

Henrieta Dulaiova (SOEST, University of Hawai'i) reviewed the likelihood of the debris being radioactive. Radioactive fumes from one of the Fukushima plants first escaped into the atmosphere the day after the tsunami and was blown northwest over Japan. Release of radioactive water into the ocean was the largest in history, but the earliest release occurred on March 28, i.e., 17 days after the tsunami. Given this sequence of events, radioactivity of the debris should pose no health threat.

Samuel Pooley (Director of the NOAA Pacific Islands Fisheries Science Center) described how existing marine debris has been harming the endangered monk seal, sea turtle, and albatross at the Papahānaumokuākea Marine National Monument through entanglement, ingestion of microplastics and larger objects (such as cigarette lighters), modification of habitat, and introduction of invasive species. The arrival of the tsunami debris, together with its possible toxins and invasives, will further endanger these animals. NOAA has been talking with EPA about the tsunami debris. The foremost issue is to gain more knowledge of the debris composition and whereabouts.



Nikolai Maximenko with NHK Los Angeles Bureau Chief Noboru Nakashima at the workshop.

Chris Woolaway (Hawai'i Ocean Safety Team) reviewed work on various marine-debris cleanup projects, the most ambitious being the Ocean Conservancy's International Coastal Cleanup Project: over 25 years, nearly 9 million volunteers in 152 countries removed over 144 million pounds of trash along 291,514 miles of coastlines and waterways.

The present Midway Atoll–Marine Debris Coastal Monitoring Pilot Project has developed a marine debris monitoring protocol for Midway and Papahānaumokuākea. People on Midway, already trained to sort and clean up marine debris using a standardized format, now need to know what to expect with the tsunami debris and how it will be dealt with. Currently much of the debris is shipped back to Honolulu after removal from shores.

Mary Crowley, Director of Project Kaisei of the Ocean Voyages Institute, and her “Marine Debris Think Tank” are bringing together “new technologies, innovations, and capabilities” to help clean debris from our oceans. Based on the debris encountered during her ocean voyages, she has devel-

oped categories and technologies for removal. The tsunami debris forms a new category of large debris, such as telephone poles, and requires further research into the appropriate technology for cleanup.

In the final presentation, Maximenko talked about ways to mitigate the impact. Only a fraction of the tsunami debris, he says, will threaten Mainland coastlines since much will travel into the North Pacific Garbage Patch. After 5 years, 95–99% of the debris will probably still be in the water, either having sunk or still floating.

For mitigation at sea, he recommends the following: explore the debris composition along the pathways predicted by SCUD; monitor the pathways continually with drifting buoys that relay their position via satellite; use available resources to clean and block passages. For mitigation at coastlines, he suggests using various observations along the pathways in order to project landfall for different types of debris.

Maximenko closed by broaching the larger issue: “We should use this tragic experiment of nature to understand the general dynamics of marine debris in the North Pacific and to develop the modeling tools for tracking. Sooner or later we will need to solve the overall debris problem. Marine Debris is an emerging science with specific tasks to develop prognostic models for debris circulation: tracking debris pathways; quantifying the dynamics and describing the characteristic of different kinds of debris; and determining the processes defining different trajectories for different types of debris in different years.”

The final discussion focused on practical solutions for the immediate threat to Midway and the Marine Sanctuary. Strong winter storms make monitoring and cleanup efforts in the region very dangerous, and the high seas make spotting the debris difficult even from airplanes.



From left, front row: Nikolai Maximenko, Mary Crowley, Chris Woolaway, John Bond; back row: Oleg Melnichenko, Ali Bel Madani, Ray Born, J.C. Hutchinson, and Jan Hafner.