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 CO_2 partial pressure varies interannually 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.