KY09-07 Cruise Summary

1. Cruise Information

1.1 Cruise number: KY09-07

1.2 Name of vessel: KAIYO

1.3 Title of the cruise: Observation Research on the Kuroshio Transport and Sea Surface Flux

1.4 Chief scientist: Yoshimi Kawai
Ocean-Atmosphere Interaction Research Team
Ocean Climate Change Research Program
Research Institute for Global Change (RIGC)
Japan Agency for Marine-Earth Science and Technology (JAMSTEC)

1.5 Representative of the science party: Hiroshi Ichikawa
Ocean-Atmosphere Interaction Research Team
Ocean Climate Change Research Program
RIGC/JAMSTEC

1.6 Cruise period: 24 August – 7 September 2009

1.7 Ports of call: From / To JAMSTEC Wharf 2.

1.8 Research area: Kuroshio Extension Region (see Figure below)

2. Overview of the Observation

2.1 Purpose and background

The amount of air-sea turbulent heat flux in the Kuroshio Extension (KE) region is the largest among the world oceans. It is expected that the large heat transfer affects the atmosphere on both small and large scales. To understand the interaction between the atmosphere and the ocean circulation in the North Pacific, it is necessary to examine the spatial distribution of surface heat flux around the KE region and its temporal variations with high accuracy. However, the existing heat flux data have still large uncertainty. Furthermore, this is one of the major CO_2-sink regions, and the partial pressure measurement of CO_2 in the surface water is very important to evaluate the CO_2 budget.

The KY09-07 cruise was conducted around the KE region. There were two moored buoys in the observation area: one is the K-TRITON buoy of JAMSTEC, which was deployed at 38°04.8'N, 146°25.2'E (JKEO site) north of KE in November 2008, and the other is the KEO buoy of NOAA, which was deployed at 32°19.0'N, 144°33.3'E (KEO site) south of KE in September 2008. They had been obtaining oceanic and surface meteorological data for research on surface heat flux estimation and air-sea interaction. These buoys also had pCO_2 sensors for biogeochemical research.

One of the main purposes of this cruise was the recovery and deployment of these moored buoys to maintain the long-term fixed-point oceanic and meteorological observations. We also planned radiosonde and XCTD (eXpendable Conductivity, Temperature and Depth profiler) observations along a line across KE to investigate atmospheric response to spatial/temporal variations in ocean temperature, and to evaluate lateral water mass and heat budgets. In addition, a drifting GPS buoy was deployed at the JKEO site in this cruise. This buoy was designed to measure wave height and period for research on freak wave. The new K-TRITON buoy deployed in this cruise also has a function to measure them.

2.2 Observations and activities

1) Oceanographic survey using XCTD
   Vertical profiles of water temperature and salinity up to 1000-m depth were observed 46 times in total at 44 sites along a closed line shown in Figure (a) (11 sites along the N line, 17 sites along the E line, 14 sites along the X line, the JKEO and KEO sites).
2) Oceanographic survey using CTD with LADCP
   Vertical profiles of water temperature, salinity and current velocity were

observed at 2 sites (Figure a). We observed them from the surface to 2000-m depth at the N07 site, to the bottom at the JKEO site.

3) Atmospheric sounding using radiosonde

Vertical profiles of air temperature, relative humidity, and wind velocity were observed 18 times in total at 13 sites along the E line shown in Figure (b) (11 sites along the E line, the JKEO and KEO sites).

4) Recovery and deployment of the K-TRITON buoys

The K-TRITON buoys have anemometers, thermometers for air temperature, hygrometers, longwave radiometers, shortwave radiometers, pCO_2 sensors, CTs (water temperature and salinity) and CTDs (water temperature, salinity, and pressure). The K-TRITON buoy deployed in the KY09-07 cruise also has a wave gauge, a rain gauge and a barometer.

5) Recovery and deployment of the KEO buoys (PMEL/NOAA)

The KEO buoys have anemometers, thermometers for air temperature, hygrometers, longwave radiometers, shortwave radiometers, pCO_2 sensors, rain gauges, barometers, current meters, CTs (water temperature and salinity) and CTDs (water temperature, salinity, and pressure).

6) Surface water sampling at the JKEO site (MIO/JAMSTEC)

Bucket water sampling was done just before and after the deployment of the K-TRITON buoy at the JKEO site for DIC and TA measurements.

7) Release of a drifting buoy

A drifting buoy was released after the deployment of the K-TRITON buoy at the JKEO site 0.3 nautical miles off the K-TRITON buoy. The drifting buoy has a function of measuring wave height, wave period, wave direction, water level, wind speed, wind direction, atmospheric pressure, air temperature and water temperature.

8) Underway marine meteorological measurements on the vessel

We observed shortwave and longwave radiations, air temperature, and relative humidity, wind speed, wind direction, atmospheric pressure during the cruise.

9) Underway oceanic measurements on the vessel

We observed surface temperature, current velocity, wave height, and wave period during the cruise.

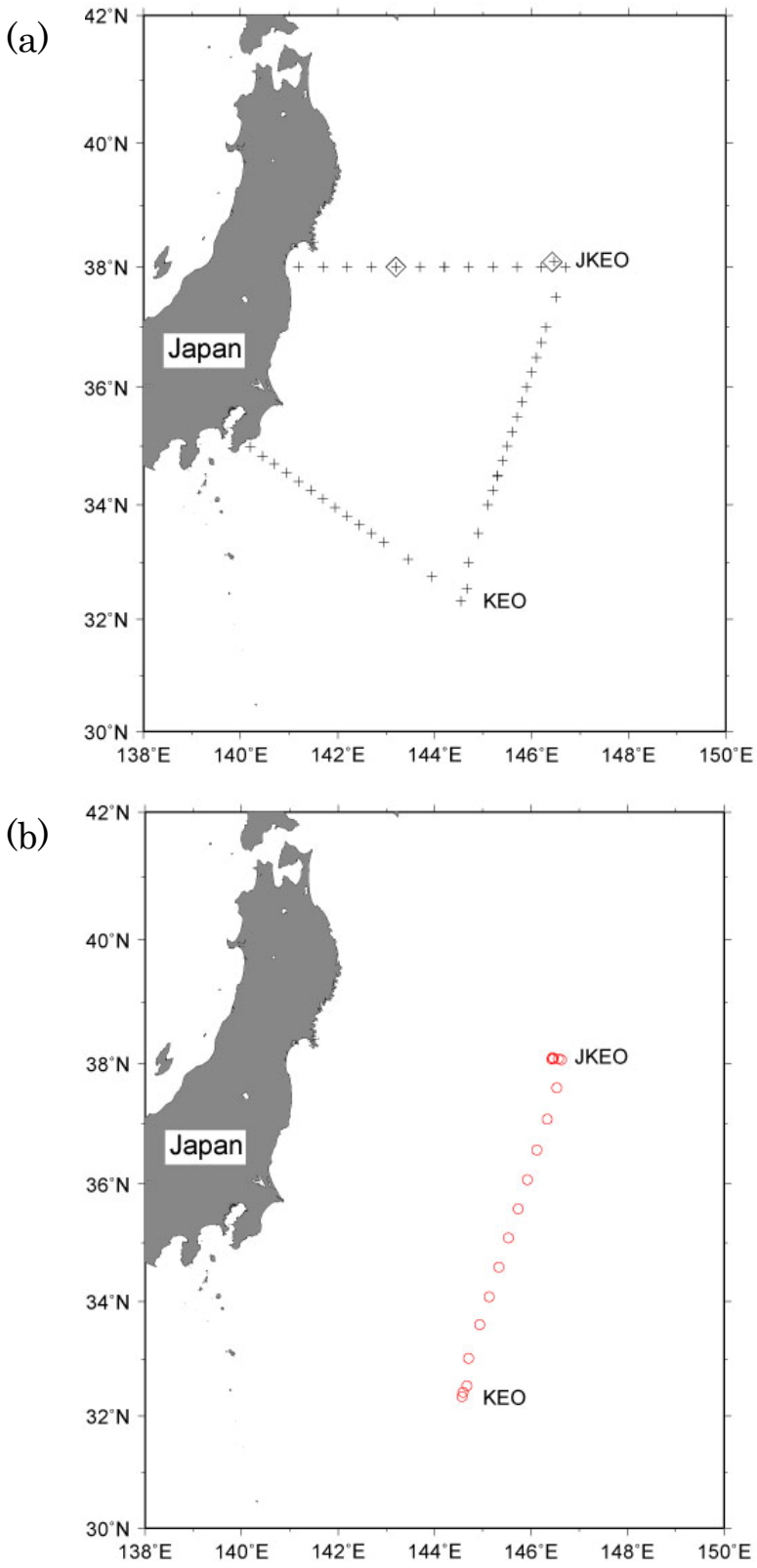

Figure. Locations of (a) the XCTD (plus) and CTD/LADCP (diamond) observations and (b) the radiosonde observations.