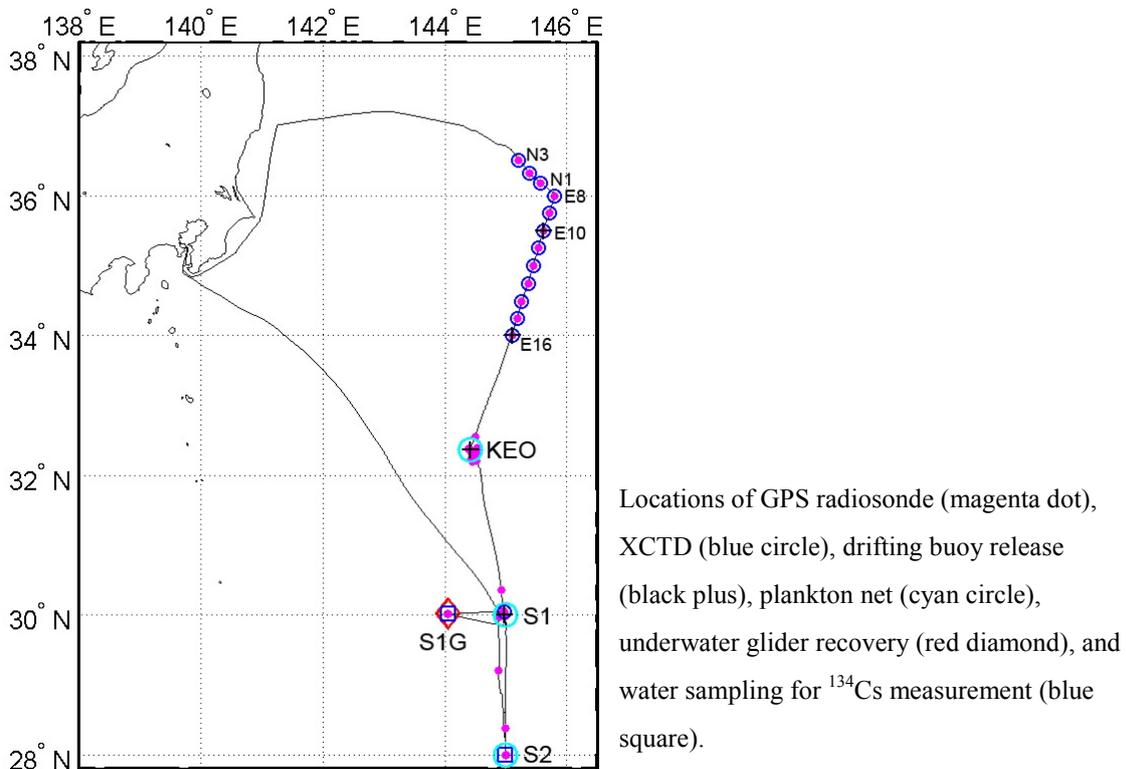


Cruise Summary

1. Cruise Information

- Cruise ID: KY14-09
- Name of vessel: KAIYO
- Title of the cruise: Transport and change processes of subtropical mode water and its effects on biogeochemical cycle
- Chief scientist [Affiliation]: Yoshimi Kawai
 - Ocean Circulation Research Group
 - Research and Development Center for Global Change (RCGC)
 - Japan Agency for Marine-Earth Science and Technology (JAMSTEC)
- Representative of the Science Party [Affiliation]: Yoshimi Kawai RCGC/JAMSTEC
- Title of proposal: Transport and change processes of subtropical mode water and its effects on biogeochemical cycle
- Cruise period: 19 June – 1 July 2014
- Ports of call: From / To: Wharf at Yokosuka Works, Sumitomo Heavy Industries
- Research area: Kuroshio Extension Region
- Research map



2. Overview of the Observation

- Overview of the observation

1. Background and purpose

The main purpose of this cruise was to investigate transport and change processes of subtropical mode water (STMW) and its effects on biogeochemical cycle.

STMW, which has vertically homogeneous properties, is formed south of the Kuroshio Extension. STMW moves southward and permeates the permanent thermocline. The formation of STMW is affected by winter weather conditions. Hence, the subtropical ocean circulation in the North Pacific reflects the climate change through the formation and transport of STMW. Furthermore, STMW is important for the ocean material circulation. It has a role of absorbing and transport CO₂ into the ocean interior. STMW also contributes to the primary production in the subtropics, where is oligotrophic in summer, by supplying nutrients upward. Recent studies have revealed that the spatial distribution of STMW is more complicated than expected before. It is indispensable to clarify the formation, transport, and change processes of STMW and the roles of STMW for the climate change and the material circulation. For these studies, we deployed and recovered surface buoys, biogeochemical moorings, and a sea glider in this cruise. CTD observations, water and plankton samplings were also conducted.

Another purpose of the cruise was the validation of new satellite data (AMSR2) and GPS-derived precipitable water.

2. Observations and activities

- 1) Atmospheric sounding using GPS radiosonde

Vertical profiles of air temperature, relative humidity, and wind velocity were observed 40 times in total (including 3 failures) at 19 positions with GPS radiosondes.

- 2) Oceanographic survey using XCTD

Vertical profiles of water temperature and salinity up to 1000-m depth were observed at 13 positions.

- 3) Underway marine meteorological measurements on the vessel

We observed shortwave and longwave radiations, air temperature, relative humidity, wind speed, wind direction, atmospheric pressure, rain rate, concentration of aerosol particles, and precipitable water throughout the cruise.

- 4) Underway oceanic measurements on the vessel

Surface temperature and current velocity were observed throughout the cruise.

- 5) Sampling of aerosol particles in the lowest atmosphere

Aerosol particles in the air were sampled with pumps and filters throughout the cruise.

- 6) Recovery of underwater glider

An underwater glider (SeaGlider), which can measure temperature, salinity, dissolved oxygen, and

pressure, was deployed at 31°58.38'N, 143°56.27'E on 27 February 2014 in the cruise of R/V Hakuho-maru (KH-14-1). We recovered it about 50 nm west of the S1 site on 21 June 2014. (This recovery position is referred to as "S1G")

7) Recovery and deployment of sediment-trap (BGC) mooring

The sediment-trap mooring was deployed at the S1 site on 16 July 2013 in the cruise of R/V Mirai (MR13-04) in order to collect settling particle continually. We recovered it on 22 June 2014. The mooring was simplified and deployed at the KEO site on 27 June 2014.

8) Recovery of POPPS mooring

POPPS was deployed at the S1 site on 16 July 2013 in the cruise of R/V Mirai (MR13-04) for measuring the vertical profiles of phytoplankton fluorescence, irradiance, temperature, salinity and dissolved oxygen. We recovered it on 21 June 2014.

9) Recovery and deployment of KEO buoys, deployment of drifting buoys (PMEL/NOAA)

KEO buoy has anemometers, thermometers for air temperature, hygrometers, longwave and shortwave radiometers, pCO₂ sensors, rain gauges, barometers, current meters, a pH sensor, Optode, CTs (water temperature and salinity) and CTDs (water temperature, salinity, and pressure). We deployed the KEO buoy (KEO12) on 25 June 2014. The KEO buoy (KEO11) was recovered on 26 June 2014.

We also deployed the Surface Velocity Program (SVP) drifters at the S1 and KEO sites, 34°00'N, and 35°30'N.

10) CTD and Water sampling at S1, S1G, S2, and KEO sites

We casted a CTD and Niskin bottles to 800 m depth at the S1G and S2 sites for the measurement of ¹³⁴Cs originated from Fukushima Daiichi Nuclear Power Station. CTD and water sampling casts were done to the bottom at the S1 site, and to 2000 m depth at the KEO site, for biogeochemical research. For 0-m water sampling, a bucket was used.

We also sampled water at 5m depth with a Niskin bottle at the KEO site just after the deployment and before the recovery of the buoys.

11) Plankton net (VMPS) at S1, S2, and KEO sites

Plankton tow sampling had performed by using the Vertical Multiple Plankton Sampler (VMPS) to collect microzooplankton from the S1, S2, and KEO sites. VMPS has 50cm x 50cm square aperture and four plankton nets can be set on the frame. CTD and conductivity sensor with fluorometer are equipped on the frame and observed data be monitored in real time on the shipboard console.