

1. Cruise Code:

MR11-08 Leg1-3

2. Main research theme:

Studies on transport of heat and materials and their variability by the general circulation of the ocean.

3. Objectives:

It is well known that climate changes of a timescale more than a decade are influenced by changes of oceanic conditions. Among various oceanic changes, we conduct shipboard observations focusing on storage and transport of anthropogenic CO₂, heat and freshwater in the ocean, which are important for global warming and relevant climate changes. Our observation line (Fig. 1) was a meridional line, which is set in the western Pacific, and traverses the main subtropical gyre in the ocean. By occupying the observation line, we intended to clarify: (1) storage of anthropogenic CO₂, dissolved oxygen, etc. in the subtropical gyre and the temporal changes, (2) temperature rise and transport of dissolved substances along the route of Circumpolar Deep Water, and (3) current degree of ocean acidification in the western Pacific. This study was conducted under the Global Ocean Ship-based Hydrographic Investigations Program (abbreviated as GO-SHIP, <http://www.go-ship.org/>).

In addition to the objectives listed above, we were also aimed at elucidating dispersion of radioactive substances, released into the sea unfortunately from the Fukushima Dai-ichi nuclear power plant.

4. Outline of observation (institutions related to observations are listed in parentheses):

(1) CTD/O₂/LADCP with water sampling (RIGC, MRI, Rakuno Gakuen Univ., AIST, BioGeos, NIRS, JAEA):

In order to observe vertical profile of physical and chemical properties in the ocean, we conducted CTD/O₂/LADCP observations and water sampling at max. 36 depths from the sea surface to the bottom at 127 stations along the observation line at nominal 149°E, which is called as WOCE P10 line (Fig. 1). Sampled water were analyzed for salinity, dissolved oxygen, nutrients, dissolved inorganic carbon, total alkalinity, pH, chlorophyll, and CFCs on board the ship. In addition, we conducted incubation experiments for CH₄ and N₂O to investigate mechanisms of sink and source processes of greenhouse gases through biological activity.

We collected water samples for isotopes and isotopomers of carbon, hydrogen, nitrogen and oxygen, those for persistent perfluoro chemicals (PFCs), and those for radioactive substances (¹³⁴Cs, ¹³⁷Cs, ¹²⁹I, etc.), which are analyzed on land.

(2) Expendable microstructure profiler (XMP) observation (RIGC):

We conducted ocean turbulence observation using XMP at selected 2 stations.

(3) Launch of Argo floats (RIGC):

We launched max. 2 Argo floats during the cruise. The launch was made just after the CTD observations at selected stations.

(4) Continuous water sampling (RIGC):

We sampled sea surface water using Continuous Sea Surface Water Monitoring System mounted in the R/V Mirai. Sampled water was analyzed for salinity, temperature, dissolved oxygen, and fluorescence.

(5) Continuous current observations (RIGC):

Current profile observations from sea surface to 600 m depth along the ship track were conducted using the Acoustic Doppler Current Profile (ADCP) installed in the R/V Mirai.

(6) Continuous atmospheric and surface seawater pCO₂ observation (RIGC):

Measurements of atmospheric and surface seawater pCO₂ were conducted continuously along the ship track using the pCO₂ measuring system installed in the R/V Mirai.

(7) Continuous meteorological observations (RIGC, Okayama Univ., AIST, Rakuno Gakuen Univ., NIES, Chiba Univ., Univ. of Toyama):

We conducted general surface meteorological observations including air pressure, air temperature, humidity, wind speed, wind direction, and precipitation. Atmospheric aerosols, gas components, clouds, radiation from sea surface, and turbulence fluxes were observed using Sky-radiometers, lidar system, ceilometers, Doppler radar, Millimeter-wave radar, MAX-DOAS (Multi-Axis Differential Optical Absorption Spectroscopy), etc. Rain were also sampled to determine the spatial distribution of isotopic composition of rainfall. In addition, air samples for greenhouse gases and PFCs were collected at selected points along the ship track.

(8) Geophysical observations (RIGC, Univ. of the Ryukyus, Tohoku Univ.):

In order to assess the earth interior activity, bathymetry, gravity and magnetic field were observed using Multi Narrow Beam Echo Sounding System, gravity meter, and shipboard three-component magnetometer system installed in the R/V Mirai along the ship track.

(9) Sampling of zooplankton (BioGeos):

To elucidate impacts of radionuclides released from the Fukushima Dai-ichi nuclear power plant on zooplankton community, we collected zooplanktons with an ORI net, and measure concentrations of ¹³⁴Cs and ¹³⁷Cs in the community.

List of abbreviations

AIST: National Institute of Advanced Industrial Science and Technology

BioGeos: Institute of Biogeosciences

JAEA: Japan Atomic Energy Agency

MRI: Meteorological Research Institute

NIES: National Institute for Environmental Studies

NIRS: National Institute of Radiological Sciences

NIST: National Institute for Environmental Studies

RIGC: Research Institute for Global Change

5. Cruise period:

From 4 December in 2011 to 9 February in 2012 (68 days)

6. Ports of call:

Port of departure: Colombo, Sri Lanka on 4 December, 2011

Port of call: Koror, Palau on 20 December, 2011

Port of call: Guam, USA on 12 January, 2012

7. Contact person for questionnaire on this cruise:

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Japan Agency for Marine-Earth Science and Technology (JAMSTEC)

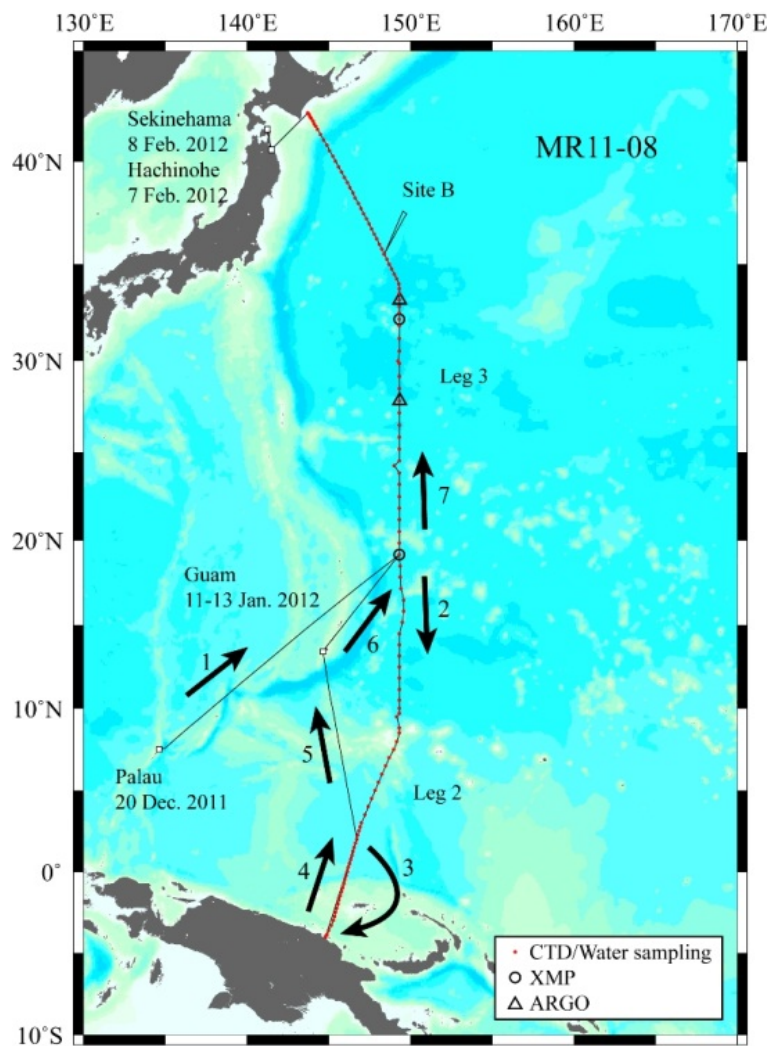


Figure 1. Station map in the western Pacific. Planned stations for CTD/O₂/LADCP and water sampling are indicated by dots,