

1. Cruise Code

MR12-05

2. Platform

R/V Mirai

3. Chief Scientists

Legs 1 and 2, Katsuro Katsumata (RIGC, JAMSTEC)

Leg 3 Hiroshi Uchida (RIGC, JAMSTEC)

4. Title of cruise

WOCE-revisit in the western Pacific and Southern oceans

5. Piggyback projects (* Principal Investigator not onboard)

(1) Verification of new chemical tracers for studying ocean general circulation (National Institute of Advanced Industrial Science and Technology)

(2) Distribution and ecology of pelagic sea skaters and their response to environmental factors (Kochi University)

(3) Optical characteristics of aerosols on oceans observed by shipboard skyradiometer (Toyama University) *

(4) Mapping stable oxygen isotope ratio on the Indian and Pacific sectors of the Southern Ocean (Hokkaido University)*

(5) Distribution of water vapor isotope ratio on oceans (Hokkaido University)*

(6) Study on ocean general circulation and heat/freshwater transport and their variability in the Pacific and Southern oceans using Argo floats (RIGC, JAMSTEC)*

(7) Carbon dioxide and volatile organic matter influencing the climate system in the Southern Ocean (Hokkaido University)

(8) Clarification of Lyra seamount formation processes (Chiba University)*

(9) Circulation of global warming gases related to marine biomass using isotopes (Rakuno Gakuen University)

(10) Standardization of geophysical data and application to ocean floor dynamics (Ryukyu University)*

(11) Temporal and spatial distribution of optical characteristics of clouds and aerosols on oceans (National Institute for Environmental Studies)*

6. Cruise period and ports of call

Leg 1 (22 days): Sekinehama (5 Nov 2012) to Auckland (26 Nov 2012)

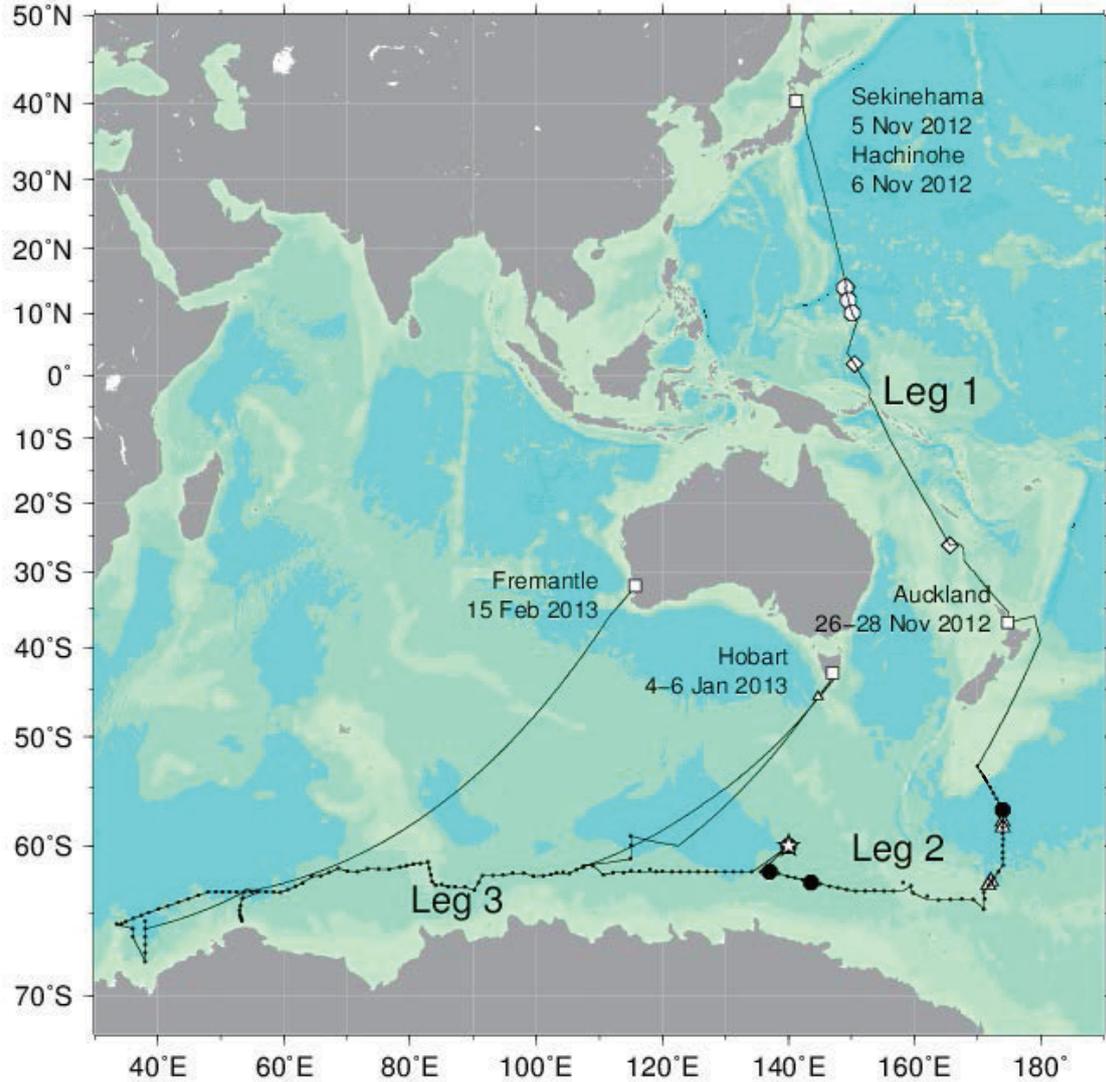
Leg 2 (38 days): Auckland (28 Nov 2012) to Hobart (4 Jan 2013)

Leg 3 (28 days): Hobart (6 Jan 2013) to Fremantle (15 Feb 2013)

7. Research area

the Southwestern Pacific and Southern ocean

8. Map



MR12-05 Cruise. White circles show the deployment position of Argo floats. White diamonds show neuston net sampling (the northernmost station overlaps the northern most Argo deployment). White large triangles show the XMP deployment stations. Star is the flux-buoy recovery position. Black dots shows CTD/bottom sampling stations. Black circles show the Deep Ninja deployment positions

9. Objectives

It is well established that oceans play important roles in the global climate system, but

quantitative description of the oceans' roles and their variabilities are still yet to be made. Given natural variabilities of the oceans, it is necessary to observe them as frequently as practicable and as accurate as possible. In this research cruise, we observed, with state-of-art precision, the Southwestern Pacific and Southern oceans, which are known to be one of the most sensitive regions in the world oceans to the climate change, particularly as a likely source of the recently-established Pacific near-bottom warming. These oceans are also known to ventilate the intermediate-depth and deep oceans and exchange anthropogenic carbon. We also recovered a JAMSTEC southern ocean mooring, which continuously measured the air-sea flux, which have never been measured in situ.

10. Outline

- (1) CTD/LADCP/Sampling (RIGC, Meteorological Research Institute, Rakuno Gakuen University, National Institute of Advanced Industrial Science and Technology, Hokkaido University)

With a CTD/LADCP system, vertical profiles were measured for temperature, conductivity, dissolved oxygen, fluorescence, turbidity, and horizontal velocity . Water sampling were performed and properties were analyzed such as salinity, density, dissolved oxygen, nutrients, dissolved inorganic carbon, total alkalinity, pH, chlorophyll and CFCs, some isotopes. Also samples were brought back for land-based analysis for persistent perfluoro chemicals (PFCs) and radioactive substances. Some expendable conductivity-temperature profilers were deployed as needed.

- (2) Flux buoy recovery (MARITEC, JAMSTEC)

Recovery was successful of the Southern Ocean flux buoy deployed January 2012 by Umitaka Maru.

- (3) Continuous pump water sampling (RIGC, National Institute of Advanced Industrial Science and Technology, Hokkaido University)

With subsurface pump installed on R/V Mirai, near-surface temperature, conductivity, dissolved oxygen, chorolophyll as well as dissolved carbon dioxide and methane were measured almost continuously.

- (4) Continuous velocity measurement by shipboard ADCP (RIGC)

With shipboard Acoustic Doppler Current Profile, horizontal velocities in the upper ocean were measured along the cruise track almost continuously.

- (5) Expendable Microstructure Profiler: XMP (RIGC)

Turbulence kinetic energy dissipation rate was estimated on 6 stations along 175°E using XMPs.

- (6) Atmospheric observations (RIGC, Rakuno Gakuen University, National Institute of Advanced Industrial Science and Technology, Hokkaido University)
- Meteorological observations were performed almost continuously for quantities including pressure, temperature, humidity, wind speed, wind direction, and precipitation.
 - Air samples were taken for analysis of CH₄, N₂O, PFOS, and PFCs.
- (7) Sea skater sampling and adaptation experiments (Kochi University)
- Neuston net sampling was performed at 3 stations all on high seas. The samples underwent a series of adaptation experiments onboard.
- (8) Cloud and aerosol observation (RIGC, National Institute for Environmental Studies, Toyama University)
- Lidar systems were used to measure vertical distribution of clouds and aerosols almost continuously.
 - Optical characteristics of the aerosols were measured using a skyradiometer almost continuously.
- (9) Float deployments (RIGC)
- On three stations on Leg 1, regular Argo floats were deployed, one at a time. Four new Deep Ninja floats were deployed at four stations on Leg 2.
- (10) Geophysical observations (University of Ryukyus, Chiba University)
- Almost continuous measurements were performed for bathymetry, gravity, and magnetic fields along the cruise track.
- (11) Precipitation and water vapor sampling (RIGC, Hokkaido University)
- Rain (snow) waters and vapor were sampled for isotope analysis. Almost continuous measurements were performed for water vapor isotope profile.
- (12) Emergency recovery of drifting SOFS buoy (owned and operated by Bureau of Meteorology and CSIRO, Australia).