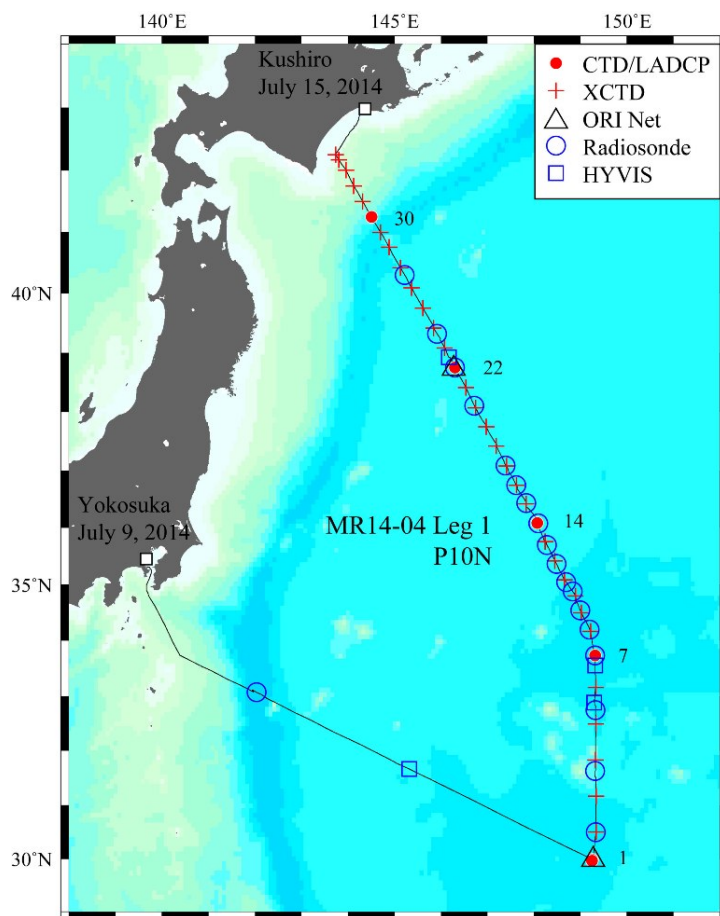
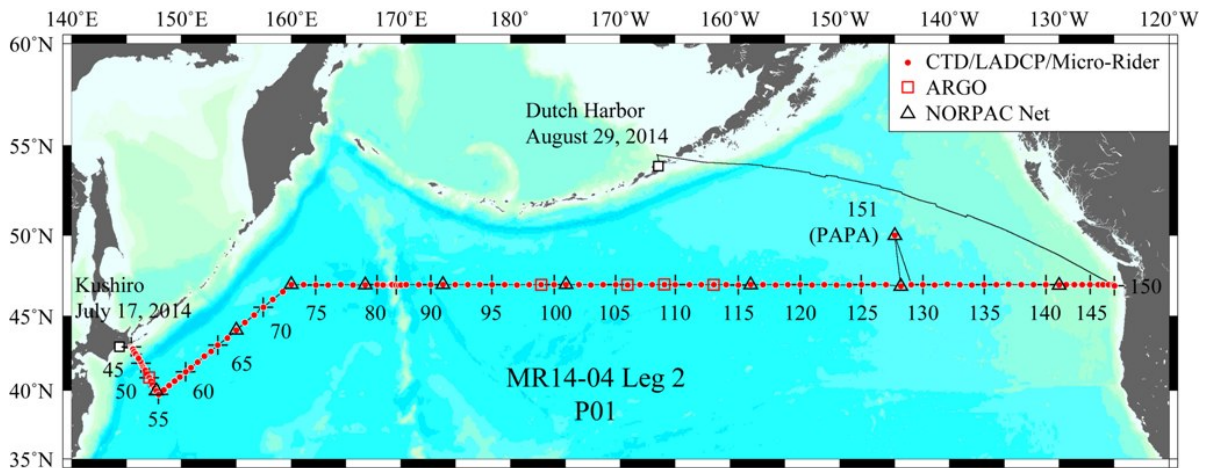


Cruise Summary

1. Cruise Information

- Cruise ID: MR14-04
- Name of vessel: R/V Mirai
- Title of the cruise: Heat and material transport and their changes in the ocean general circulation
- Chief scientist [Affiliation]: Hiroshi Uchida [Japan Agency for Marine-Earth Science and Technology]
- Representative of the Science Party [Affiliation]: Akihiko Murata [Japan Agency for Marine-Earth Science and Technology]
- Title of proposal: Heat and material transport and their changes in the ocean general circulation
- Cruise period: July 9, 2014 ~ August 29, 2014
- Ports of call: Yokosuka ~ Kushiro ~ Dutch Harbor, USA
- Research area: North Pacific
- Research map:





2. Overview of the Observation

It is well known that the oceans play a central role in determining global climate. However heat and material transports in the ocean and their temporal changes have not yet been sufficiently quantified. Therefore, global climate change is not understood satisfactorily. The main purposes of this research are to evaluate heat and material transports such as anthropogenic CO₂, nutrients, etc. in the Pacific Ocean and to detect their long-term changes and basin-scale biogeochemical changes since the 1990s.

This cruise is a reoccupation of the hydrographic sections called WHP-P10N along 149°E and WHP-P01 along 47°N of the North Pacific. The WHP-P10N section was previously observed by the Japan Agency for Marine-Earth Science and Technology (JAMSTEC) in 2005, in 2011, and in 2014 by the Japan Meteorological Agency. The WHP-P01 section was previously observed in 1985 by the Scripps Institution of Oceanography (USA), in 1999 by the Japan Fisheries Agency / the JAMSTEC / the Institute of Ocean Sciences (Canada), and in 2007 by the JAMSTEC. This study was conducted under the Global Ocean Ship-based Hydrographic Investigations Program (abbreviated as GO-SHIP, <http://www.go-ship.org/>). Data obtained from those cruises are available from the CLIVAR & Carbon Hydrographic Data Office (CCHDO) web site (<http://cchdo.ucsd.edu>).

In leg 1 of this cruise, we conducted CTD and discrete water sampling at selected 5 stations and zooplankton sampling by using ORI net at two stations along the WHP-P10N section mainly for estimation of dispersion of radioactive substances released into the sea by the Fukushima Dai-ichi nuclear power plant accident in March 2011. To understand the oceanographic condition along the WHP-P10N section in detail, we deployed XCTDs between the CTD stations. In addition, we launched radiosondes and Hydrometer Video Sondes (HYVIS) to understand the atmospheric condition along the cruise track. Especially in the section across the Kuroshio Extension, we densely launched radiosondes simultaneously with the XCTDs. At station 1, an ARGO float was deployed to take a photograph and recovered after that.

In leg 2 of this cruise, we conducted full-depth CTD, lowered acoustic Doppler current profiler (LADCP), Micro-Rider measurements, and discrete water sampling for physical, chemical and

biogeochemical properties of seawater from a maximum of 36 layers along the WHP-P01 section and at the ocean station PAPA. We deployed two ARGO floats with RINKO oxygen sensor in an anticyclonic eddy off Hokkaido and four ARGO floats in the area where the number of ARGO floats is small to maintain the global array. Furthermore, we sampled marine plankton by using NORPAC net to examine changes in calcification responses of planktonic organisms and pH in the subarctic North Pacific.

Also, we sampled seawater to examine horizontal and vertical distribution of microbial population (picoeukaryotes, bacteria, archaea, and viruses) in gene level to explain relationship between the microbial population and ocean circulations (seawater properties). In addition, we observed physical, chemical, and biogeochemical properties of seawater and atmosphere, and geophysical parameters (sea bottom topography, gravity acceleration, etc.) continuously along the cruise track in order to accumulate basic scientific data in global scale, especially for unobserved regions.