Cruise Summary

1. Cruise information

1.1 Cruise code

MR23-07

1.2 Name of Vessel

R/V *Mirai*

1.3. Title

Quantitative observation experiment in the North Pacific subarctic gyre ― GO-SHIP Observation P14

1.4. Chief scientist and project description

Katsuro Katsumata（RIGC, JAMSTEC）

Fiscal Year: 2023

Type of project: JAMSTEC in-house ship use

Project number: P23-07

1.5 Cruise period

Dutch Harbor (6th October 2023) to Shimizu (9th November 2023) 35 days

1.6 Research Area

Bering Sea and North Pacific Ocean

1.7 Map

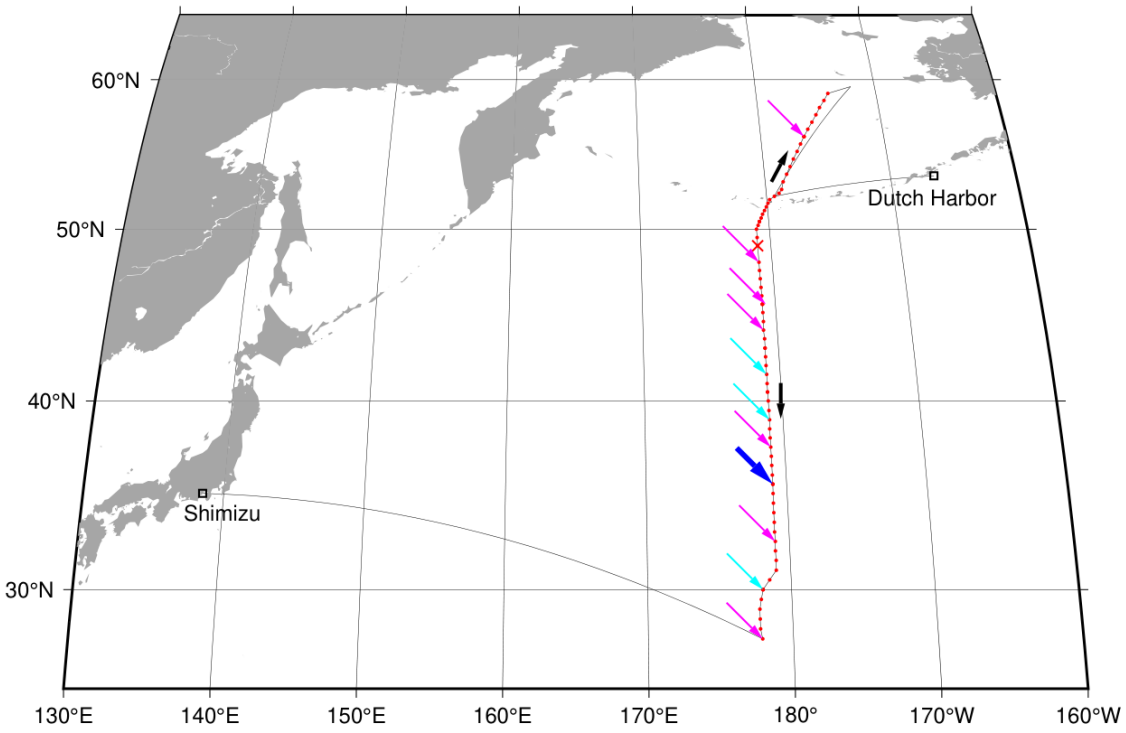

Figure: Thin black line shows the cruise track. To avoid rough weather, the station observation was initiated from Station 16, just north of the Amchitka Strait and proceeded northeastword to Station 1. Then after sailing to Station 17, the observation continued southward to Station 70, which is indicated by the two black arrows. The red dots show the CTD stations, the red cross the XCTD only station, magenta arrows deployments of the biogeochemical floats, the cyan arrows deployments of temperature-salinity (core) Argo floats, the blue arrow deployment of a Deep NINJA float.

2. Content of project

2.1 Objective

In this cruise, we observe the North Pacific Ocean to investigate its dynamics and to monitor the status. The station locations and methods follow the standards defined through the World Ocean Circulation Experiment (WOCE) in the 1980s in order to facilitate comparison with accumulated data, leading to deeper understanding of the North Pacific climate system and its evolution. The cruise also contributes to optimisation study of the observation system which includes autonomous floats deployed since the WOCE era, satellite observation, and past cruises – all integrated in a state estimate numerical model. Our cruise contributes to Global Climate Observing System (GCOS), Global Ocean Ship-based Hydrographic Investigations Programme (GO-SHIP), which is a program of Global Ocean Observing System (GOOS).

3. Observations

3.1 CTD, LADCP and water sampling

Vertical profiles of water temperature, salinity, current direction/velocity, microstructure, etc. were measured with an CTD and other electrical sensors attached to a CTD frame. Furthermore, sea water from near surface to near bottom at maximum of 36 depths were taken by Niskin samplers, and physical and biogeochemical data on salinity, nutrients, dissolved oxygen, carbonate properties (dissolved inorganic carbon, pH, total alkalinity, and organic alkalinity), density, pigments such as chlorophyll-a, CDOM, FDOM, CFCs, SF_6, isotopes (carbon, cesium, radon, uran, tritium), PAHs, etc. were obtained.

Surface seawater was also sampled with a bucket at selected stations.

Samplings were made for calibration of analysis instruments.

XCTDs were deployed at selected station, partly test newly developed probes

An XCTD was deployed to complement an aborted CTD cast at a station

Samplings were made for biological studies.

3.2 Research into microbial ecosystem

Heterotrophic and autotrophic microbial activities were measured by an incubation experiment.

3.3 Continuous pump water sampling

With subsurface pump installed on the vessel, water temperature, salinity, dissolved oxygen and fluorescence in surface seawater were measured continuously. Atmospheric and surface seawater pCO_2 were also measured continuously. Filtered surface seawater were also collected for nutrients measurement. The pump water was also used for near-surface samplings for isotopes and PAHs.

3.4 Marine meteorological observations

Meteorological parameters such as pressure, temperature, humidity, wind velocity, and radiations were measured. Cloud base height was also measured continuously by ceilometer.

3.5 Observation of precipitation

Three-dimensional structure of precipitating clouds were measured by Doppler radars. Microwave radiometer measured vertically integrated atmospheric vapor contents. A cloud camera was used to photograph celestial images.

3.6 Aerosols

Air, cloud and aerosol were observed by a lidar continuously.

3.7 Shipboard ADCP

Current direction and velocity were measured continuously by ADCP mounted on the vessel.

3.8 Satellite data

Satellite data such as NOAA/AVHRR, Himawari, etc. were received during the cruise.

3.9 Geophysical observations

Bathymetry and gravity were measured along the cruise track.

3.10 Deployments of ARGO floats

At CTD stations ARGO floats, Deep NINJA floats, and biogeochemical floats were deployed.