

## Cruise Summary

### 1. Ship name and Cruise code

R/V MIRAI

MR08-02

### 2. Title of the Cruise (Main Mission)

Observational Study on the Air-Sea Interaction in the Tropical Western Pacific Ocean

### 3. Chief Scientist

Kunio Yoneyama

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

Institute of Observational Research for Global Change (IORGC)

### 4. Research Themes of Sub-missions and Principal Investigators (PIs)

- (1) Study on the internal structure of precipitation system and its interaction with environment over the tropical western Pacific Ocean

PI : Taro Shinoda (Nagoya University)

- (2) Study on lifecycle of clouds over the tropical western Pacific Ocean using cloud radar and lidar

PI : Hajime Okamoto (Tohoku University)

- (3) Continuous observations of clouds and aerosols using two-wavelength polarization lidar

PI : Nobuo Sugimoto (National Institute for Environmental Studies)

- (4) Rain and water vapor sampling for stable isotope measurement

PI : Naoyuki Kurita (JAMSTEC)

- (5) Continuous measurements of air-sea surface eddy fluxes

PI : Osamu Tsukamoto (Okayama University)

- (6) N<sub>2</sub> fixation activity and phytoplankton dynamics in the subtropical and tropical North Pacific

PI : Ken Furuya (The University of Tokyo)

- (7) Distribution and ecology of three species of oceanic sea skaters inhabiting tropical area around equator in the Pacific Ocean and their responses to environmental factors

PI : Tetsuo Harada (Kochi University)

- (8) Standardization of geophysical data and study on its application to the sea plate dynamics

PI : Takeshi Matsumoto (University of the Ryukyus)

- (9) Tectonic evolution of the Pacific Plate.

PI : Masao Nakanishi (Chiba University)

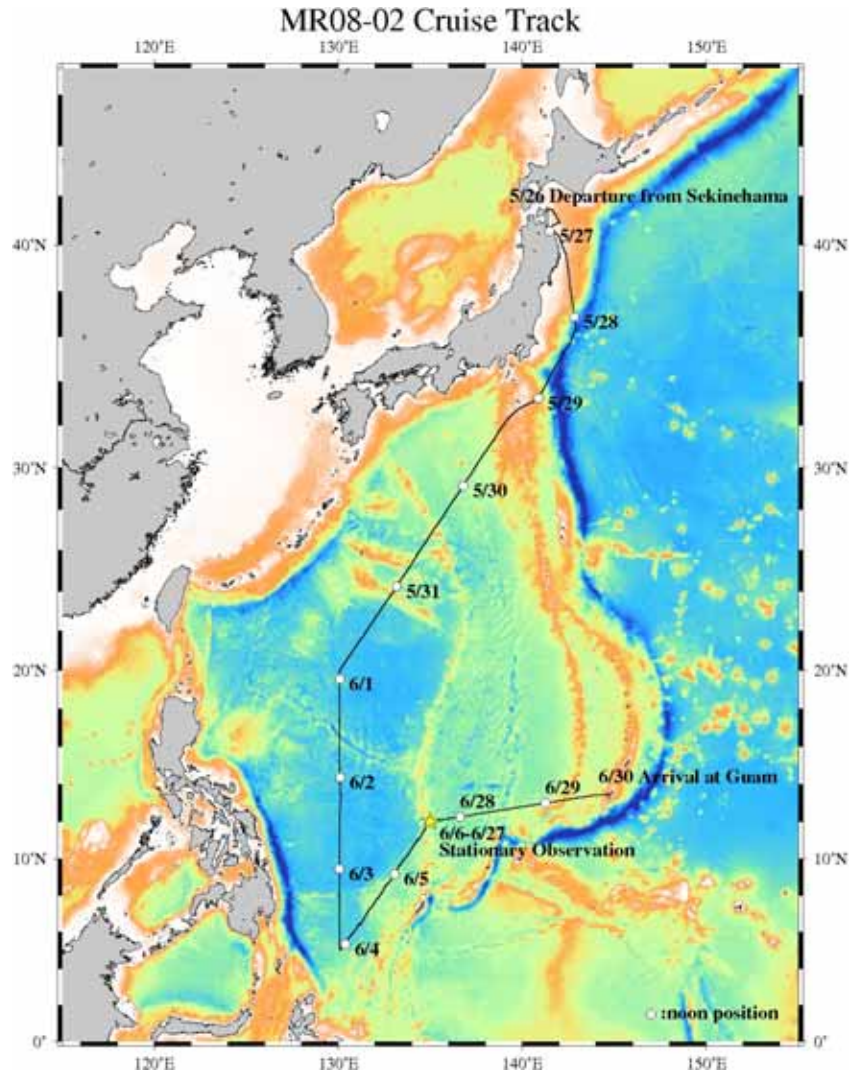
### 5. Period and Ports of call

2008	May 26	departed Sekinehama, Japan
	May 27	called at Hachinohe, Japan
	June 30	arrived at Guam, U.S.A.

## 6. Research Area

Tropical Western Pacific Ocean

Stationary observation at fixed site at 12N, 135E from June 6 through 27, 2008



## 7. Purpose

Since the huge amount of heat released from active convections developed over the tropical western Pacific Ocean drives the atmospheric circulation, this area is thought to be a heat engine of the globe. Therefore, it is important to study the convective activity over this area in studying the global climate. In particular, large-scale cloud systems accompanied with the Madden-Julian oscillation (MJO), Asian monsoon, and tropical depressions (or cyclones) are the major precipitating systems which are often observed in the boreal summer season. Therefore, the aim of this cruise was to study the mechanism of development and maintenance of cloud systems associated with these phenomena.

## 8. Overview of Observations

In order to investigate the atmospheric and oceanic conditions in the tropical western Pacific Ocean in the boreal summer season, the intensive observations. First, we deployed 5 Argo floats along 130.1E line from 20N to 5N. Then, we conducted the observations at a fixed site at 12N, 135E from June 6 through June 27 (22 days).

During the first half of observation period, so-called trade winds (easterlies) were prevailed in the lower troposphere. This period corresponded to the convectively inactive phase of intraseasonal variability, and only shallow cumulus clouds can develop. On the other hand, deep convections much developed in the latter half of stationary observation. In particular, tropical cyclone developed just south-west of the Mirai on June 19. This shift of convective activity from inactive to active can be confirmed by the time series of Doppler radar echo area (see Figure below). In corresponding to this feature, atmospheric instability index CAPE (convective available potential energy) clearly shows the gradual increase in the first half of observation period, while it decreases after that. This feature suggest it might be due to the fact that energy stored was used for development of convections.

During the cruise, the following observations were intensively conducted.

- |      |                               |                        |
|------|-------------------------------|------------------------|
| (1)  | 5.3-GHz Doppler radar         | continuously           |
| (2)  | GPS Radiosonde                | 209 times (* 208 data) |
| (3)  | Ceilometer                    | continuously           |
| (4)  | Surface Meteorology           | continuously           |
| (5)  | GPS Meteorology               | continuously           |
| (6)  | CTD and water sampling        | 99 times               |
| (7)  | ADCP                          | continuously           |
| (8)  | Sea surface water monitoring  | continuously           |
| (9)  | Mie-scattering LIDAR          | continuously           |
| (10) | 95-GHz cloud profiling radar  | continuously           |
| (11) | Infrared radiometer           | continuously           |
| (12) | Rain and water vapor sampling | continuously           |
| (13) | Turbulent flux                | continuously           |
| (14) | Gravity/Magnetic force        | continuously           |
| (15) | Topography                    | continuously           |
| (16) | Sea skater sampling           | 27 times               |
| (17) | Argo float deployment         | 5 times                |

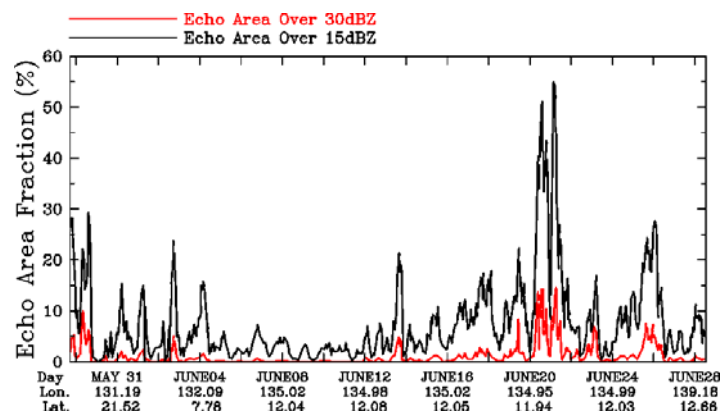


Figure. Variation of radar echo areas obtained from surveillance PPI scans. The indicated value is the ratio of the echo area to the radar coverage area with a radius of 200 km.