

Cruise Summary

1. Cruise Information

- Cruise ID

MR11-07 (Leg-2)

- Name of vessel

R/V Mirai

- Title of the cruise

Observational Study on the Intreseasonal Variability in the Indian Ocean

- Chief scientist [Affiliation]

Masaki Katsumata (JAMSTEC)

- Title, representative and affiliation of the Science Parties

- (1) Observational and modeling analyses of the effects of multi-scale moisture variability on the organization of meso-scale convective systems.
(PI: Tetsuya Takemi / Kyoto University)
- (2) Validation of daily simulation results using a cloud-resolving model over the tropical Indian Ocean.
(PI: Taroh Shinoda / Nagoya University)
- (3) On-board continuous air-sea flux measurement.
(PI: Osamu Tsukamoto / Okayama University)
- (4) Observation study on ozone and water vapor variability in the tropical tropopause layer.
(PI: Masatomo Fujiwara / Hokkaido University)
- (5) Distribution and configuration of clouds in various Oceans.
(PI: Toshiaki Takano / Chiba University)
- (6) Lidar observations of optical characteristics and vertical distribution of aerosols and clouds.
(PI: Nobuo Sugimoto / National Institute for Environmental Studies)
- (7) Maritime aerosol optical properties from measurements of ship-borne sky radiometer.
(PI: Kazuma Aoki / Toyama University)
- (8) Tropospheric aerosol and gas observations on a research vessel by MAX-DOAS.
(PI: Hisahiro Takashima / JAMSTEC)
- (9) Water sampling for building water isotopologue map over the Ocean.
(PI: Naoyuki Kurita / JAMSTEC)
- (10) Distribution and ecology of oceanic Halobates inhabiting tropical area of Indian Ocean and their responding system to several environmental factors.

(PI: Tetsuo Harada / Kochi University)

(11) Standardising the marine geophysics data and its application to the ocean floor geodynamics studies.

(PI: Takeshi Matsumoto / University of the Ryukyu)

- Cruise period

Oct.28, 2011 to Dec.02, 2011

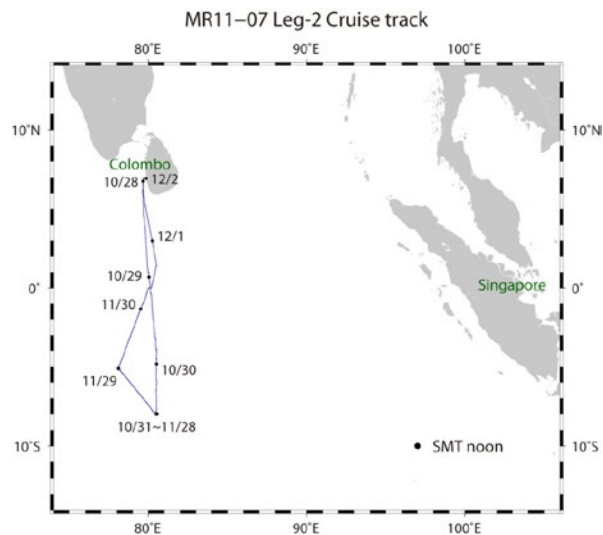
- Ports of call

Oct. 28: departed Colombo, Sri Lanka

Dec. 02: arrived Colombo, Sri Lanka

- Research area

Tropical Central Indian Ocean, as following map.



2. Overview of the Observation

In order to investigate the atmospheric and oceanic variations in the central equatorial Indian Ocean and their role in the intraseasonal variation, especially Madden-Julian Oscillation (MJO), the intensive observations by using R/V Mirai were carried out. This cruise was a component of the international field campaign named CINDY/DYNAMO (Cooperative Indian Ocean Experiment for the Intraseasonal Variation in Year 2011 / Dynamic of Madden-Julian Oscillation) to form the quadrilateral observation array with R/V Roger Revelle at (Eq, 80E), Addu Atoll at (Eq, 73E), and Diego Garcia (7S, 72E).

The most of the cruise days in both Leg-1 and Leg-2 were dedicated to perform stationary observation at (8.0S, 80.5E) to obtain high-resolution time series of the oceanic and atmospheric

variations. She was at the station for 52 days in total, from Sep.30 to Oct.24 in Leg-1 and from Oct.31 to Nov.28 in Leg-2.

During the observation period, two events of the convectively active phase of MJO (hereafter “MJO”) rose in the CINDY/DYNAMO array, as in the index by Wheeler and Hendon (2004). The characteristics over Mirai at 8S were very different between two events. The observed atmospheric and oceanic profiles were successfully captured by various instruments (radiosonde, Doppler radar, CTDO, etc.).

Over Mirai, active convection and moist atmosphere were observed in the former half of Leg-1. The high temperature and low salinity in the oceanic surface mixing layer (hereafter “oceanic surface layer”) were reasonably observed during the convectively active period. The situation turned suddenly into convectively inactive in the latter half of Leg-1. Though the oceanic surface layer gradually deepened and was warmed gradually with the apparent diurnal cycle, the atmosphere kept dry and convectively inactive. In the end of Leg-1, the first MJO was apparent on the equator and northern hemisphere side of the CINDY/DYNAMO array, without any active convection over Mirai.

In Leg-2, second MJO event was apparent also in the end of the Leg. Toward the MJO, the atmospheric condition gradually changed as in precipitable water and radar echo coverage, with the variation of several days. Oceanic surface layer is limited as about 40-meter depth where the diurnal warming was observed continuously thru Leg-2. Drastic changes of the oceanic parameters were also observed in the middle of Leg-2.

These observed results will be analyzed further, with combining the data from other platforms deployed over the CINDY/DYNAMO array over the central Indian Ocean. Two of them were also deployed in this cruise: a subsurface buoy and an ARGO-type float. These were deployed at (5S, 78E) on September 29, to obtain the meteorological and oceanic data within the CINDY/DYNAMO southern array. The former equipped the acoustic Doppler current profiler (ADCP) to capture the oceanic current above 200m depth, as well as the passive acoustic listener (PAL) to monitor the rainfall and wind speed at ocean surface. The subsurface buoy was successfully recovered at the end of the cruise on Nov.29. The ARGO-type float also reported daily oceanic profiles continuously.

These observed data revealed detailed meridional structure of the MJO, in which the zonal structure had been highlighted in the previous studies. The further analyses for the obtained data will be performed to engrave the detail of the processes to spawn the convectively active phase of the MJO.