doi : 10.17596/0003649

R/V Mirai Cruise Report
MR04-08
(Leg 2)

January 14 – February 19, 2005
Tropical Ocean Climate Study (TOCS)

Edited by
Shigeki Hosoda

Japan Agency for Marine-Earth Science and Techonlogy
(JAMSTEC)


SCIENCE AND TECHNOLOGY CENTER
YOKOSUKA,JAPAN

Contents

1. Cruise name and code
2. Introduction and observation summary
   2.1 Introduction
   2.2 Overview
   2.3 Observation summary
3. Period, ports of call, cruise log and cruise track
   3.1 Period
   3.2 Ports of call
   3.3 Cruise log
   3.4 Cruise track
4. Chief scientist
5. Participants list
   5.1 R/V MIRAI scientist and technical staff
   5.2 R/V MIRAI crew member
6. General observation
   6.1 Meteorological measurement
      6.1.1 Surface meteorological observation
      6.1.2 Ceilometer observation
   6.2 CTD/XCTD
      6.2.1 CTD
      6.2.2 XCTD
   6.3 Validation of CTD cast data (Salinity measurement of sampled seawater)
   6.4 Continuous monitoring of surface seawater (EPCS)
   6.5 Shipboard ADCP
   6.6 Underway geophysics
      6.6.1 Sea surface gravity
      6.6.2 On board geomagnetic vector measurement
      6.6.3 Swath bathymetry
7. Special observations
   7.1 TRITON mooring
      7.1.1 TRITON mooring operation
      7.1.2 Inter-comparison between shipboard CTD and TRITON transmitted data
   7.2 ADCP subsurface mooring
   7.3 ARGO float (profiling float) deployment
   7.4 Lidar observations of clouds and aerosol
   7.5 Studies on behaviors and climate influence of atmospheric aerosols over the ocean
   7.6 Distribution and dispersal airborne insects in the Pacific Ocean

1. Cruise name and code

Tropical Ocean Climatology Study

MR04-08 (Leg 2)

Ship: R/V Mirai

Captain: Yujiro Kita

2. Introduction and observation summary

2.1. Introduction

The purpose of this cruise is to observe physical oceanographic conditions in the western tropical Pacific Ocean for better understanding of air-sea interaction affecting on the ENSO (El Nino/Southern Oscillation) phenomena and its related climate change. The surface layer in the western tropical Pacific Ocean is characterized by high sea surface temperature (SST), which plays major role in driving global atmospheric circulation. El Nino occurs when warm water migrates eastward, and causes short-term climate changes in the world dramatically. For example, the western Pacific area has very little rainfall when the "El Nino" occurred, as in 1997-98. This atmospheric and oceanic system is so complicated, and we still do not have enough knowledge about it.

This climate system has various time scales. To investigate the mechanism, we need precise and detailed data for long period. Therefore, ocean and atmosphere observing mooring array is effective to obtain such data set. The major mission of this cruise is to deploy TRITON buoys developed at JAMSTEC for the long term measurements of ocean and atmosphere in the western tropical Pacific Ocean. We also deployed ADCP subsurface buoys in the Pacific during this cruise.

2.2. Overview

2.2.1. Ship

R/V Mirai

Captain Yujiro Kita

2.2.2. Cruise code

MR04-08 Leg 2

2.2.3. Project name

Tropical Ocean Climate Study (TOCS)

2.2.4. Undertaking institution

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

2-15, Natsushima-cho, Yokosuka, 237-0061, Japan

2.2.5. Chief scientist

Shigeki Hosoda (JAMSTEC)

2.2.6. Period

January 14, 2005 (Koror, Republic of Palau) – February 19, 2005 (Sekinehama, Japan)

2.2.7. Research participants

Total 17 scientists and technical staff participated from 5 institutions and companies.

2.3. Observation summary

TRITON mooring deployment:	9 sites
TRITON mooring recovery:	9 sites
TRITON mooring maintenance:	1 site
ADCP mooring deployment:	3 sites
ADCP mooring recovery:	3 sites
Argo float launching:	2 floats
CTD (Salinity, Temperature and Depth) and water sampling:	19 casts
XCTD (Salinity, Temperature and Depth):	27 casts
Surface meteorology:	continuous
ADCP measurements:	continuous
Surface temperature and salinity measurements by intake method:	continuous

Other specially designed observations have been carried out successfully.

Observed Oceanic and Atmospheric condition

According to information of the TAO/TRITON buoy array, during this cruise, maximum sea surface temperature area together with active atmospheric convection shifted eastward and could be observed near the date line in the southern hemisphere. In this condition, due to continuous strong westerly wind associated with MJO (the Maddan Julian Oscillation), we gave up maintenance of TRITON buoy at 2N 138E. The salinity CTD and XCTD section along 147E and 156E indicated the low salinity water covered the surface layer and heavy precipitation associated with tropical depression in the equatorial region. As to the equatorial current system, the equatorial undercurrent was well developed normally along equator on about 200m. And strong eastward current was observed off New Guinea coast in the surface layer. The current might be associated with the strong westerly wind near the equatorial region.

3. Period, port of call, cruise log and cruise track

3.1 Period

January 14, 2005 – February 19, 2005

3.2 Port of call

Koror, Republic of Palau (Departure; January 14, 2005)

3.3 Cruise log

SMT (Ship mean time)	**UTC**	**Event**
Jan. 14 (Fri.)		
09:20	00:20	Departure at Koror, Republic of Palau (SMT=UTC+09:00)
11:00	02:00	Safety Guidance on the R/V Mirai
13:15	04:15	Boat station drill
15:00	06:00	Meeting for Leg.2 observation
Jan. 15 (Sat.)		
07:00	22:00	Start of continuous water and shipboad observations
08:00-08:32	23:00-23:32	Check of TRITON buoy (04-52.00N, 137-16.19E)
08:53-10:12	23:53-01:12	C01-S01 (04-52.36 N, 137-16.19 E, 4086 m) CTD cast with 2 water samplings, down to 2000 m depth
Jan. 16 (Sun.)		
07:54-09:12	22:54-00:12	C02-S01 (02-03.16 N, 138-04.36 E, 4304 m) CTD cast with 2 water samplings, down to 2000 m depth
Jan. 17 (Mon.)		
03:15	18:15	XCTD X-01 (01-59.97N, 141-59.78E, 2551 m)
05:21	20:21	XCTD X-02 (01-30.33N, 142-01.23E, 2835 m)
07:22	22:22	XCTD X-03 (01-00.45N, 141-59.49E, 3092 m)
09:26	00:26	XCTD X-04 (00-30.33N, 141-59.49E, 3323 m)
11:26	02:26	XCTD X-05 (00-00.53N, 141-58.73E, 3388 m)
13:31	04:31	XCTD X-06 (00-29.98S, 141-58.43E, 3258 m)
15:34	06:34	XCTD X-07 (01-00.01S, 141-58.41E, 2967 m)
17:31	08:31	XCTD X-08 (01-30.01S, 141-57.67E, 3509 m)
19:33	10:33	XCTD X-09 (02-00.00S, 141-57.61E, 3631 m)
21:31	12:31	XCTD X-10 (02-29.99S, 141-56.88E, 3546 m)
Jan. 18 (Tue.)		
08:25-10:49	23:25-01:49	Recovery of ADCP mooring (02-28.80 N, 141-56.88E, 3448 m)
13:07-14:19	04:07-05:19	Deployment of ADCP mooring (02-28.74S, 141-56.77E, 3444 m)
Jan. 19 (Wed.)		
01:30	16:30	XCTD X-11 (00-00.02N, 142-59.99E, 3103 m)
05:20	20:20	XCTD X-12 (00-00.43N, 144-00.00E, 3549 m)
09:11	00:11	XCTD X-13 (00-00.02N, 145-00.04E, 3727 m)
12:59	03:59	XCTD X-14 (00-00.08S, 145-59.99E, 3720 m)
Jan. 20 (Thu.)		
07:55-08:45	22:55-23:45	C04-S01 (01-58.32 N, 147-02.92 E, 4510 m) CTD cast with

		1 water sampling, down to 1000 m depth
13:02	04:02	XCTD X-15 (03-00.03N, 147-01.46E, 4418 m)
17:12	08:12	XCTD X-16 (03-59.98N, 147-02.23E, 4780 m)
Jan. 21 (Fri.)		
08:14-10:56	23:14-01:56	Deployment of TRITON mooring (04-57.87N, 147-01.69E, 4244 m)
11:15-12:00	02:15-03:00	C03-S01 (04-58.35N, 147-01.46E, 4289 m) CTD cast with 1 water sampling, down to 1000 m depth
14:02-14:48	05:02-05:48	C03-S02 (05-03.48N, 146-57.67E, 4221 m) CTD cast with 1 water sampling, down to 1000 m depth
Jan. 22 (Sat.)		
07:59-10:39	22:59-01:39	Recovery of TRITON mooring (05-02.51N, 146-56.92E, 4249 m)
Jan. 23 (Sun.)		
07:55-11:19	22:55-02:19	Recovery of TRITON mooring (01-59.50N, 147-01.68E, 4523 m)
Jan. 24 (Mon.)		
08:16-10:28	23:16-01:28	Deployment of TRITON mooring (01-59.54N, 147-01.41E, 4517 m)
12:57-13:42	03:57-04:42	C04-S02 (01-59.49N, 147-01.68E, 4516 m) CTD cast with 1 water sampling, down to 1000 m depth
17:58	08:58	XCTD X-17 (01-00.01N, 147-00.56E, 4530 m)
Jan. 25 (Tue.)		
08:13-10:11	23:13-01:11	Deployment of TRITON mooring (00-03.65N, 147-00.70E, 4480 m)
12:55-13:40	03:55-04:40	C05-S01 (00-03.38N, 147-01.44E, 4469 m) CTD cast with 1 water sampling, down to 1000 m depth
14:11-14:55	05:11-05:55	C05-S02 (00-00.86N, 147-02.54E, 4504 m) CTD cast with 1 water sampling, down to 1000 m depth
Jan. 26 (Wed.)		
07:57-11:00	22:57-02:00	Recovery of TRITON mooring (00-01.68S, 146-59.73E, 4566 m)
Jan. 27 (Thu.)		
09:00-11:08	00:00-02:08	Recovery of ADCP mooring (00-00.36N, 147-04.58E, 4485 m)
13:04-14:13	04:04-05:13	Deployment of ADCP mooring (00-00.41S, 147-04.72E, 4477 m)
Jan. 28 (Fri.)		
		Cruise for 5S 156E
Jan. 29 (Sat.)		
08:12-09:37	23:12-00:37	Deployment of TRITON mooring (05-01.93S, 156-01.50E, 1521 m)
10:24-11:05	01:24-02:05	C06-S01 (05-02.40S, 156-02.14E, 1503 m) CTD cast with 1 water sampling, down to 1000 m depth
12:55-13:36	03:55-04:36	C06-S02 (04-58.09S, 156-02.00E, 1492 m) CTD cast with

		1 water sampling, down to 1000 m depth
Jan. 30 (Sun.)		
08:00-10:16	23:00-01:16	Recovery of TRITON mooring (04-58.01S, 156-00.99E, 1510 m)
14:24	05:24	XCTD X-18 (04-00.00S, 155-59.90E, 1783 m)
18:19	09:19	XCTD X-19 (03-00.01S, 155-58.75E, 1809 m)
Jan. 31 (Mon.)		
08:11-09:45	23:11-00:45	Deployment of TRITON mooring (02-01.01S, 155-57.59E, 1749 m)
10:24-11:05	01:24-02:05	C07-S01 (02-00.70S, 155-56.82E, 1748 m) CTD cast with 1 water sampling, down to 1000 m depth
12:55-13:36	03:55-04:36	C07-S02 (01-59.41S, 156-01.91E, 1758 m) CTD cast with 1 water sampling, down to 1000 m depth
Feb. 01 (Tue.)		
07:58-1008	22:58-01:08	Recovery of TRITON mooring (01-59.05S, 156-01.58E, 1751 m)
14:19	05:19	XCTD X-20 (00-58.40S, 156-01.92E, 2079 m)
Feb. 02 (Wed.)		
08:14-10:42	23:14-01:42	Deployment of TRITON mooring (00-00.73N, 156-02.98E, 1950 m)
13:07-13:53	04:07-04:53	C08-S01 (00-01.09N, 156-00.78E, 1956 m) CTD cast with 1 water sampling, down to 1000 m depth
14:23-15:09	05:23-06:09	C08-S02 (00-01.32S, 156-00.78E, 1944 m) CTD cast with 1 water sampling, down to 1000 m depth
Feb. 03 (Thu.)		
07:57-10:33	22:57-01:33	Recovery of TRITON mooring (00-00.78S, 155-57.88E, 1941 m)
Feb. 04 (Fri.)		
08:00-09:17	23:00-00:17	Recovery of ADCP mooring (00-00.04S, 156-08.39E, 1956 m)
09:54-10:42	00:54-01:42	Deployment of ADCP mooring (00-00.00N, 156-08.39E, 1960 m)
15:15	06:15	XCTD X-21 (00-59.99N, 156-04.88E, 2219 m)
Feb. 05 (Sat.)		
08:11-09:58	23:11-00:58	Deployment of TRITON mooring (02-02.23N, 156-01.21E, 2573 m)
10:52-11:36	01:52-02:36	C09-S01 (02-01.58N, 156-00.85E, 2584 m) CTD cast with 1 water sampling, down to 1000 m depth
13:08-14:26	04:08-05:26	C09-S02 (01-56.70N, 155-59.19E, 2564 m) CTD cast with 2 water samplings, down to 2000 m depth
Feb. 06 (Sun.)		
07:55-10:37	22:55-01:37	Recovery of TRITON mooring (01-57.15N, 155-59.96E, 2568 m)
15:02	06:02	XCTD X-22 (02-59.90N, 156-00.30E, 2877 m)
19:13	10:02	XCTD X-23 (04-00.00N, 156-03.66E, 3490 m)
23:16	14:16	XCTD X-24 (05-00.03N, 156-04.56E, 3600 m)

Feb. 07 (Mon.)		
13:09-16:03	04:09-07:03	Recovery of TRITON mooring (04-59.44N, 156-03.08E, 3605 m)
Feb. 08 (Tue.)		
08:12-10:16	23:12-01:16	Deployment of TRITON mooring (04-58.49N, 156-02.18E, 3603 m)
13:07-14:31	04:07-05:31	C10-S01 (04-59.06N, 156-00.26E, 3600 m) CTD cast with 2 water samplings, down to 2000 m depth
18:39	09:39	XCTD X-25 (06-00.00N, 156-00.26E, 4148 m)
22:42	13:42	XCTD X-26 (06-59.98N, 155-58.51E, 4794 m)
Feb. 09 (Wed.)		
06:35	21:35	XCTD X-27 (08-00.02N, 155-56.12E, 4794 m)
08:04-11:26	23:04-02:26	Recovery of TRITON mooring (08-01.00N, 155-57.01E, 4838 m)
Feb. 10 (Thu.)		
08:10-10:37	23:10-01:37	Deployment of TRITON mooring (08-01.30N, 155-56.11E, 4859 m)
13:07-14:24	04:07-05:24	C11-S01 (08-01.50N, 155-55.36E, 4834 m) CTD cast with 2 water samplings, down to 2000 m depth
Feb. 11 (Fri.)		
15:13	06:13	Launching of Argo float (13-56.17N, 155-55.36E, 6048m)
Feb. 12 (Sat.)		
		Cruise for 23N 150E
Feb. 13 (Sun.)		
08:57-10:10	23:57-01:10	C12-S01 (22-59.82N, 150-00.10E, 5742 m) CTD cast with 2 water samplings, down to 2000 m depth
10:14	01:14	Launching of Argo float (22-59.82N, 150-00.10E, 5742 m)
Feb. 14 (Mon.)		
		Cruise for Hachinohe
Feb. 15 (Tue.)		
		Cruise for Hachinohe
Feb. 16 (Wed.)		
		Cruise for Hachinohe
Feb. 17 (Thu.)		
18:00	09:00	Stop of continuous water and shipboad observations
Feb. 18 (Fri.)		
09:00	00:00	Arrival at Hachinohe, Japan
15:00	06:00	Departure at Hachinohe
Feb. 19 (Sat.)		
09:00	00:00	Arrival at Sekinehama, Japan

3.4 Cruise track

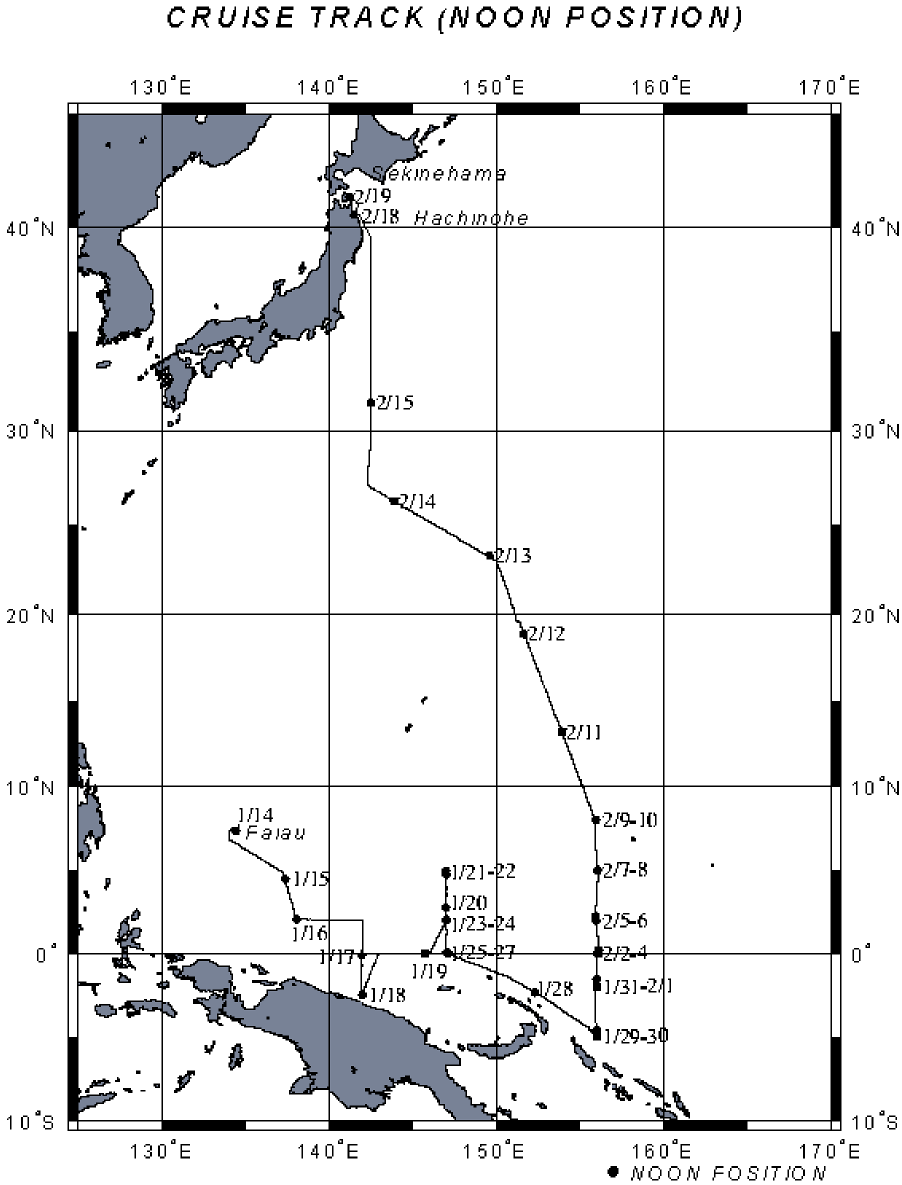


Figure 3.4-1. Noon Position.

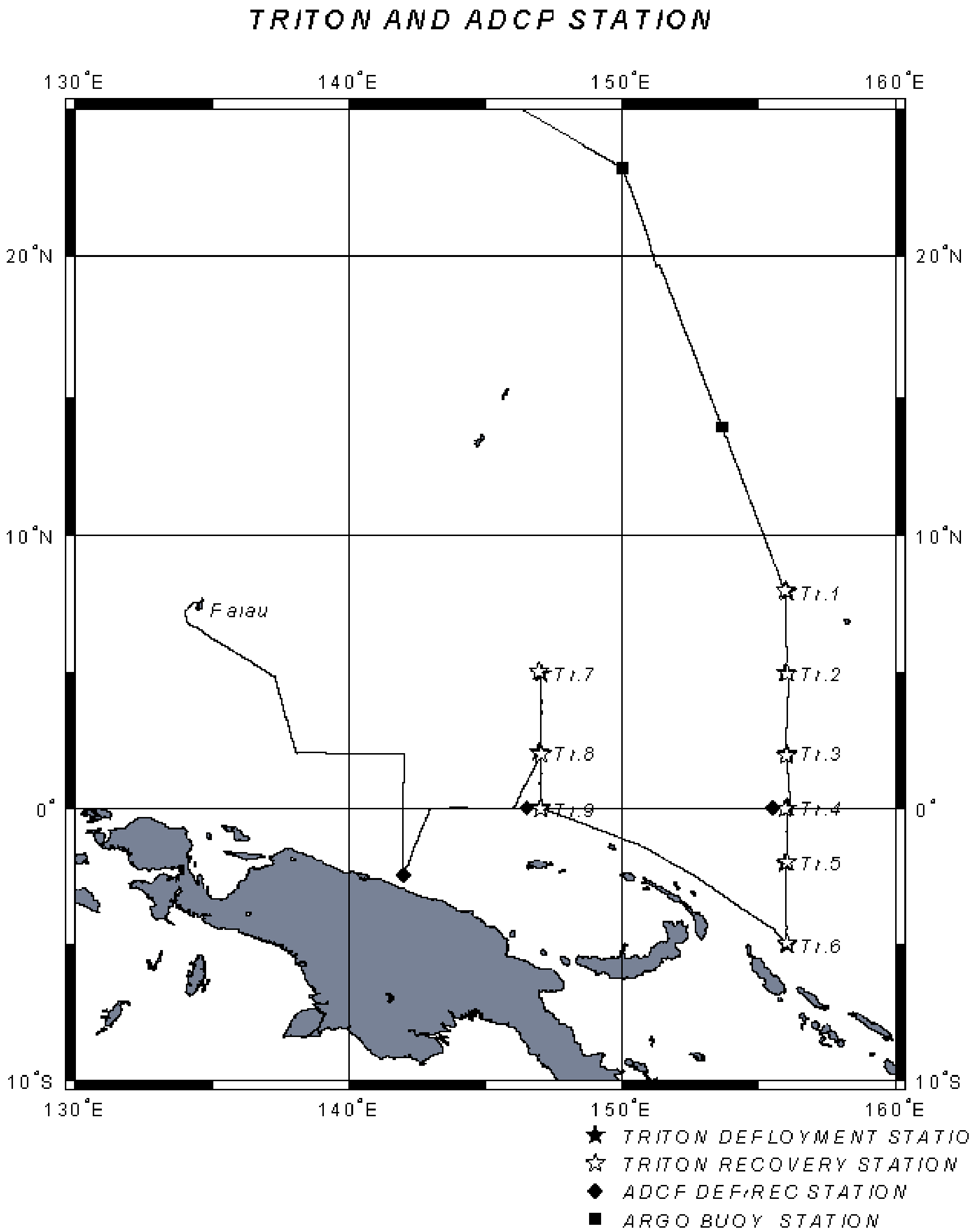


Figure 3.4-2. TRITON BUOY and ADCP Recovery/Deployment Position.

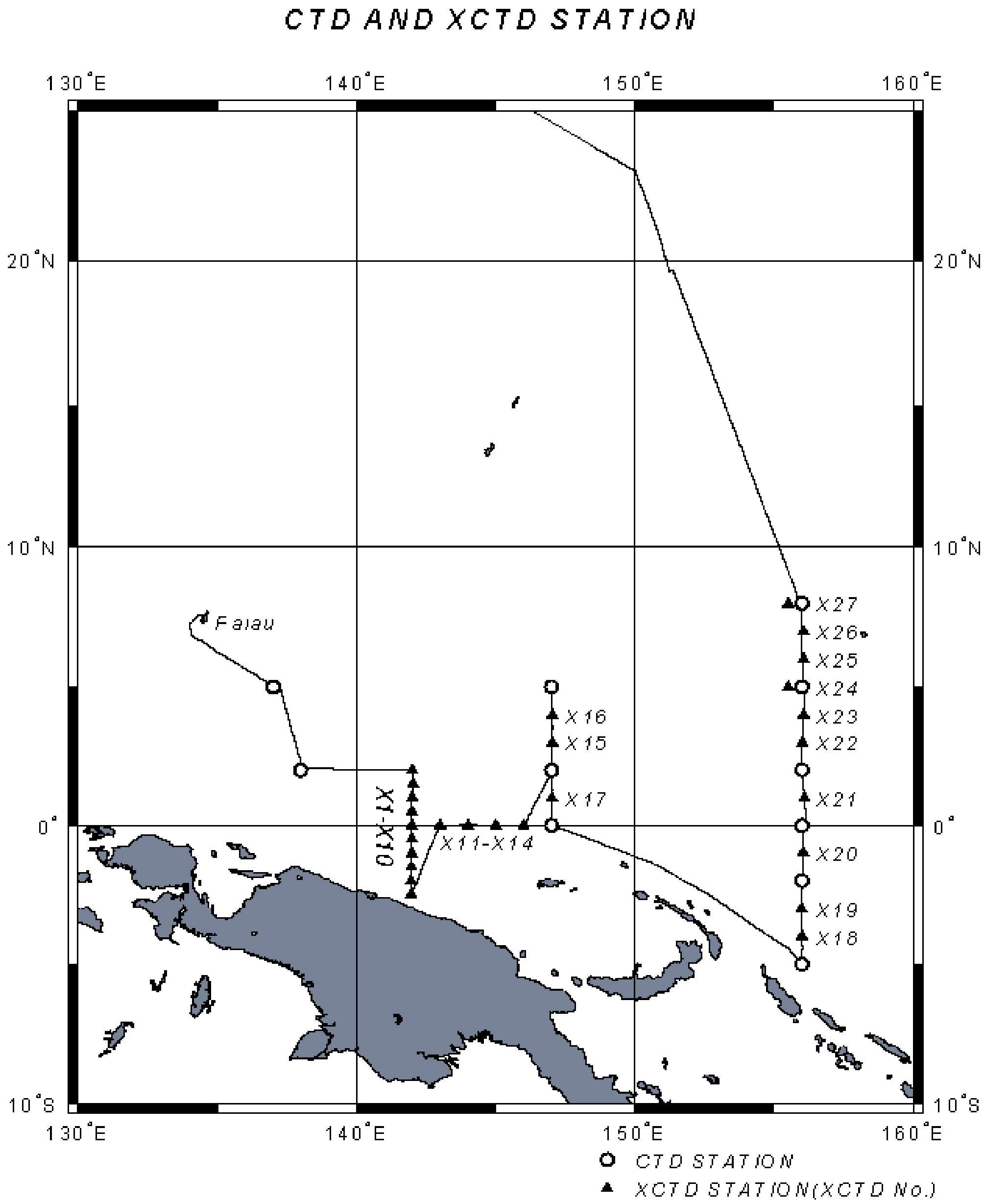


Figure 3.4-3. CTD and XCTD Stations.

4. Chief scientist

Shigeki Hosoda
Research Scientist
Institute of Observational Research for Global Change (IORGC),
Japan Agency for Marine-Earth Science and Technology (JAMSTEC)
2-15, Natsushima-cho, Yokosuka, 237-0061, Japan

5. Participants list

5.1. R/V MIRAI scientist and technical staff

Sigeki Hosoda	JAMSTEC
Masayuki Yamaguchi	JAMSTEC
Akihide Kamei	NIES
Kouhei Murata	K-Tokai Univ.
Shinya Okumura	GODI
Ryo Ohyama	GODI
Masaki Taguchi	MWJ
Takeo Matsumoto	MWJ
Hiroshi Matsunaga	MWJ
Kei Suminaga	MWJ
Masaki Furuhata	MWJ
Kenichi Katayama	MWJ
Takayuki Hashimukai	MWJ
Akinori Murata	MWJ
Keisuke Matsumoto	MWJ
Masanori Enoki	MWJ
Ayaka Hatsuyama	MWJ

JAMSTEC:	Japan Agency for Marine-Earth Science and Technology 2-15 Natsushima, Yokosuka, Kanagawa, Japan
NIES:	National Institute for Environmental Studies 16-2 Onogawa, Tsukuda, Ibaraki, Japan
K-Tokai Univ.:	Kyushu Tokai University Kawayo, Choyo-mura, Aso-gun, Kumamoto, Japan
GODI:	Global Ocean Development Inc. 1-13-8 Kamiookanishi, Konan-ku, Yokohama, Japan
MWJ:	Marine Works Japan Ltd. 2-16-32-2F Kamariyahigashi, Kawazawa-ku, Yokohama, Japan

5.2 R/V MIRAI Crew member

Master	Yujirou Kita
Chief Officer	Takahiro Sakoda
1st. Officer	Haruhiko Inoue
2nd Officer	Katsunori Minami
3rd Officer	Nobuo Fukaura
Chief Engineer	Toshiyuki Igata
1st Engineer	Shinji Tokunaga
2nd Engineer	Takashi Ohmichi
3rd Engineer	Kenji Ishida
Chief Radio Officer	Shuji Nakabayashi
2nd Radio Officer	Keiichirou Shishido
Boatswain	Kenetsu Ishikawa
Able Seaman	Kenichi Torao
Able Seaman	Keiji Yamauchi
Able Seaman	Chiaki Takata
Able Seaman	Kunihiko Omote
Able Seaman	Masami Sugami
Able Seaman	Hisao Oguni
Able Seaman	Yosuke Kuwahara
Able Seaman	Kazuyoshi Kudo
Able Seaman	Tsuyoshi Sato
Able Seaman	Tsuyoshi Monzawa
Able Seaman	Masashige Okada
No1. Oiler	Yukitoshi Horiuchi
Oiler	Toshimi Yoshikawa
Oiler	Kiyoharu Emoto
Oiler	Yoshihiro Sugimoto
Oiler	Nobuo Boshita
Oiler	Kazumi Yamashita
Chief Steward	Yasutaka Kurita
Cook	Hatsuji Hiraishi
Cook	Hitoshi Ota
Cook	Tatsuji Hamabe
Cook	Hiroyuki Yoshizawa

6. General observation

6.1 Meteorology and atmospheric observation

6.1.1 Surface Meteorological Observation

Shinya Okumura	(Global Ocean Development Inc.,GODI)
Ryo Ohyama	(GODI)
Kunio Yoneyama	(JAMSTEC) Principal Investigator / Not on-board

Objectives

The surface meteorological parameters are observed as a basic dataset of the meteorology. These parameters bring us the information about the temporal variation of the meteorological condition surrounding the ship.

Methods

The surface meteorological parameters were observed throughout the MR04-08Leg2 cruise from departure at Palau on 14 January 2005 to arrival at Sekinehama on 19 February 2005. At this cruise, we used two systems for the surface meteorological observation.

1) MIRAI Surface Meteorological observation (SMet) system
2) Shipboard Oceanographic and Atmospheric Radiation (SOAR) System

1) MIRAI Surface Meteorological observation (SMet) system

Instruments of SMet system are listed in Table 6.1.1-1 and measured parameters are listed in Table 6.1.1-2. Data was collected and processed by KOAC-7800 weather data processor made by Koshin-Denki, Japan. The data set has 6-second averaged.

2) Shipboard Oceanographic and Atmospheric Radiation (SOAR) system

SOAR system designed by BNL (Brookhaven National Laboratory, USA) consists of major three parts.

i) Portable Radiation Package (PRP) designed by BNL – short and long wave downward radiation.
ii) Zeno Meteorological (Zeno/Met) system designed by BNL – wind, air temperature, relative humidity, pressure, and rainfall measurement.
iii) Scientific Computer System (SCS) designed by NOAA (National Oceanic and Atmospheric Administration, USA) – centralized data acquisition and logging of all data sets.

SCS recorded PRP data every 6 seconds, Zeno/Met data every 10 seconds. Instruments and their locations are listed in Table6.1.1-3 and measured parameters are listed in Table 6.1.1-4.

We have carried out inspecting and comparing about following three sensors, before and after the cruise.

a) Young Rain gauge (SMet and SOAR)
   Inspecting the linearity of output value from the rain gauge sensor to change input value by adding fixed quantity of test water.
b) Barometer (SMet and SOAR)
   Comparing with the portable barometer value, PTB220CASE, VAISALA.
c) Thermometer (air temperature and relative humidity) (SMet and SOAR)
   Comparing with the portable thermometer value, HMP41/45, VAISALA.

Preliminary results

Figures 6.1.1-1 show the time series of the following parameters;

Wind (SOAR)
Air temperature (SOAR)
Relative humidity (SOAR)
Precipitation (SOAR)
Short/long wave radiation (SOAR)
Pressure (SOAR)
Sea surface temperature (SMet)
Significant wave height (SMet)

Data archives

The raw data obtained during this cruise will be submitted to the JAMSTEC Data Management Division. Corrected datasets will be available from K. Yoneyama (JAMSTEC).

Remarks

(1) There is no PRPdata which shows following period, due to the FRSR sensor maintenance.
22 Jan 2005 06:41:54UTC - 22 Jan 2005 06:44:15UTC

(2) We used the calibraiton coefficents of the another PIR for calculate long wave radiation, due to the we replaced the PRPunits at the Chuuk port 11 Dec 2004.
We will recalculate long wave radiation data after next calibration.

Table 6.1.1-1 Instruments and installations of MIRAI Surface Meteorological system.

Sensors	Type	Manufacturer	Location (altitude from surface)
Anemometer	KE-500	Koshin Denki, Japan	foremast (24 m)
Tair/RH	HMP45A	Vaisala, Finland	
with 43408 Gill aspirated radiation shield		R.M. Young, USA	compass deck (21 m)
			starboard side and port side
Thermometer: SST	RFN1-0	Koshin Denki, Japan	4th deck (-1m, inlet -5m)
Barometer	F-451	Yokogawa, Japan	captain deck (13 m)
			weather observation room
Rain gauge	50202	R. M. Young, USA	compass deck (19 m)
Optical rain gauge	ORG-815DR	Osi, USA	compass deck (19 m)
Radiometer (short wave)	MS-801	Eiko Seiki, Japan	radar mast (28 m)
Radiometer (long wave)	MS-202	Eiko Seiki, Japan	radar mast (28 m)
Wave height meter	MW-2	Tsurumi-seiki, Japan	bow (10 m)

Table 6.1.1-2 Parameters of MIRAI Surface Meteorological observation system.

	Parmeter	Units	Remarks
1	Latitude	degree	
2	Longitude	degree	
3	Ship's speed	knot	Mirai log, DS-30 Furuno
4	Ship's heading	degree	Mirai gyro, TG-6000, Tokimec
5	Relative wind speed	m/s	6sec./10min. averaged
6	Relative wind direction	degree	6sec./10min. averaged
7	True wind speed	m/s	6sec./10min. averaged
8	True wind direction	degree	6sec./10min. averaged
9	Barometric pressure	hPa	adjusted to sea surface level 6sec. averaged
10	Air temperature (starboard side)	degC	6sec. averaged
11	Air temperature (port side)	degC	6sec. averaged
12	Dewpoint temperature (starboard side)	degC	6sec. averaged
13	Dewpoint temperature (port side)	degC	6sec. averaged
14	Relative humidity (starboard side)	%	6sec. averaged
15	Relative humidity (port side)	%	6sec. averaged
16	Sea surface temperature	degC	6sec. averaged
17	Rain rate (optical rain gauge)	mm/hr	hourly accumulation
18	Rain rate (capacitive rain gauge)	mm/hr	hourly accumulation
19	Down welling shortwave radiation	W/m^2	6sec. averaged
20	Down welling infra-red radiation	W/m^2	6sec. averaged
21	Significant wave height (bow)	m	hourly
22	Significant wave height (aft)	m	hourly
23	Significant wave period (bow)	second	hourly
24	Significant wave period (aft)	second	hourly

Table 6.1.1-3 Instrument and installation locations of SOAR system.

Sensors (*Zeno/Met*)	Type	Manufacturer	Location (altitude from surface)
Anemometer	05106	R.M. Young, USA	foremast (25 m)
Tair/RH	HMP45A	Vaisala, Finland	
with 43408 Gill aspirated radiation shield		R.M. Young, USA	foremast (24 m)
Barometer	61201	R.M. Young, USA	
with 61002 Gill pressure port		R.M. Young, USA	foremast (24 m)
Rain gauge	50202	R. M. Young, USA	foremast (24 m)
Optical rain gauge	ORG-815DA	Osi, USA	foremast (24 m)

Sensors (*PRP*)	Type	Manufacturer	Location (altitude from surface)
Radiometer (short wave)	PSP	Epply Labs, USA	foremast (25 m)
Radiometer (long wave)	PIR	Epply Labs, USA	foremast (25 m)
Fast rotating shadowband radiometer(FRSR)		Yankee, USA	foremast (25 m)

Table 6.1.1-4 Parameters of SOAR system.

	Parmeter	Units	Remarks
1	Latitude	degree	
2	Longitude	degree	
3	Sog	knot	
4	Cog	degree	
5	Relative wind speed	m/s	
6	Relative wind direction	degree	
7	Barometric pressure	hPa	
8	Air temperature	degC	
9	Relative humidity	%	
10	Rain rate (optical rain gauge)	mm/hr	
11	Precipitation (capacitive rain gauge)	mm	reset at 50 mm
12	Down welling shortwave radiation	W/m^2	
13	Down welling infra-red radiation	W/m^2	
14	Defuse irradiance	W/m^2	

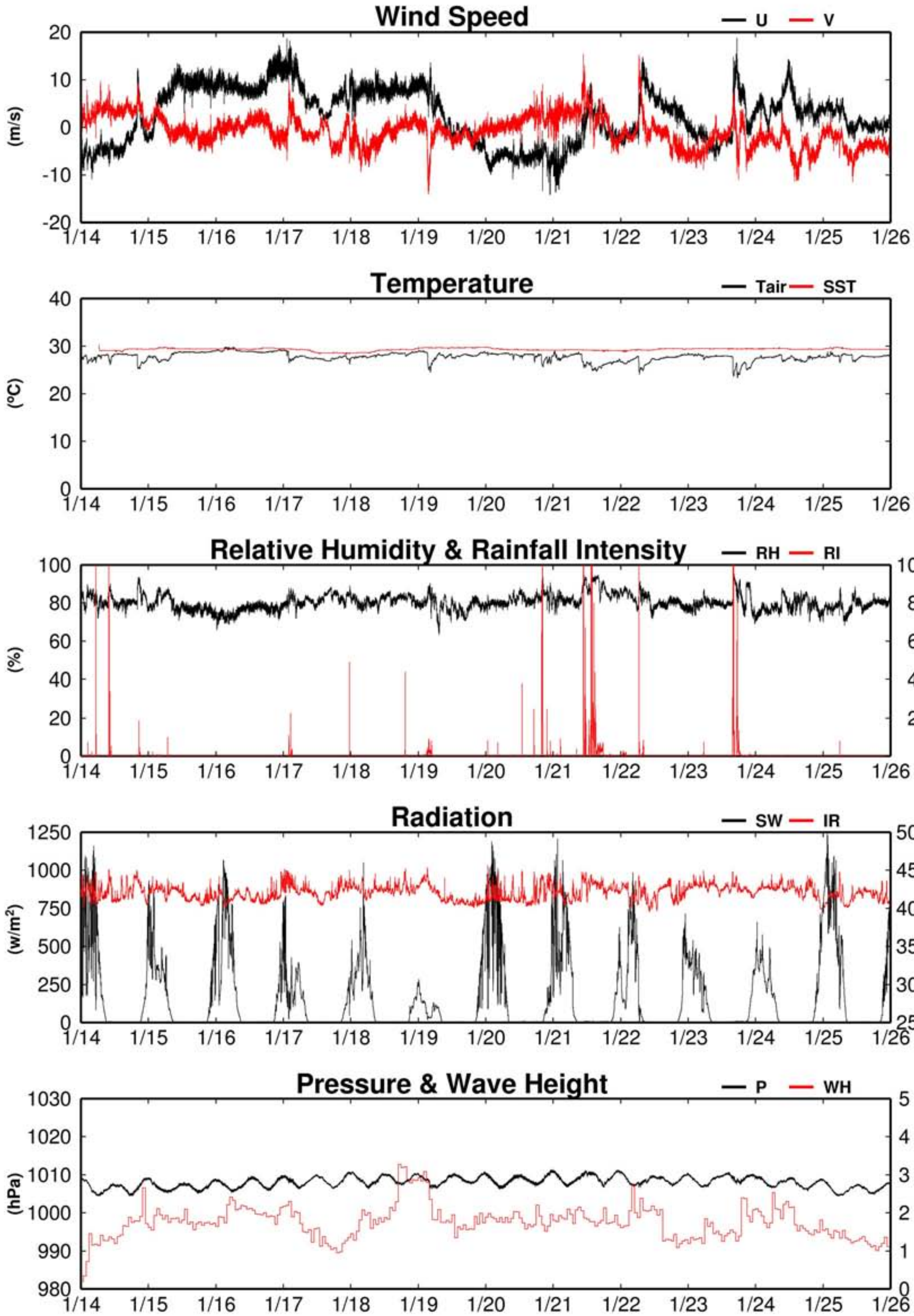


Figure 6.1.1-1 Time series of surface meteorological parameters during the cruise.

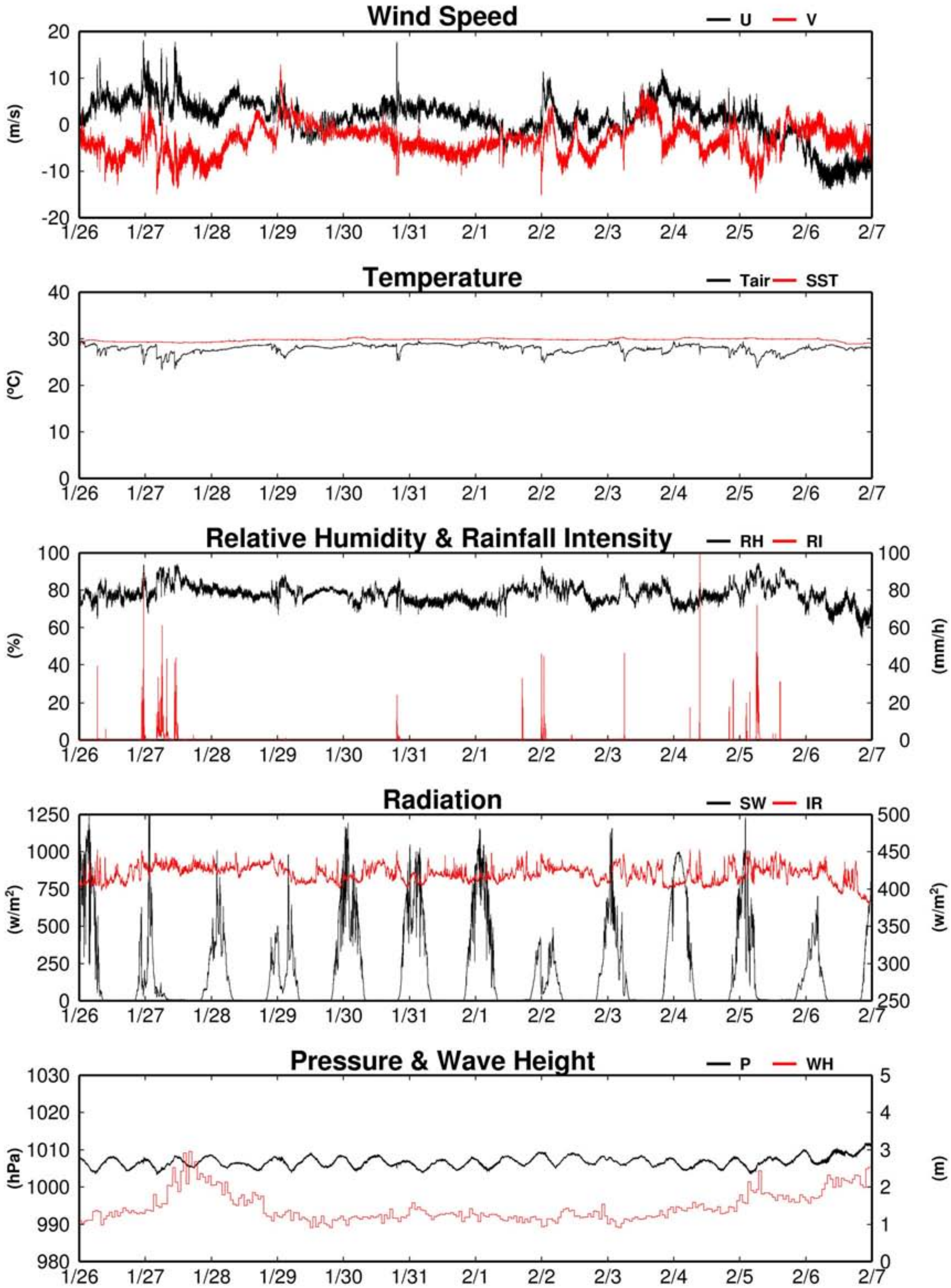


Figure 6.1.1-1 Continue.

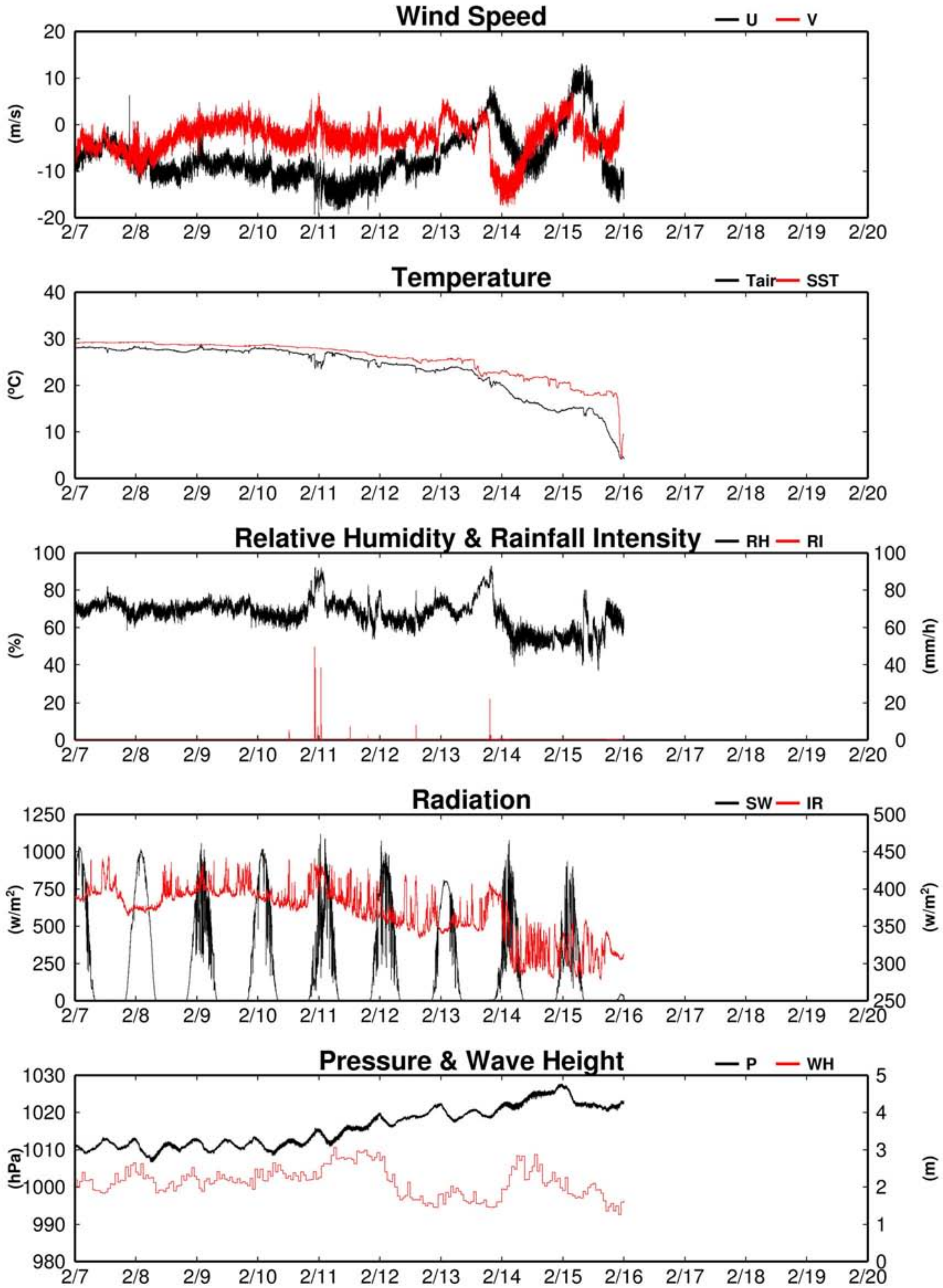


Figure 6.1.1-1 Continue.

6.1.2 Ceilometer Observation

Shinya Okumura (Global Ocean Development Inc.,GODI)
Ryo Ohyama (GODI)
Kunio Yoneyama (JAMSTEC) Principal Investigator / Not on-board

(1) Objectives

The information of cloud base height and the liquid water amount around cloud base is important to understand the process of the formation of cloud. To get the information, the ceilometer observation was carried out.

(2) Parameters

1. Cloud base height [m].
2. Backscatter profile, sensitivity and range normalized at 30 m resolution.
3. Estimated cloud amount [oktas] and height [m]; Sky Condition Algorithm.

(3) Methods

We measured cloud base height and backscatter profile using ceilometer (CT-25K, VAISALA, Finland) throughout the MR04-08Leg2 cruise from the departure of Palau on 14 January 2005 to arrival of Sekinehama on 19 February 2005.

Major parameters for the measurement configuration are as follows;

Laser source:	Indium Gallium Arsenide (InGaAs) Diode
Transmitting wavelength:	905±5 mm at 25 degC
Transmitting average power:	8.9 mW
Repetition rate:	5.57 kHz
Detector:	Silicon avalanche photodiode (APD) Responsibility at 905 nm: 65 A/W
Measurement range:	0 ~ 7.5 km
Resolution:	50 ft in full range
Sampling rate:	60 sec
Sky Condition	0, 1, 3, 5, 7, 8 oktas (9: Vertical Visibility) (0: Sky Clear, 1:Few, 3:Scattered, 5-7: Broken, 8: Overcast)

On the archive dataset, cloud base height and backscatter profile are recorded with the resolution of 30 m (100 ft).

(4) Preliminary results

Figure 6.1.2-1 shows the time series of the first, second and third lowest cloud base height.

(5) Data archives

The raw data obtained during this cruise will be submitted to JAMSTEC Data Management Division.

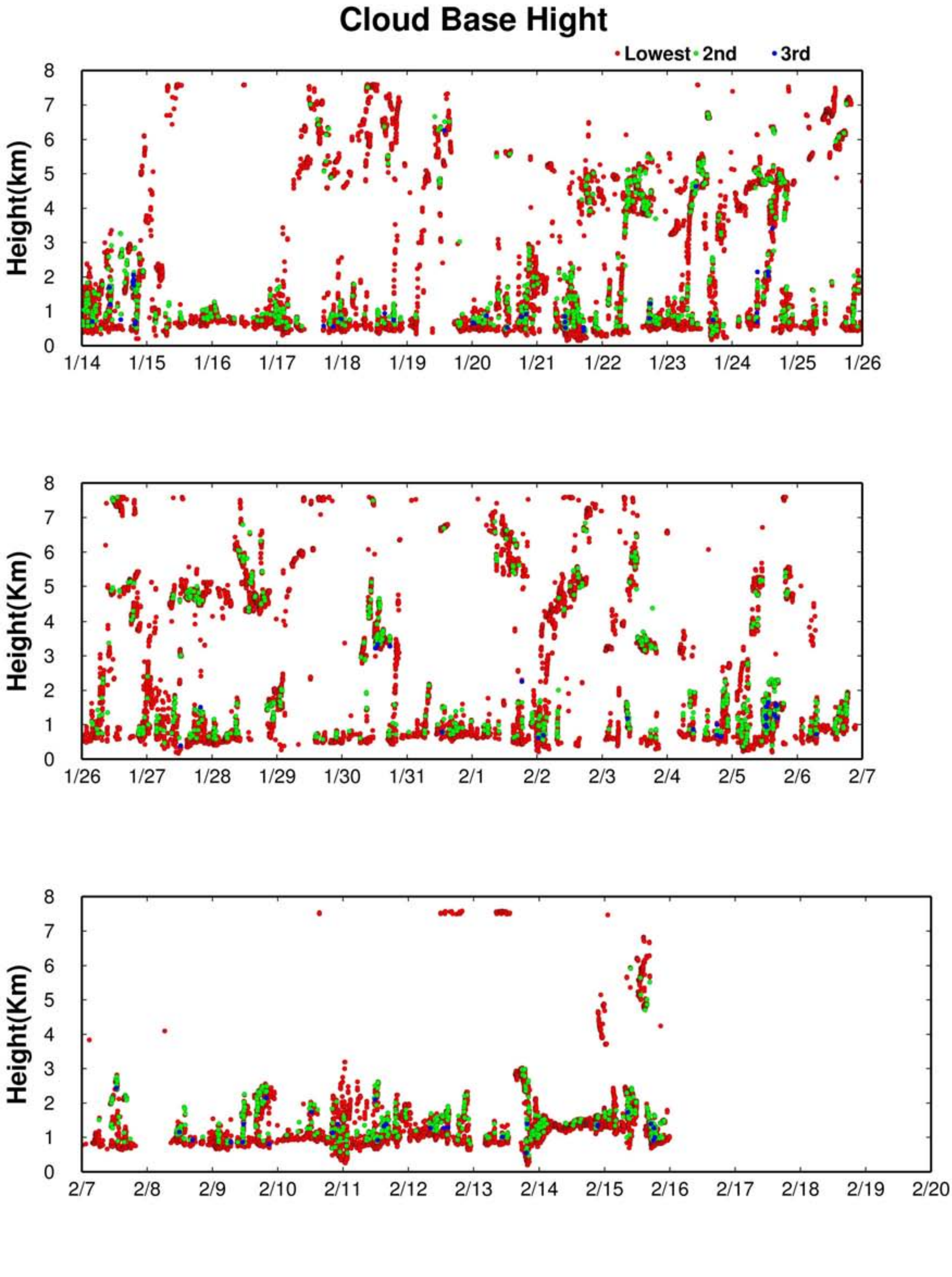


Figure 6.1.2-1 1st, 2nd and 3rd lowest cloud base height during the cruise.

6.2. CTD/XCTD

6.2.1. CTD

Personnel	Shigeki Hosoda	(JAMSTEC): Principal Investigator	
	Hiroshi Matsunaga	(MWJ)	:Operation leader
	Akinori Murata	(MWJ)	
	Masanori Enoki	(MWJ)	

(1) Objective

Investigation of oceanic structure and water sampling.

(2) Overview of the equipment and observation

CTD/Carousel water sampling system (CTD system), which is 12-position Carousel Water Sampler (SBE 32) with SBE 9plus (Sea-Bird Electronics Inc) attached with sensors, was used during this cruise. 12-litter Niskin bottles were used for sampling seawater. The CTD system was deployed from starboard on working deck. During this cruise, 19 CTD observations were carried out (see Table 6.2.1).

(3) List of sensors and equipments

Under water unit:	SBE, Inc., SBE 9plus, S/N 0280
Temperature sensor:	SBE, Inc., SBE 3Plus, S/N 032453
Conductivity sensor:	SBE, Inc., SBE 04C, S/N 042435
Pump:	SBE, Inc., SBE 5T, S/N 053293
Deck unit:	SBE, Inc., SBE 11plus, S/N 11P8010-0308
Carousel Water Sampler:	SBE, Inc., SBE 32, S/N 3222295-0170
Water sample bottle:	General Oceanics, Inc., 12-litre Niskin-X

(4) Data processing

The SEASOFT-Win32 (Ver. 5.27b) was used for processing the CTD data. Descriptions and settings of the parameters for the SEASOFT were written as follows.

DATCNV converted the raw data to scan number, pressure, depth, temperatures, conductivities, descent rate. modulo error count and pump status. DATCNV also extracted bottle information where scans were marked with the bottle confirm bit during acquisition. The duration was set to 3.0 seconds, and the offset was set to 0.0 seconds.

ROSSUM created a summary of the bottle data. The bottle position, date, time were output as the first two columns. Salinity, sigma-theta and potential temperatures were averaged over 3.0 seconds.

WILDEDIT marked extreme outliers in the data files. The first pass of WILDEDIT obtained an accurate estimate of the true standard deviation of the data. The data were read in blocks of 1000 scans. Data greater than 10 standard deviations were flagged. The second pass computed a standard deviation over the same

1000 scans excluding the flagged values. Values greater than 20 standard deviations were marked bad. This process was applied to pressure, temperatures and conductivities outputs.

CELLTM used a recursive filter to remove conductivity cell thermal mass effects from the measured conductivity. Typical values used were thermal anomaly amplitude alpha = 0.03 and the time constant 1/beta = 7.0.

FILTER performed a low pass filter on pressure with a time constant of 0.15 seconds. In order to produce zero phase lag (no time shift) the filter runs forward first then backwards.

SECTION selected a time span of data based on scan number in order to reduce a file size. The minimum number was set to be the starting time when the CTD package was beneath the sea-surface after activation of the pump. The maximum number was set to be the end time when the package came up from the surface. (Data to check the CTD pressure drift were prepared before SECTION.)

LOOPEDIT marked scans where the CTD was moving less than the minimum velocity of 0.0 m/s (traveling backwards due to ship roll).

BINAVG averaged the data into 1 dbar pressure bins. The center value of the first bin was set equal to the bin size. The bin minimum and maximum values are the center value plus and minus half the bin size. Scans with pressures greater than the minimum and less than or equal to the maximum were averaged. Scans were interpolated so that a data record exists every dbar.

DERIVE was re-used to compute salinity, potential temperature, and sigma-theta.

SPLIT was used to split data into the down cast and the up cast.

(5) Preliminary Results

Date, time and locations of the CTD casts are listed in Table 6.2.1. Vertical profile of temperature and salinity with pressure are shown in Figure 6.2.1-1 – 19.

(6) Data archive

All raw and processed data files will be submitted to the Data Management Office (DMO) and will be opened to public via “R/V MIRAI Data Web Page” in the JAMSTEC web site.

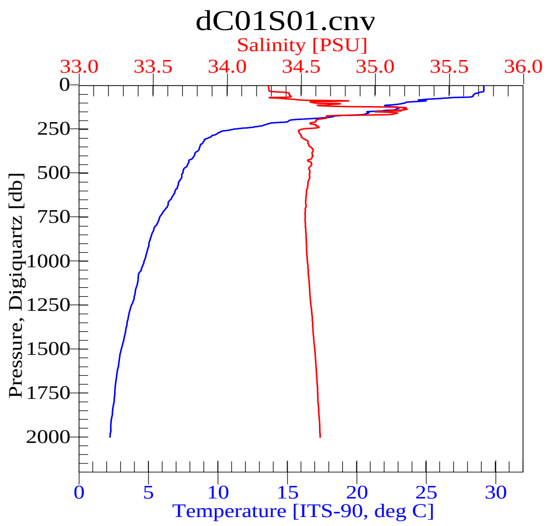


Figure 6.2.1-1.

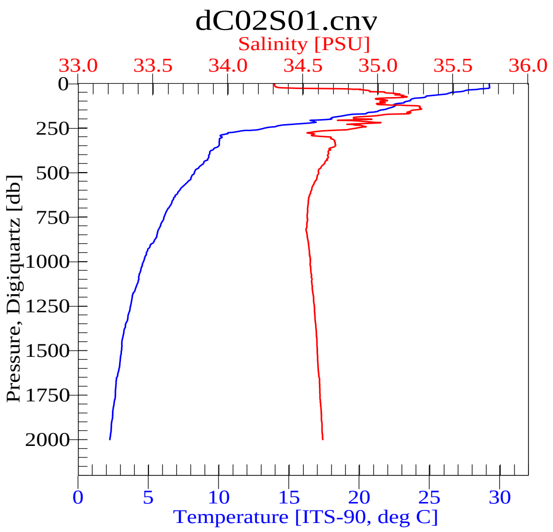


Figure 6.2.1-2.

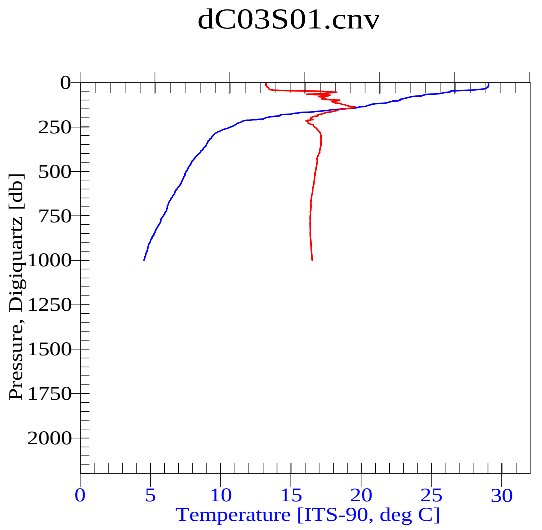


Figure 6.2.1-3.

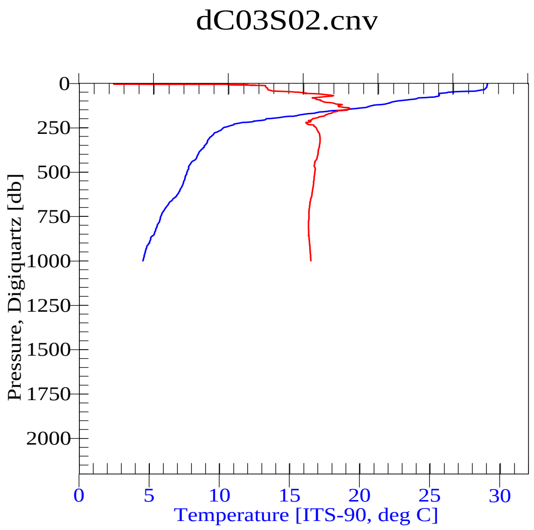


Figure 6.2.1-4.

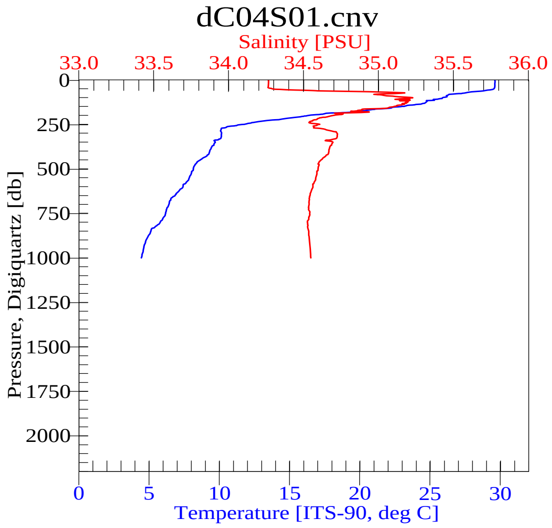


Figure 6.2.1-5.

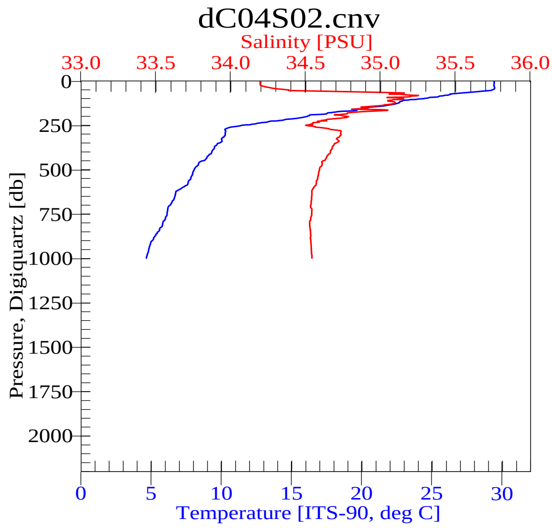


Figure 6.2.1-6.

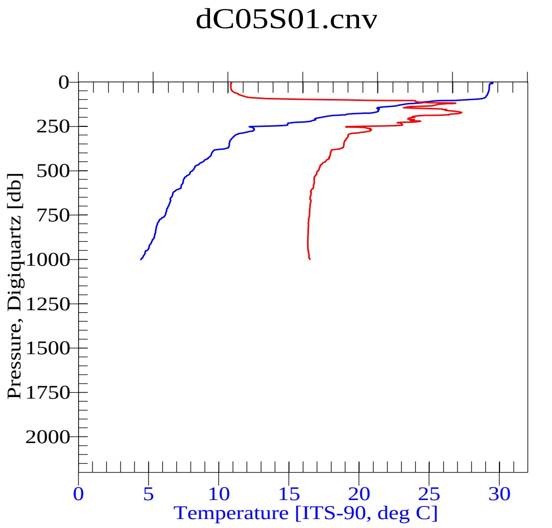


Figure 6.2.1-7.

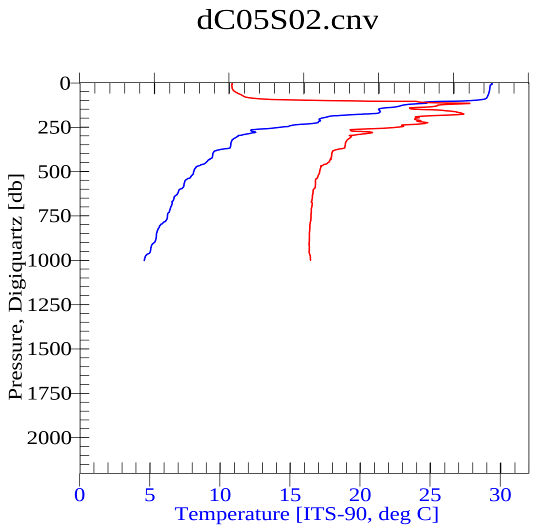


Figure 6.2.1-8.

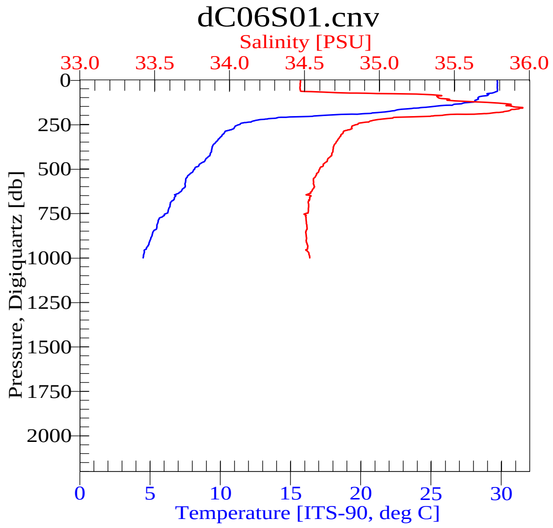


Figure 6.2.1-9.

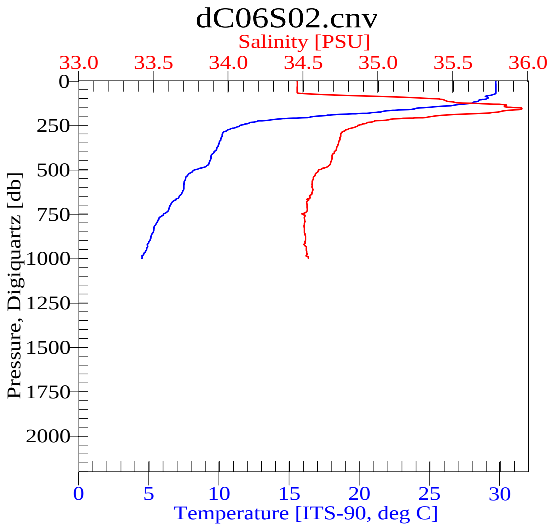


Figure 6.2.1-10.

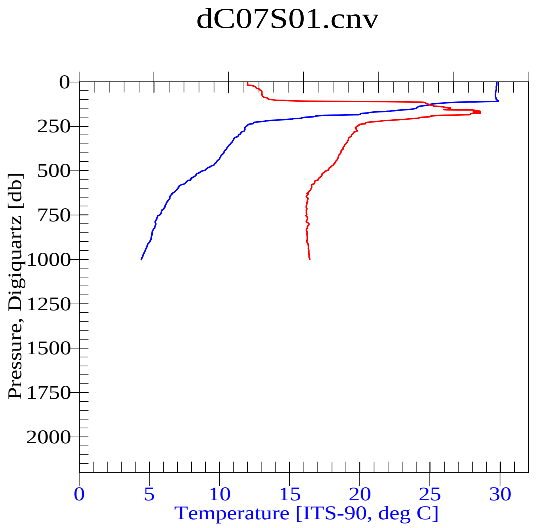


Figure 6.2.1-11.

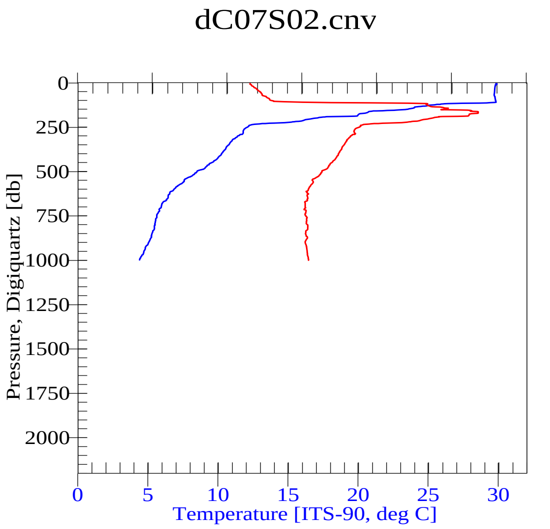


Figure 6.2.1-12.

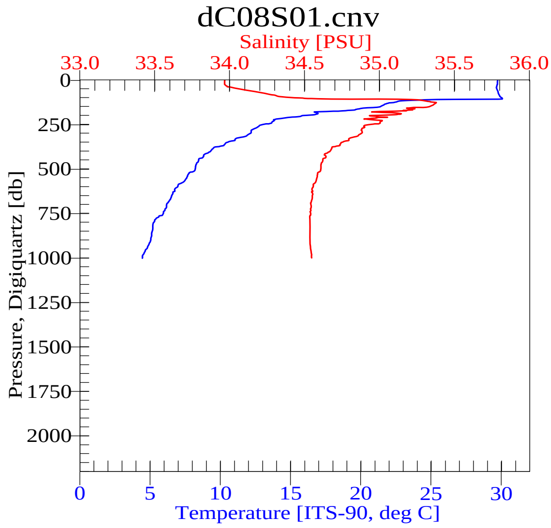


Figure 6.2.1-13.

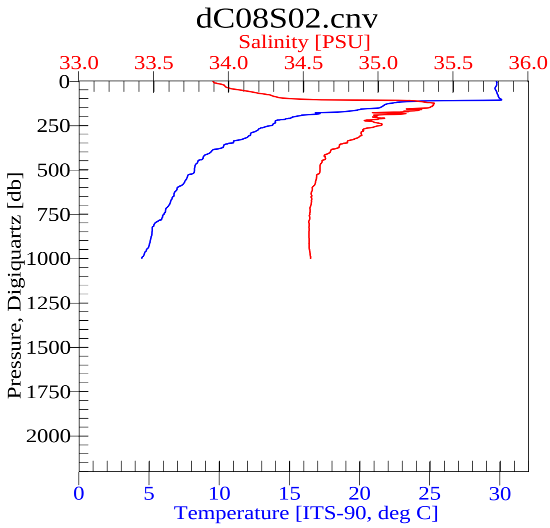


Figure 6.2.1-14.

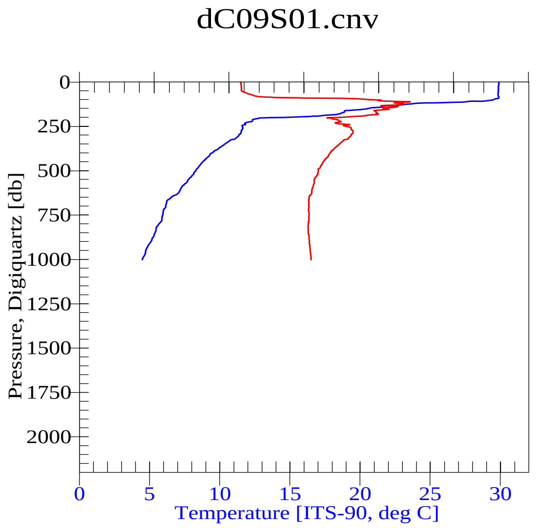


Figure 6.2.1-15.

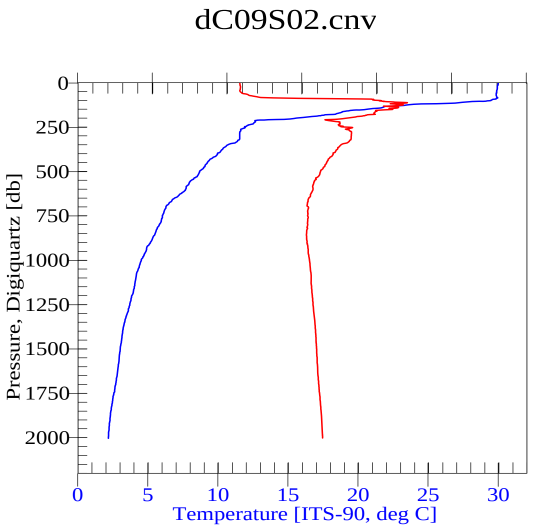


Figure 6.2.1-16.

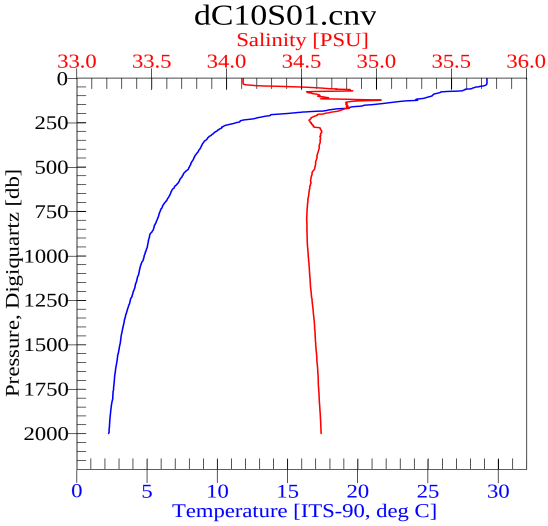


Figure 6.2.1-17.

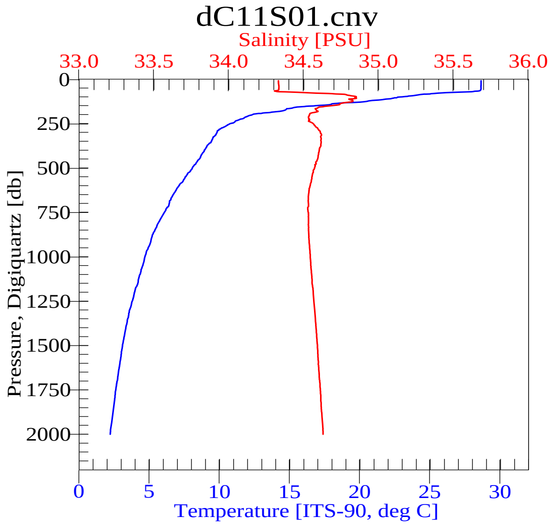


Figure 6.2.1-18.

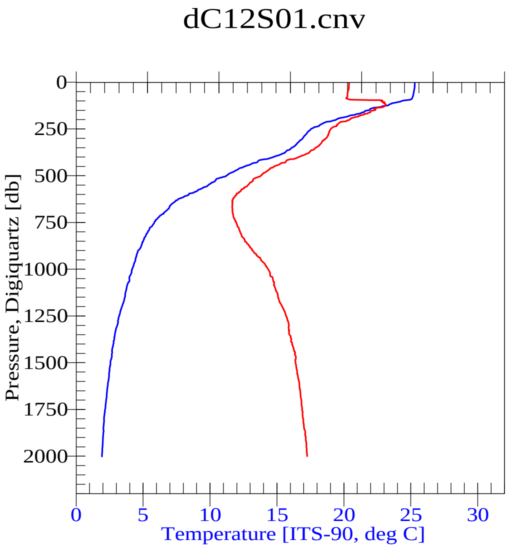


Figure 6.2.1-19.

Table 6.2.1 CTD Cast table

STNNBR	CASTNO	Date(UTC)	Time(UTC)		Start Position		Depth	WIRE	Max	Max	CTD data	Remarks
		yyyy/mm/dd	Start	End	Latitude	Longitude		OUT	Depth	Pressure	file name	
C01	1	2005/1/14-15	23:57	1:10	04-52.29N	137-16.47E	4086.0	1988.2	1980.2	2000.4	C01S01	
C02	1	2005/1/15-16	22:58	0:10	02-03.29N	138-04.36E	4310.0	1990.8	1980.5	2000.1	C02S01	
C04	1	2005/1/19	23:00	23:42	01.58.41N	147-02.91E	4509.0	996.7	993.2	1000.6	C04S01	
C03	1	2005/1/21	2:20	2:57	04-58.30N	147-01.24E	4289.0	998.1	993.6	1001.0	C03S01	
C03	2	2005/1/21	5:07	5:45	05-03.46N	146-57.43E	4214.0	997.4	993.7	1001.9	C03S02	
C04	2	2005/1/24	4:01	4:39	01-59.59N	147-01.57E	4518.0	997.6	992.1	1000.4	C04S02	
C05	1	2005/1/25	3:59	4:38	00-03.51N	147-01.34E	4475.0	996.3	992.8	1000.4	C05S01	
C05	2	2005/1/25	5:15	5:53	00-00.72N	147-02.46E	4499.0	994.3	992.9	1001.3	C05S02	
C06	1	2005/1/29	1:28	2:03	05-02.27S	156-01.95E	1508.0	997.8	993.1	1000.0	C06S01	*1
C06	2	2005/1/29	3:59	4:34	04-58.82S	156-01.76E	1495.0	995.0	992.7	1001.1	C06S02	
C07	1	2005/1/31	1:31	2:08	02-00.66S	155-56.93E	1751.0	997.0	992.1	1000.8	C07S01	*2
C07	2	2005/1/31	4:11	4:46	01-59.28S	156-01.91E	1760.0	991.9	993.3	1000.2	C07S02	
C08	1	2005/2/2	4:12	4:50	00-01.16N	156-03.48E	1952.0	994.3	993.0	1001.0	C08S01	
C08	2	2005/2/2	5:28	6:06	00-01.22S	156-00.69E	1943.0	995.2	992.7	1000.3	C08S02	
C09	1	2005/2/5	1:56	2:34	02-01.63N	156-01.02E	2583.0	1001.1	993.2	1000.7	C09S01	
C09	2	2005/2/5	4:12	5:24	01-56.89N	155-59.39E	2566.0	1997.9	1981.4	2000.4	C09S02	
C10	1	2005/2/8	4:11	5:27	04-58.96N	156-03.51E	3601.0	1982.0	1978.8	2000.1	C10S01	*3
C11	1	2005/2/10	4:11	5:22	08-01.47N	155-55.39E	4827.0	1980.5	1979.6	2000.4	C11S01	*4
C12	1	2005/2/13	0:00	1:07	22-59.85N	150-00.06E	5736.0	1982.5	1977.4	2000.2	C12S01	

*1 The position information in the data file is missed. The position in this sheet is correct.

*2 There are spikes at 115db in salinity data.

*3 There are spikes at 1709db in salinity data.

*4 Surface information (upper 5db) was not observed because of rough sea.

6.2.2 XCTD obserevation

Shinya Okumura (Global Ocean Development Inc.,GODI)
Ryo Ohyama (GODI)
Shigeki Hosoda (JAMSTEC) Principal Investigator

(1) Objectives

Investigation of oceanic structure.

(2) Parameters

According to the manufacturer's nominal specifications, the range and accuracy of parameters measured by the XCTD (eXpendable Conductivity, Temperature & Depth profiler) are as follows;

Parameter	Range	Accuracy
Conductivity	0 ~ 60 mS/cm	+/- 0.03 mS/cm
Temperature	-2 ~ 35 deg-C	+/- 0.02 deg-C
Depth	0 ~ 1000 m	

(3) Methods

We observed the vertical profiles of the sea water temperature and salinity measured by XCTD-1 manufactured by Tsurumi-Seiki Co.. The signal was converted by MK-100, Tsurumi-Seiki Co. and was recorded by WinXCTD software (Ver.1.07) provided by Tsurumi-Seiki Co.. We cast 26 probes (X01 – X26) by using automatic launcher.

(4) Observation log

Table 6.2.2-1 XCTD observation log

Station	Date	Time	Lat.	Lon.	SST	SSS	MD	WD	Probe S/N
X01	2005/01/16	18:15	01-59.97N	141-59.78E	29.46	34.255	1035	2551	04037305
X02	2005/01/16	20:20	01-30.33N	142-01.23E	29.44	34.205	1036	2835	04037306
X03	2005/01/16	22:21	01-00.45N	141-59.49E	29.34	34.165	1036	3092	04037304
X04	2005/01/17	00:26	00-29.99N	141-58.92E	29.32	34.111	1035	3323	04037308
X05	2005/01/17	02:25	00-00.53N	141-58.73E	29.26	34.143	1037	3388	04037311
X06	2005/01/17	04:30	00-29.98S	141-58.44E	29.13	34.240	1035	3258	04037307
X07	2005/01/17	06:33	01-00.01S	141-58.41E	29.16	34.351	1035	2967	04037309
X08	2005/01/17	08:34	01-30.01S	141-57.67E	29.02	34.359	1033	3509	04037310
X09	2005/01/17	10:32	02-00.00S	141-57.11E	28.70	34.228	1035	3631	04037313
X10	2005/01/17	12:31	02-29.99S	141-56.88E	28.37	34.267	1035	3546	04037312
X11	2005/01/18	16:30	00-00.02N	142-59.99E	29.11	34.126	1036	3103	04037316
X12	2005/01/18	20:19	00-00.43N	143-60.00E	29.09	34.070	1036	3549	04037314
X13	2005/01/19	00:10	00-00.02S	145-00.04E	29.48	34.064	1036	3727	04037318
X14	2005/01/19	03:59	00-00.08S	145-59.99E	29.53	34.022	980	3720	04037317
X15	2005/01/20	04:01	03-00.03N	147-01.46E	29.36	34.437	1035	4418	04037320
X16	2005/01/20	08:12	03-59.98N	147-02.23E	29.15	34.118	1035	4780	04037319
X17	2005/01/24	08:58	01-00.01N	147-00.56E	29.49	34.054	1035	4530	04037321
X18	2005/01/30	05:23	04-00.02S	155-59.89E	30.20	34.423	1035	1783	04037323

X19	2005/01/30	09:18	03-00.01S	155-58.75E	29.75	34.312	1035	1809	04037322
X20	2005/02/01	05:18	00-58.40S	156-01.92E	30.01	34.123	1035	2079	04037325
X21	2005/02/04	06:15	00-59.99N	156-04.88E	30.11	34.021	1035	2219	04037326
X22	2005/02/06	06:02	02-59.99N	156-00.32E	29.66	34.102	1036	2877	04037328
X23	2005/02/06	10:12	04-00.00N	156-03.66E	29.55	34.152	1036	3490	04037329
X24	2005/02/06	14:15	05-00.03N	156-04.56E	28.91	34.143	1036	3600	04037327
X25	2005/02/08	09:38	06-00.00N	156-00.26E	28.64	34.316	1036	4148	04037331
X26	2005/02/08	13:41	06-59.98N	155-58.51E	28.63	34.331	1035	4493	04037332
X27	2005/02/08	21:35	08-00.02N	155-56.12E	28.46	34.366	1036	4794	04037330

Acronyms in Table 6.2.2-1 are as follows;

SST: Sea surface temperature [deg-C] measured by Continuous Sea Surface Monitoring System
SSS: Sea surface salinity [PSU] measured by Continuous Sea Surface Monitorring System
MD: Maximum measured depth [m]
WD: Water Depth [m]

(5) Preliminary results

Vertical sections are shown in the following figures ;
Figure 6.2.2-1, 6.2.2-2 and 6.2.2-3 show observed station and temperature, salinity along 142E from 2N to 2-30S.
Figure 6.2.2-4, 6.2.2-5 and 6.2.2-6 show observed station and temperature, salinity along EQ from 142E to 146E.
Figure 6.2.2-7, 6.2.2-8 and 6.2.2-9 show observed station and temperature, salinity along 147E from 4N to 1N.
Figure 6.2.2-10, 6.2.2-11 and 6.2.2-12 show observed station and temperature, salinity along 156E from 4S to 8N.

(6) Data archive

XCTD data obtained during this cruise will be submitted to the JAMSTEC and will be available via “R/V Mirai Data Web Page” in JAMSTEC home page.

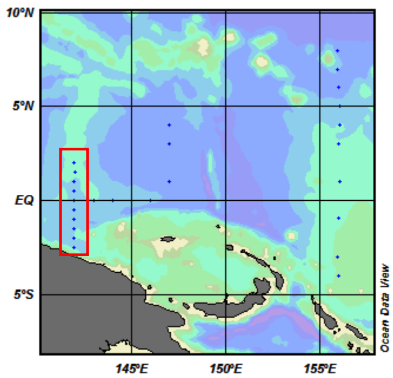


Figure 6.2.2-1 Observed station

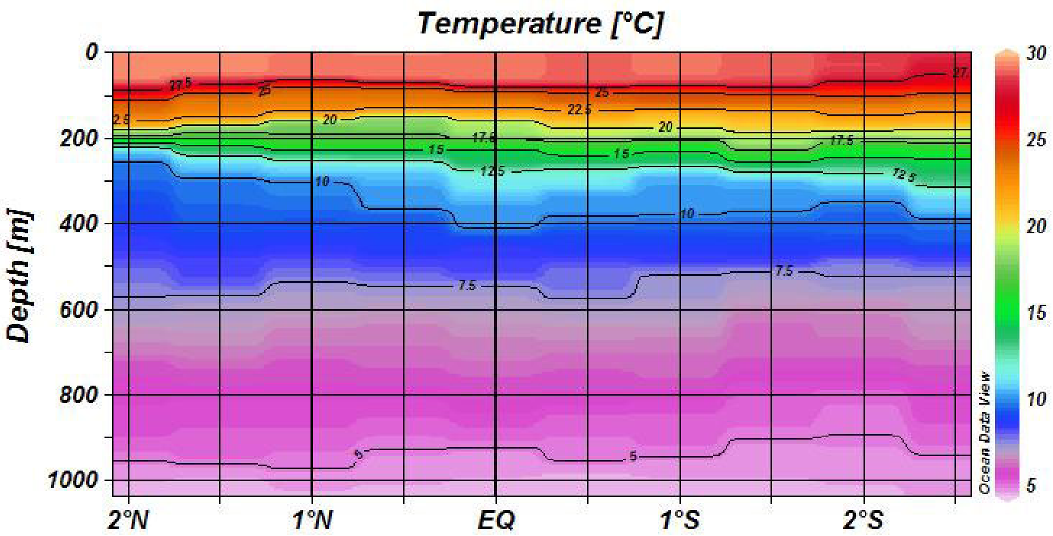


Figure 6.2.2-2 Temperature along 142E

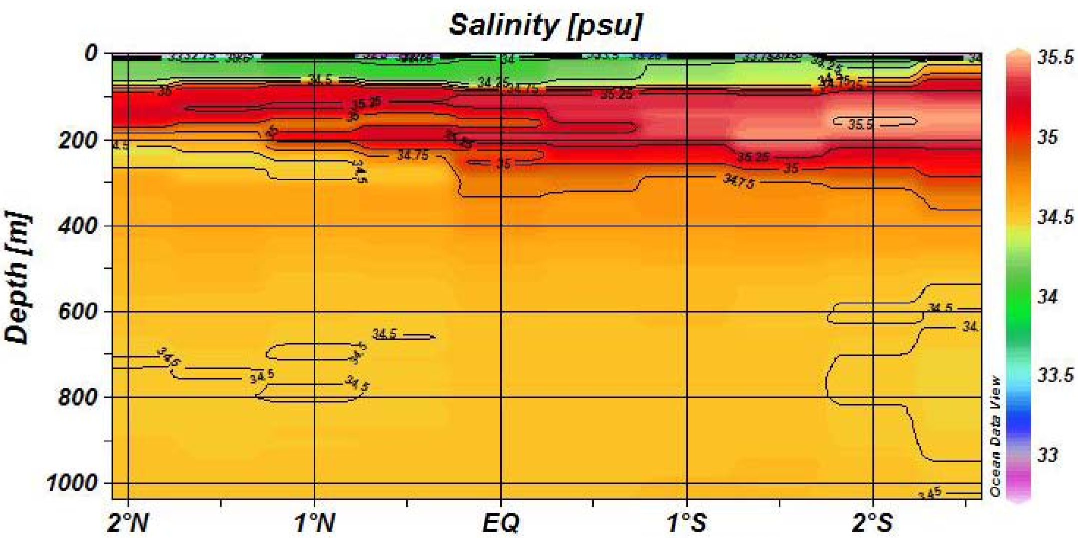


Figure 6.2.2-3 Salinity along 142E

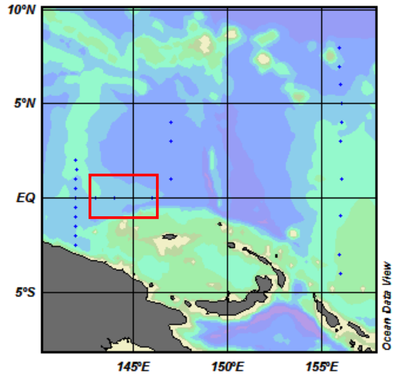


Figure 6.2.2-4 Observed station

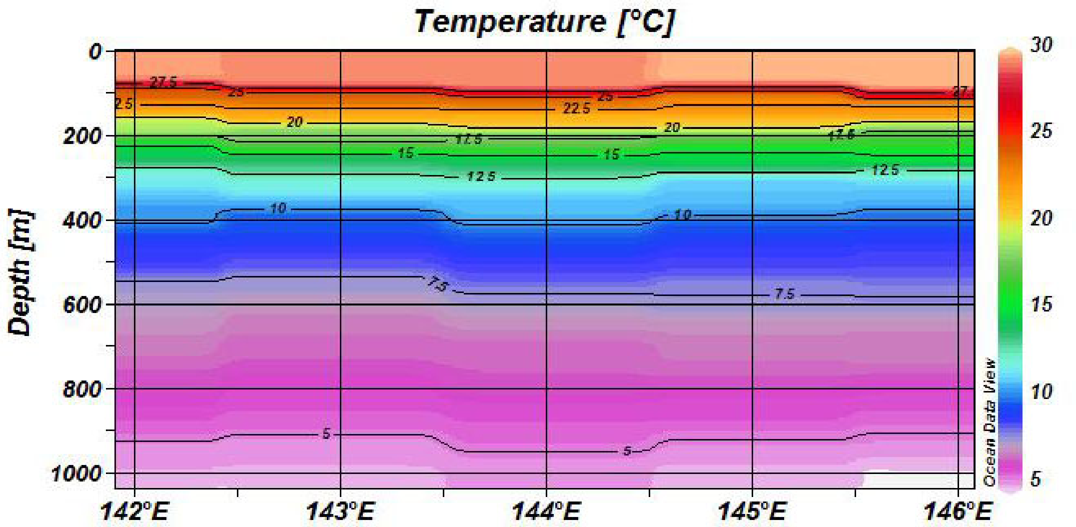


Figure 6.2.2-5 Temperature along EQ

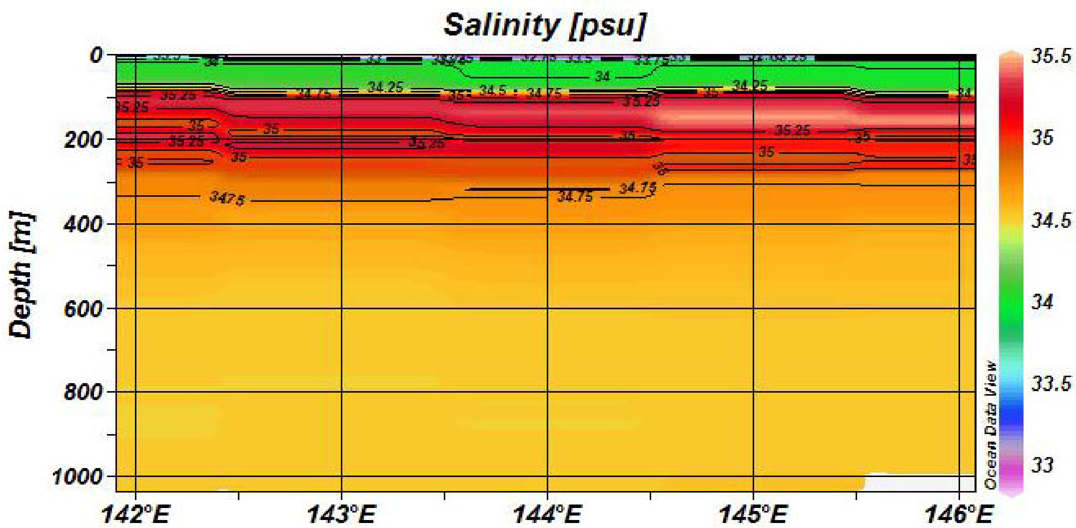


Figure 6.2.2-6 Salinity along EQ

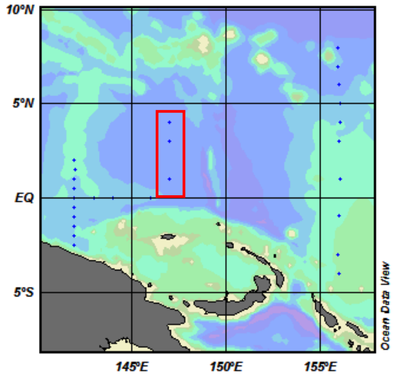


Figure 6.2.2-7 Observed station

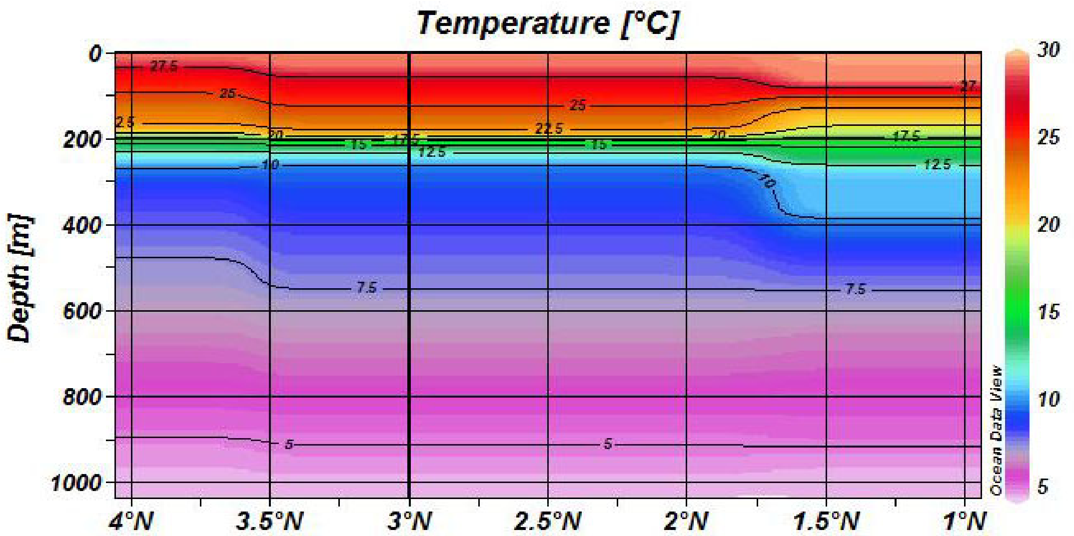


Figure 6.2.2-8 Temperature along 147E

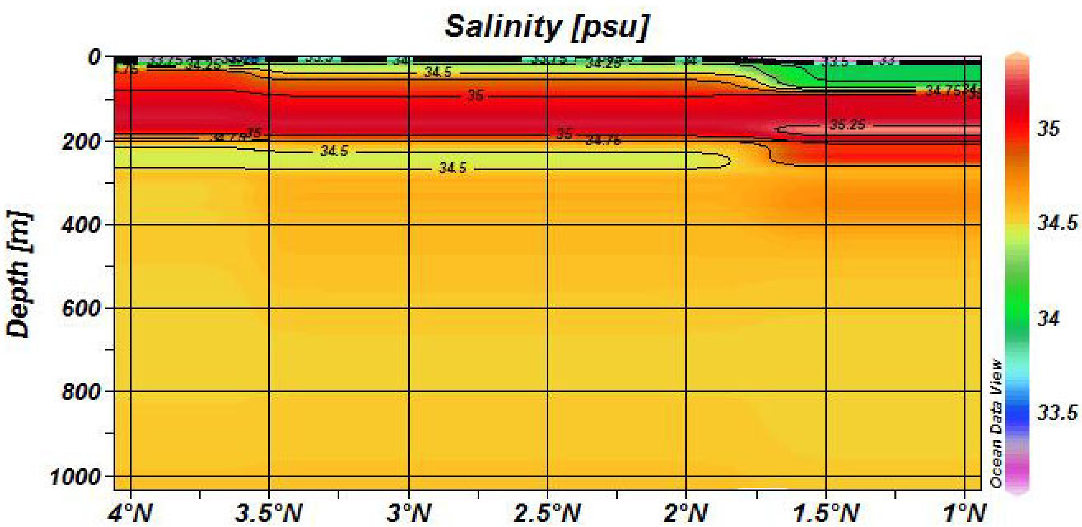


Figure 6.2.2-9 Salinity along 147E

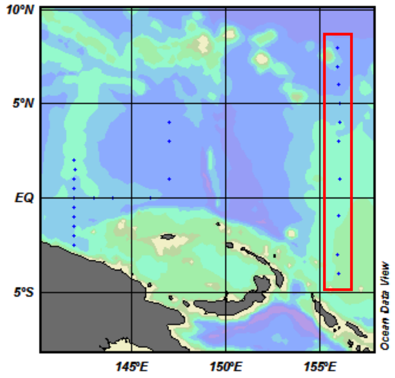


Figure 6.2.2-10 Observed station

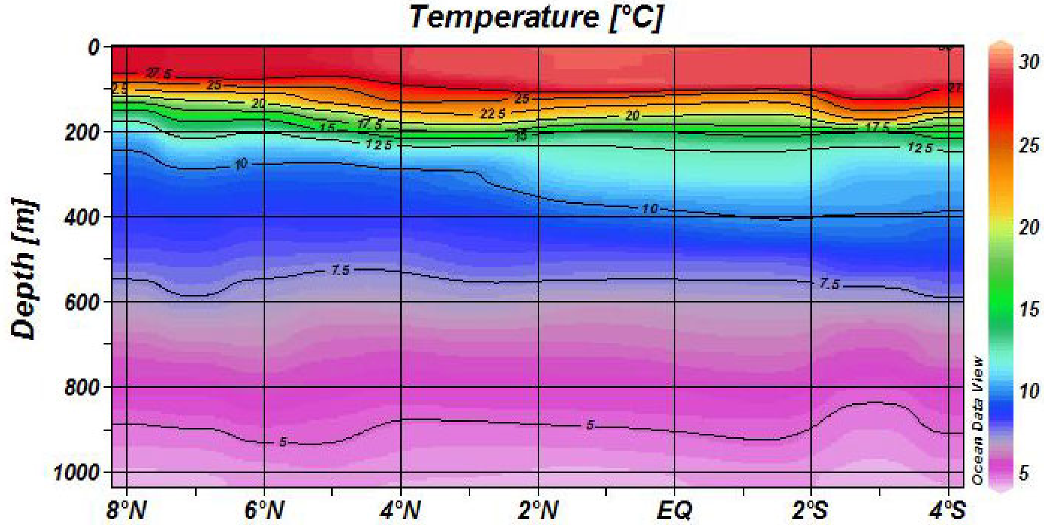


Figure 6.2.2-11 Temperature along 156E

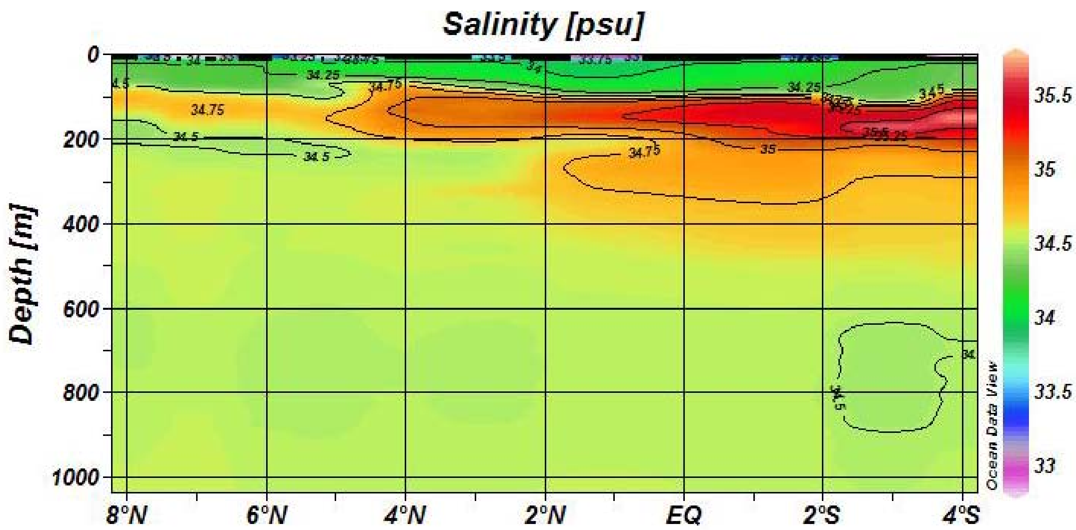


Figure 6.2.2-12 Salinity along 156E

6.3. Validation of CTD cast data

6.3.1. Salinity measurement of sampled seawater

(1) Personnel

Kenichi Katayama (MWJ) : Operation Leader
Akinari Murata (MWJ)

(2) Objective

Bottle salinity was measured in order to compare with CTD salinity.

(3) Instrument and Method

The salinity analysis was carried out on R/V MIRAI during the cruise of MR04-08 Leg2 using the Guildline AUTOSAL salinometer model 8400B (S/N 62556), with additional peristaltic-type intake pump, manufactured by Ocean Scientific International, Ltd. We also used two Guildline platinum thermometers model 9450. One thermometer monitored an ambient temperature and the other monitored a bath temperature.

The specifications of AUTOSAL salinometer and thermometer are shown as follows ;

Salinometer (Model 8400B "AUTOSAL" ; Guildline Instruments Ltd.)

Measurement Range	:	0.005 to 42 (PSU)
Accuracy	:	Better than ±0.002 (PSU) over 24 hours without restandardization
Maximum Resolution	:	Better than ±0.0002 (PSU) at 35 (PSU)

Thermometer (Model 9540 ; Guildline Instruments Ltd.)

Measurement Range	:	-180 to +240 deg C
Resolution	:	0.001
Limits of error ±deg C	:	0.01 (24 hours @ 23 deg C ±1 deg C)
Repeatability	:	±2 least significant digits

The measurement system was almost the same as Aoyama *et al.* (2003). The salinometer was operated in the air-conditioned ship's laboratory 'AUTOSAL ROOM' which was set to 24 deg C. Temperature in the room varied from 20.1 degree-C to 22.6 degree-C, while temperature in the bath is very stable and varied within +/- 0.002 deg C.

The measurement for each sample was done with a double conductivity ratio that is defined as median of 31 times reading of the salinometer. Data collection is started after 5 seconds and it takes about 10 seconds to collect 31 readings. If the difference between the double conductivity ratio measured for each sample is smaller than 0.00002, the average value of these double conductivity ratio was used to calculate the bottle salinity with the algorithm for practical salinity scale, 1978 (UNESCO, 1981). If this condition isn't satisfied within 5 times in a series of measurement for each sample, we deal with it as the bad sample.

(3-1) Standardization

The salinometer was standardized at the beginning of the sequence of measurements using IAPSO standard seawater (SSW). Because of the good stability of the salinometer, standardize of the salinometer was performed only once, the Standardize Dial was adjusted at the time. 5 bottles of the SSW were measured in total, and their standard deviation to the catalogue value was 0.0001 (PSU). The value is used for the calibration (linear compensation) of the measured salinity.

The specifications of SSW used in this cruise are shown as follows.

Standard seawater (SSW)

Batch	: P144
Conductivity ratio	: 0.99987
Salinity	: 34.995
Preparation date	: 23-Sep.-2003

(3-2) Sub-Standard Seawater

We also used sub-standard seawater (SUB) that was sampled and filtered by Millipore filter (pore size of 0.45μm), which was stored in a 20 liters polyethylene container. It was measured every about 10 samples in order to check the drift of the salinometer. During the whole measurements, there was no detectable sudden drift of the salinometer.

The specifications of SUB used in this cruise are shown as follows.

Sub standard seawater (SUB)

Sampling cruise ID	: MR03-K01
Sampling depth	: 2,000m
Filtration date	: 27-Feb.-2003

(3-3) Salinity Sample Collection

Seawater samples were collected with 12 liter Niskin-X (Non-coating) bottles and the EPCS. The salinity sample bottle of the 250ml brown grass bottle with screw cap was used to collect the sample water. Each bottle was rinsed three times with the sample water, and was filled with sample water to the bottle shoulder. Its cap was also thoroughly rinsed. The bottle was stored more than 24 hours in 'AUTOSAL ROOM' before the salinity measurement.

The kind and number of samples are shown as follows ;

Table 6.3.1-1 Kind and number of samples

Kind of Samples	Number of Samples
Samples for CTD	49
Samples for EPCS	31
Total	80

(4) Preliminary Results

Data of all samples were shown in Table 6.3.1-2. We estimated the precision of this method using 23 pairs of duplicate samples taken from the same pressure but different Niskin bottles, and compared the salinity of all samples to check the salinity data of CTD. The average and standard deviation of duplicate samples were shown in Table 6.3.1-3.

The average of difference between measurement data and CTD data were -0.0059 (PSU) and the standard deviation was 0.0006 (PSU), and those of duplicate samples were 0.0004 (PSU) and 0.0003 (PSU), respectively.

(5) Data Archive

All processed salinity data were submitted to Principal Investigator according to the data management policy of JAMSTEC.

(6) Reference

・Aoyama, M., T. Joyce, T. Kawano and Y. Takatsuki: Standard seawater comparison up to P129. *Deep-Sea Research*, I, Vol. 49, 1103～1114, 2002

・UNESCO: Tenth report of the Joint Panel on Oceanographic Tables and Standards. *UNESCO Technical Papers in Marine Science*, 36, 25 pp., 1981

6.4 Continuous monitoring of surface seawater

6.4.1 EPCS

(1) Personnel

Shigeki Hosoda (JAMSTEC): Principal Investigator

Masanori Enoki (MWJ): Operation Leader

(2) Objective

To measure salinity and temperature of near-sea surface water.

(3) Methods

The *Continuous Sea Surface Water Monitoring System* (Nippon Kaiyo Co. Ltd.) can automatically measure salinity, temperature and particle size of plankton in near-sea surface water continuously, every 1-minute. This system is located in the "*sea surface monitoring laboratory*" on R/V MIRAI. This system is connected to shipboard LAN-system. Measured data is stored in a computer with storage device every 1-minute together with time and position of ship, and displayed in the computer for the data management.

Near-surface water was continuously pumped up to the laboratory and flowed into the *Continuous Sea Surface Water Monitoring System* through a vinyl-chloride pipe. The flow rate for the system is controlled by several valves and was 12L/min. The flow rate is measured with flow meter.

Specification of the each sensor in this system of listed below.

a) Temperature and Salinity sensor

SEACAT THERMOSALINOGRAPH

Model:	SBE-21, SEA-BIRD ELECTRONICS, INC.	
Serial number:	2126391-2641	
Measurement range:	Temperature -5 to +35℃,	Salinity0 to 6.5 S m-1
Accuracy:	Temperature 0.01 ℃ 6month-1,	Salinity0.001 S m-1 month-1
Resolution:	Temperatures 0.001℃,	Salinity0.0001 S m-1

b) Bottom of ship thermometer

Model:	SBE 3S, SEA-BIRD ELECTRONICS, INC.
Serial number:	032175
Measurement range:	-5 to +35℃
Resolution:	±0.001℃

Stability: 0.002 ℃ year-1

c) Particle Size sensor

Model: P-05, Nippon Kaiyo LTD.

Serial number: P5024

Measurement range: 0.2681 mm to 6.666 mm

Accuracy: ±10% of range

Reproducibility: ±5%

Stability: 5% week-1

d) Flow meter

Model: EMARG2W, Aichi Watch Electronics LTD.

Serial number: 8672

Measurement range: 0 to 30 l min-1

Accuracy: ±1%

Stability: ±1% day-1

The monitoring Periods (UTC) during this cruise are listed below.

22:31-14/Jan./2005 to 00:00-15/Feb./2005.

(4) Preliminary Result

The figures of time series of the temperature (Bottom of ship thermometer) and salinity were shown in Fig. 6.4.1-1 and 6.4.1-2.

The relation between the sensor value and salinity analyzed by the AUTOSAL were shown in Fig. 6.4.1-3.

(5) Date archive

The data were stored on a magnetic optical disk, which will be submitted to the Data Management Office (DMO) JAMSTEC, and will be opened to public via "R/V MIRAI Data Web Page" in JAMSTEC Web page.

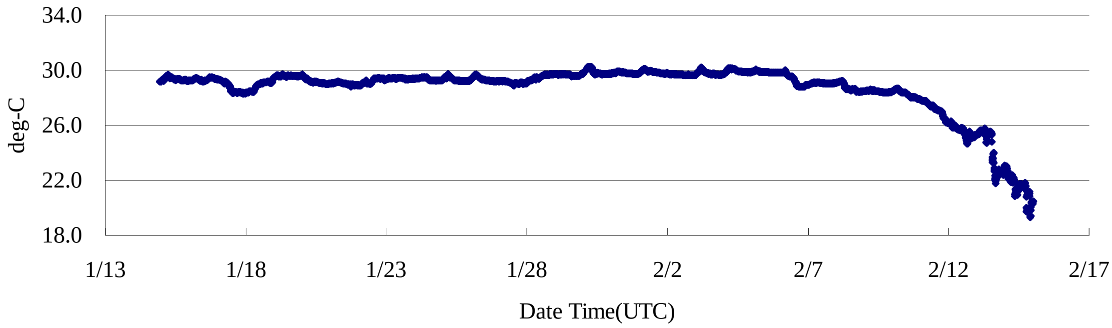


Figure 6.4.1-1 Time series of temperature in the sea surface water.

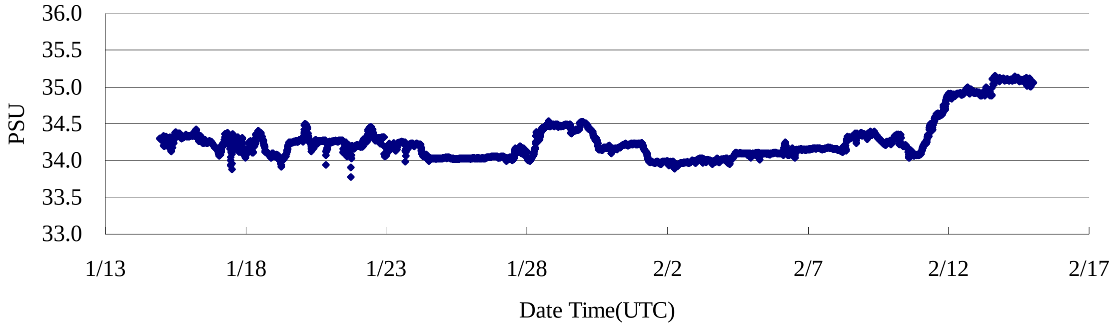


Figure 6.4.1-2 Time series of salinity in the sea surface water.

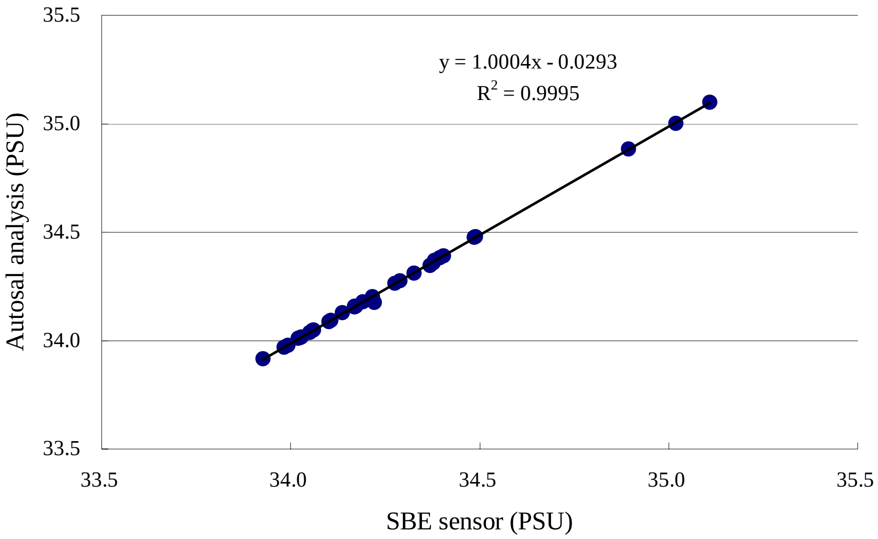


Figure 6.4.1-3 The correlation between salinity [sensor] and salinity analysis result.

6.5 Shipboard ADCP

(1) Personnel

Shigeki Hosoda	(JAMSTEC) Principal Investigator
Shinya Okumura	(Global Ocean Development Inc., GODI)
Ryo Ohyama	(GODI)

(2) Parameters

Current velocity of each depth cell [cm/s]
Echo intensity of each depth cell [dB]

(3) Methods

Continuous upper ocean current measurement along ship's track were made using hull-mounted Acoustic Doppler Current Profiler, RD Instruments VM-75 system installed on the centerline and approximately 28 m aft from the bow. The firmware version was 5.59 and the data acquisition software was VmDas Ver.1.3. For most of its operation, the instrument was configured for water-tracking mode recording each ping as the raw data in 16 m (bin size) x 40 bins (bin number) from 24.74 m to 648.74 m. Bottom-tracking mode, interleaved bottom-ping with water-ping, was made in shallower water region to get the calibration data for evaluating transducer misalignment angle. Raw data was recorded in beam coordinate, and then converted to earth coordinate using ship's heading data from ship's main gyrocompass, Tokimec TG-6000. The position fix data from ship's navigation system was also recorded in NMEA0183 format and merged with ensemble data in the VmDas.

The system performed well throughout the cruise. The profile range always reached 600 m under calm weather. But the rough sea condition made this range shorter, less than 300 m. Also, 60 seconds and 300 seconds average data were recorded as short-term average (STA) and long-term average (LTA) data.

The system consists of following components;

1. a 75 kHz Broadband (coded-pulse) profiler with 4-beam Doppler sonar operating at 75 KHz (RD Instruments, USA), mounted with beams pointing 30 degrees from the vertical and 45 degrees azimuth from the keel;
2. the Ship's main gyro compass (Tokimec, Japan), continuously providing ship's heading measurements to the ADCP;
3. a GPS navigation receiver (Leica MX9400) providing position fixes;
4. a personal computer running data acquisition software. The clock of the logging PC is adjusted to GPS time every 5 minutes.

(4) Preliminary results

Horizontal velocity along the ship's track is presented in figure 6-5-1, 2 and 3.

(5) Data archives

These data obtained in this cruise will be submitted to the JAMSTEC DMD (Data Management Division), and will be opened to the public via "R/V Mirai Data Web Page" in JAMSTEC home page.

(6) Remarks

We did not correct data from departure at Rep. of Palau (14 Jan 2005 00:00UTC) to 14 Jan 2005 22:00UTC, due to the EEZ for Rep. of Palau.

Table 6-5-1 Major parameters

Bottom-Track Commands

BP000 -------------------- Ping per Ensemble
BP001 -------------------- Ping per Ensemble

Environmental Sensor Commands

EA = +00000 -------------------- Heading Alignment (1/100 deg)
EB = +00000 -------------------- Heading Bias (1/100 deg)
ED = 00065 -------------------- Transducer Depth (0-65535dm)
EF = +0001 -------------------- Pitch/Roll Division/Multiplier (pos/neg) [1/99-99]
EH = 00000 -------------------- Heading (1/100 deg)
ES = 35 -------------------- Salinity (0-40 pp thousand)
EX = 00000 -------------------- Coord Transform (Xform; Type; Tilts; 3Bm; Map)
EZ = 1020001 -------------------- Sensor Source(C; D; H; P; R; S; T)

Timing Commands

TE = 00000200 -------------------- Time per Ensemble (hrs; min; sec; sec/100)
TP = 000200 -------------------- Time per Ping (min: sec; sec/100)

Water Track Commands

WA = 255 -------------------- False Target Threshold (Max) (0-255 counts)
WB = 1 -------------------- Mode 1 Bandwidth Control (0=Wid, 1=Med, 2=Nar)
WC = 064 -------------------- Low Correlation Threshold (0-255)
WD = 111111111 -------------------- Data Out (V; C; A; PG; St; Vsum; Vsum^2; #G; P0)
WE = 5000 -------------------- Error Velocity Threshold (0-5000 mm/s)
WF = 0800 -------------------- Blank After Transmit (cm)
WG = 001 -------------------- Percent Good Minimum (0-100%)
WM = 1 -------------------- Profiling Mode (1-8)
WN = 100 -------------------- Number of Depth Cells (1-128)
WP = 00001 -------------------- Pings per Ensemble (0-100%)
WS = 1600 -------------------- Depth Cell Size (cm)
WV = 999 -------------------- Mode 1 Ambiguity Velocity (cm/s radial)

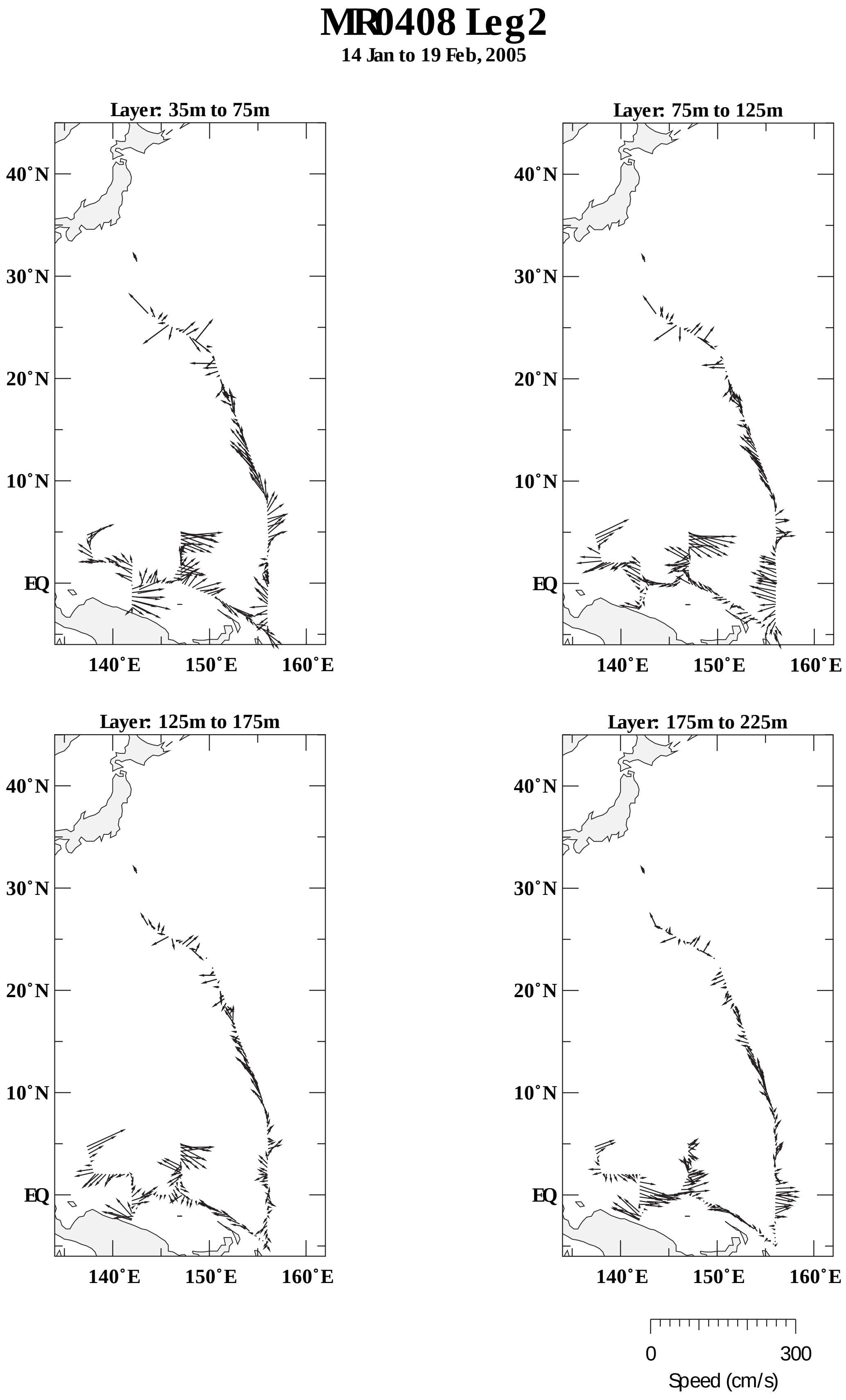


Figure 6-5-1 Horizontal Velocity along Track

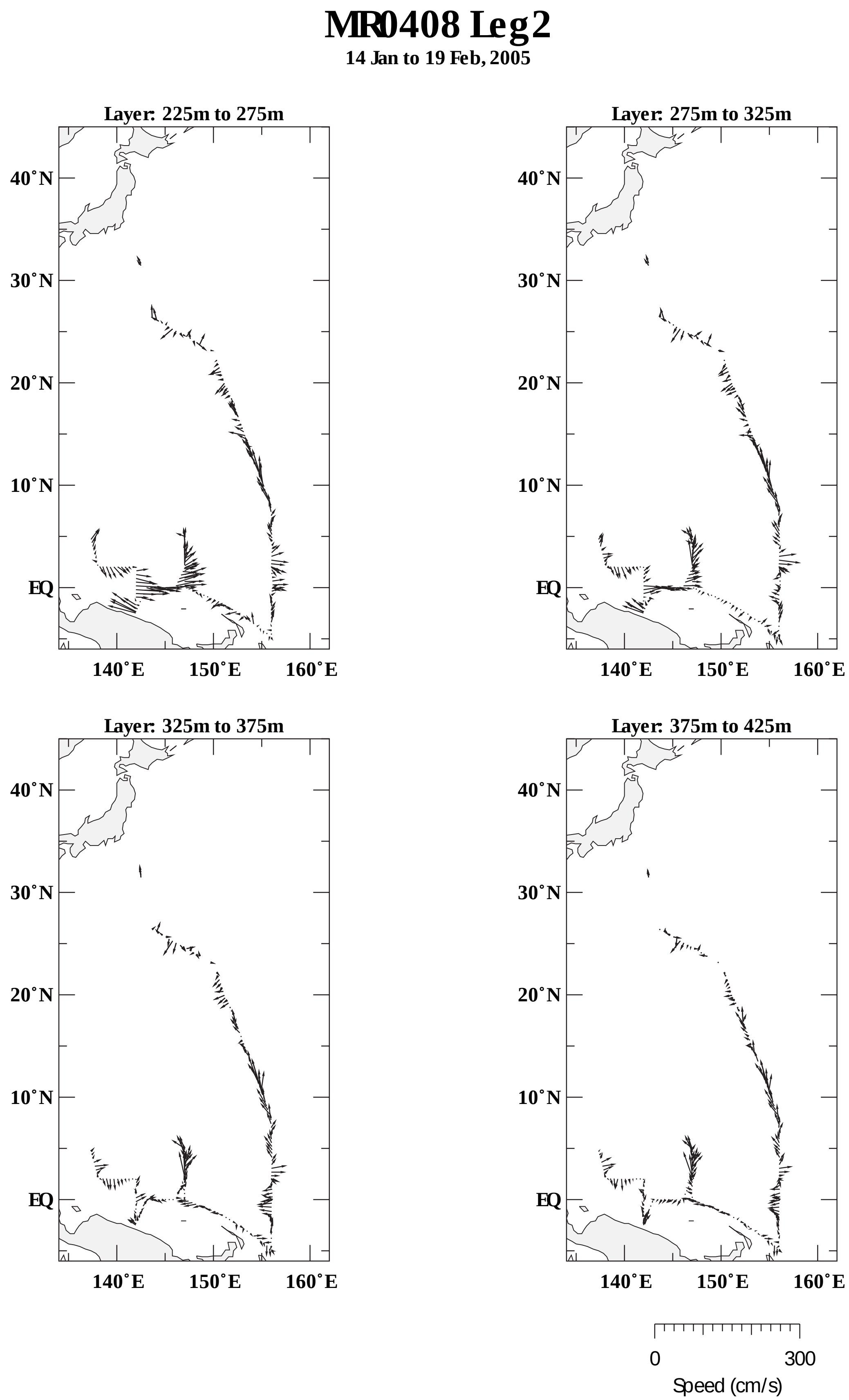


Figure 6-5-2 Horizontal Velocity along Track

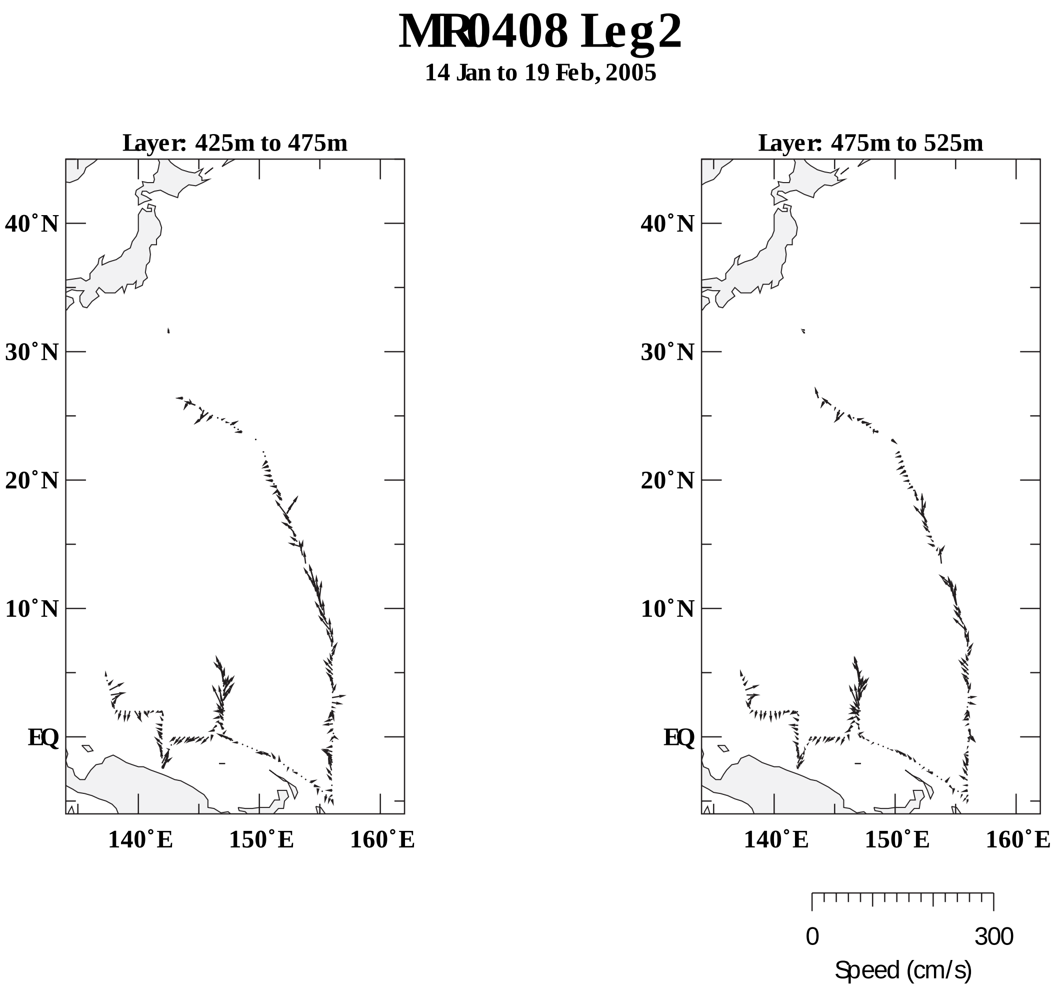


Figure 6-5-3 Horizontal Velocity along Track

6.6 Underway geophysics

6.6.1 Sea surface gravity

(1) Personnel

Shinya Okumura	(Global Ocean Development Inc. GODI)
Ryo Ohyama	(GODI)
Toshiya Fujiwara	(JAMSTEC): Principal investigator (Not on board)

(2) Introduction

The difference of local gravity is an important parameter in geophysics and geodesy. We collected gravity data at the sea surface during the MR04-08 Leg2 cruise from Koror, Rep. of Palau on 14 Jan 2005 to Sekinehama, Japan on 19 Feb 2005.

(3) Parameters

Relative Gravity [mGal]

(4) Data Acquisition

We have measured relative gravity using LaCoste and Romberg air-sea gravity meter S-116 (LaCosat and Romberg Gravity Meters, Inc.) during this cruise. To convert the relative gravity to absolute one, we measured gravity, using portable gravity meter (Scintrex gravity meter CG-5M), at Sekinehama as reference points.

(5) Preliminary Results

Absolute gravity shown in Table 6-6-1

Table 6-6-1

No.	Date	UTC	Port	Absolute Gravity (mGal)	Sea Level (cm)	Draft (cm)	Gravity at Sensor (mGal)	L&R (mGal)
1	2005/Jan/13	08:25	PALAU	-	173	660	-	10680.7
2	2005/Feb/19	-	SEKINE Harbor	981527.61	-	-	-	-

*1: Gravity at Sensor= Absolute Gravity + Sea Level*0.3086/100 + (Draft-530)/100*0.0431

*2: LaCoste and Romberg air-sea gravity meter S-116

(6) Data Archives

Gravity data obtained during this cruise will be submitted to the JAMSTEC Data Management Division, and archived there.

(7) Remarks

We did not collect data from departure at Rep. of Palau (14 Jan 2005 00:15UTC) to 14 Jan 2005 22:00UTC due to the EEZ of Rep. of Palau.

6.6.2 On-board geomagnetic vector measurement

Shinya Okumura (Global Ocean Development Inc., GODI)
Ryo Ohyama (GODI)
Toshiya Fujiwara (JAMSTEC; Not on board)

(1) Introduction

Measurements of magnetic force on the sea are required for the geophysical investigations of marine magnetic anomaly caused by magnetization in upper crustal structure. We measured geomagnetic field using a three-component magnetometer during the MR04-08 Leg2 cruise from 14 Jan 2005 to 19 Feb 2005.

(2) Instruments on R/V Mirai

A shipboard three-component magnetometer system (Tierra Tecnica SFG1214) is equipped on-board R/V Mirai. Three-axis flux-gate sensors with ring-cored coils are fixed on the fore mast. Outputs of the sensors are digitized by a 20-bit A/D converter (1 nT/LSB), and sampled at 8 times per second. Ship's heading, pitch and roll are measured utilizing a ring-laser gyro installed for controlling attitude of a Doppler radar. Ship's position (D-GPS) and speed data are taken from LAN every second.

(3) Data Archives

Magnetic force data obtained during this cruise will be submitted to the JAMSTEC Data Management Division, and archived there.

(5) Remarks

We did not correct data from departure at Rep. of Palau (14 Jan 2005 00:15UTC) to 14 Jan 2005 22:00UTC due to the EEZ of Rep. of Palau.

6.6.3 Swath bathymetry

(1) Personnel

Shinya Okumura	(Global Ocean Development Inc. GODI)
Ryo Ohyama	(GODI)
Toshiya Fujiwara	(JAMSTEC): Principal investigator (Not on board)

(2) Introduction

R/V MIRAI equipped a Multi Narrow Beam Echo Sounding system (MNBES), SEABEAM 2112.004 (SeaBeam Instruments Inc.) The main objective of MNBES survey is collecting continuous bathymetry data along ship's track to make a contribution to geological and geophysical investigations and global datasets. We had carried out bathymetric survey during the MR04-08 Leg2 cruise from 14 Jan 2005 to 19 Feb 2005.

(3) Data Acquisition

The "SEABEAM 2100" on R/V MIRAI was used for bathymetry mapping during this cruise. To get accurate sound velocity of water column for ray-path correction of acoustic multibeam, we used Surface Sound Velocimeter (SSV) data at the surface (6.2m) sound velocity, and the others depth sound velocity calculated temperature and salinity profiles from CTD data by the equation in Mackenzie (1981) during this cruise.

System configuration and performance of SEABEAM 2112.004,

Frequency:	12 kHz
Transmit beam width:	2 degree
Transmit power:	20 kW
Transmit pulse length:	3 to 20 msec.
Depth range:	100 to 11,000 m
Beam spacing:	1 degree athwart ship
Swath width:	150 degree (max)
	120 degree to 4,500 m
	100 degree to 6,000 m
	90 degree to 11,000 m
Depth accuracy:	Within < 0.5% of depth or +/-1m, whichever is greater, over the entire swath. (Nadir beam has greater accuracy; typically within < 0.2% of depth or +/-1m, whichever is greater)

(4) Preliminary Results

The results will be published after primary processing.

(5) Data Archives

Bathymetry data obtained during this cruise will be submitted to the JAMSTEC Data Management Division, and archived there.

(6) Remarks

We did not collect data from departure at Rep. of Palau (14 Jan 2005) to 14 Jan 2005 22:00UTC due to the EEZ of Rep. of Palau.

7 Special Observation

7.1 TRITON moorings

7.1.1 TRITON Mooring Operation

(1) Personnel

Shigeki Hosoda	(JAMSTEC): Principal Investigator
Masayuki Yamaguchi	(JAMSTEC): Technical staff
Masaki Taguchi	(MWJ): Technical Staff
Takeo Matsumoto	(MWJ): Operation Leader
Hiroshi Matsunaga	(MWJ): Technical Staff
Kenichi Katayama	(MWJ): Technical Staff
Akinori Murata	(MWJ): Technical Staff
Masaki Furuhata	(MWJ): Technical Staff
Takayuki Hashimukai	(MWJ): Technical Staff
Keisuke Matsumoto	(MWJ): Technical Staff
Kei Suminaga	(MWJ): Technical Staff
Masanori Enoki	(MWJ): Technical Staff
Ayaka Hatsuyama	(MWJ): Technical Staff

(2) Objectives

The large-scale air-sea interaction over the warmest sea surface temperature region in the western tropical Pacific Ocean called warm pool that affects the global atmosphere and causes El Nino phenomena. The formation mechanism of the warm pool and the air-sea interaction over the warm pool have not been well understood. Therefore, long term data sets of temperature, salinity, currents and meteorological elements have been required at fixed locations. The TRITON program aims to obtain the basic data to improve the predictions of El Nino and variations of Asia-Australian Monsoon system.

TRITON buoy array is integrated with the existing TAO(Tropical Atmosphere Ocean) array, which is presently operated by the Pacific Marine Environmental Laboratory/National Oceanic and Atmospheric Administration of the United States. TRITON is a component of international research program of CLIVAR (Climate Variability and Predictability), which is a major component of World Climate Research Program sponsored by the World Meteorological Organization, the International Council of Scientific Unions, and the Intergovernmental Oceanographic Commission of UNESCO. TRITON will also contribute to the development of GOOS (Global Ocean Observing System) and GCOS (Global Climate Observing System).

Nine TRITON buoys have been successfully recovered during this R/V MIRAI cruise (MR04-08), nine buoys deployed and two buoys visited.

(3) Measured parameters

Meteorological parameters:	wind speed, direction, atmospheric pressure, air temperature, relative humidity, radiation, precipitation.
Oceanic parameters:	water temperature and conductivity at 1.5m, 25m, 50m, 75m, 100m, 125m, 150m, 200m, 300m, 500m 750m, depth at 300m and 750m, currents at 10m.

(4) Instrument

1) CTD and CT

SBE-37 IM MicroCAT

A/D cycles to average : 4

Sampling interval : 600sec

Measurement range, Temperature : -5～+35 deg-C

Measurement range, Conductivity : 0～+7 S/m

Measurement range, Pressure : 0～full scale range

2) CRN(Current meter)

SonTek Argonaut ADCM

Sensor frequency : 1500kHz

Sampling interval : 1200sec

Average interval : 120sec

3) Meteorological sensors

Precipitation

SCTI ORG-115DX

Atmospheric pressure

PARPSCIENTIFIC. Inc. DIGIQUARTZ FLOATING BAROMETER 6000SERIES

Relative humidity/air temperature, Shortwave radiation, Wind speed/direction

Woods Hole Institution ASIMET

Sampling interval : 60sec

Data analysis : 600sec averaged

(5) Locations of TRITON buoys deployment

Nominal location	8N, 156E
ID number at JAMSTEC	01008
Number on surface float	T04
ARGOS PTT number	09794
ARGOS backup PTT number	07860, 07881
Deployed date	10 Feb. 2005
Exact location	08 - 01.30N, 155 - 56.11E
Depth	4,859 m

Nominal location	5N, 156E
ID number at JAMSTEC	02008
Number on surface float	T05
ARGOS PTT number	03780
ARGOS backup PTT number	07861, 24235
Deployed date	08 Feb. 2005
Exact location	04 - 58.49N, 156 - 02.18E
Depth	3,603 m
Option sensors	Two Precipitation sensors (capacitive type) on the tower

Nominal location	2N, 156E
ID number at JAMSTEC	03009
Number on surface float	T06
ARGOS PTT number	11826
ARGOS backup PTT number	07864, 24237
Deployed date	05 Feb. 2005

Exact location	02 - 02.23N, 156 - 01.21 E
Depth	2,573 m
Option sensors	CT at 175 m : S/N 0191 (SBE)

Nominal location	EQ, 156E
ID number at JAMSTEC	04009
Number on surface float	T07
ARGOS PTT number	03594
ARGOS backup PTT number	07871
Deployed date	02 Feb. 2005
Exact location	00 - 00.73S, 156 - 02.98 E
Depth	1,950 m
Option sensors	Precipitation sensor (capacitive type) on the tower
	CT at 175m : S/N 0999 (SBE)
	CT at 1.5m (ALEC)
	CT at 500m (TSK)

Nominal location	2S, 156E
ID number at JAMSTEC	05007
Number on surface float	T14
ARGOS PTT number	07962
ARGOS backup PTT number	11592, 11584
Deployed date	31 Jan. 2005
Exact location	02 - 01.00S, 155 - 57.59 E
Depth	1,749 m

Nominal location	5S, 156E
ID number at JAMSTEC	06007
Number on surface float	T15
ARGOS PTT number	09770
ARGOS backup PTT number	11593, 24245
Deployed date	29 Jan. 2005
Exact location	05 - 01.93S, 156 - 01.50 E
Depth	1,521 m
Option sensors	Precipitation sensor (capacitive type) on the tower

Nominal location	5N, 147E
ID number at JAMSTEC	07007
Number on surface float	T16
ARGOS PTT number	09771
ARGOS backup PTT number	24238, 13067
Deployed date	20 Jan. 2005
Exact location	04 - 57.87S, 147 - 01.69 E
Depth	4,244 m
Option sensors	CT at 25m : S/N 1030 (SBE)

Nominal location	2N, 147E
ID number at JAMSTEC	08006
Number on surface float	T17
ARGOS PTT number	20374
ARGOS backup PTT number	24236, 24229
Deployed date	24 Jan. 2005
Exact location	01 - 59.54S, 147 - 01.09E
Depth	4,517 m
Option sensors	Ct at 175m : S/N1027 (SBE)

Nominal location	EQ, 147E
ID number at JAMSTEC	09007
Number on surface float	T19
ARGOS PTT number	20392, 24230
ARGOS backup PTT number	24234
Deployed date	25 Jan. 2005
Exact location	00 - 03.65N, 147 - 00.70E
Depth	4,480 m
Option sensors	Precipitation sensor (capacitive type) on the tower

(6) TRITON recovered

Nominal location	8N, 156E
ID number at JAMSTEC	01007
Number on surface float	T01
ARGOS PTT number	20380
ARGOS backup PTT number	07881
Deployed date	23 Jan. 2004
Recovered date	08 Feb. 2005
Exact location	08 - 01.00N, 155 - 57.01E
Depth	4,838 m

Nominal location	5N, 156E
ID number at JAMSTEC	02007
Number on surface float	T21
ARGOS PTT number	20417
ARGOS backup PTT number	24233
Deployed date	25 Jan. 2004
Recovered date	07 Feb. 2005
Exact location	05 - 01.97N, 156 - 03.44E
Depth	3,514 m
Option sensors	Precipitation sensor (capacitive type) on the tower

Nominal location	2N, 156E
ID number at JAMSTEC	03008
Number on surface float	T22
ARGOS PTT number	09793

ARGOS backup PTT number	24235
Deployed date	14 Feb. 2004
Recovered date	05 Feb. 2005
Exact location	01 - 57.15N, 155 - 59.96E
Depth	2,568 m

Nominal location	EQ, 156E
ID number at JAMSTEC	04008
Number on surface float	T23
ARGOS PTT number	20451
ARGOS backup PTT number	24237
Deployed date	12 Feb. 2004
Recovered date	02 Feb. 2005
Exact location	00 - 02.60S, 156 - 02.13E
Depth	1,854 m
Option sensors	Precipitation sensor (capacitive type) on the tower

Nominal location	2S, 156E
ID number at JAMSTEC	05006
Number on surface float	T24
ARGOS PTT number	20384
ARGOS backup PTT number	24240
Deployed date	08 Feb. 2004
Recovered date	31 Jan. 2005
Exact location	01 - 59.05S, 156 - 01.58E
Depth	1,751 m

Nominal location	5S, 156E
ID number at JAMSTEC	06006
Number on surface float	T13
ARGOS PTT number	11823
ARGOS backup PTT number	11584
Deployed date	05 Feb. 2004
Recovered date	29 Jan. 2005
Exact location	04 - 58.01S, 156 - 00.99E
Depth	1,510 m
Option sensors	Precipitation sensor (capacitive type) on the tower

Nominal location	5N, 147E
ID number at JAMSTEC	07006
Number on surface float	T20
ARGOS PTT number	09427
ARGOS backup PTT number	24229
Deployed date	08 Nov. 2003
Recovered date	21 Jan. 2004
Exact location	05 - 02.51N, 146 - 56.92E
Depth	4,249 m

Option sensors	Precipitation sensor (capacitive type) at Tower

Nominal location	2N, 147E
ID number at JAMSTEC	08005
Number on surface float	T25
ARGOS PTT number	20439
ARGOS backup PTT number	24230
Deployed date	12 Nov. 2003
Recovered date	22 Jan. 2005
Exact location	01 - 59.50Ｎ, 147 - 01.68Ｅ
Depth	4,523 m
Option sensors	CT at 175 m : S/N0532 (SBE)

Nominal location	EQ, 147E
ID number at JAMSTEC	09006
Number on surface float	T26
ARGOS PTT number	20275
ARGOS backup PTT number	24232
Deployed date	15 Nov. 2003
Recovered date	25 Jan. 2005
Exact location	00 - 03.63S, 147 - 04.67Ｅ
Depth	4,368 m

*: Dates are UTC and represent anchor drop times for deployments and release time for recoveries, respectively.

(7)TRITON Visited

Nominal location	5N, 137E
ID number at JAMSTEC	11004
Number on surface float	T09
ARGOS PTT number	03779
ARGOS backup PTT number	24241
Visited date	14 Jan. 2005
Exact location	04 - 51.60S, 137 - 15.62Ｅ
Depth	4,096 m

Nominal location	2N, 138E
ID number at JAMSTEC	12006
Number on surface float	T10
ARGOS PTT number	09792
ARGOS backup PTT number	24242
Visited date	15 Jan. 2005
Exact location	02 - 04.02S, 138 - 03.74Ｅ
Depth	4,325 m

(8) Details of deployed

We had deployed nine TRITON buoys, described them details in the list.

Deployed TRITON buoys

Observation No.	Location.	Details.
01008	8N156E	Deploy with full spec.
02008	5N156E	Deploy with full spec and two optional precipitation sensor.
03009	2N156E	Deploy with full spec and one optional CT sensor.
04009	EQ156E	Deploy with full spec and one optional precipitation sensor and three optional CT sensor.
05007	2S156E	Deploy with full spec.
06007	5S156E	Deploy with full spec and one optional precipitation sensor.
07007	5N147E	Deploy with full spec and one optional CT sensor.
08006	2N147E	Deploy with full spec and one optional CT sensor.
09007	EQ147E	Deploy with full spec and one optional precipitation sensor.

(9) Data archive

Hourly averaged data are transmitted through ARGOS satellite data transmission system in almost real time. The real time data are provided to meteorological organizations via Global Telecommunication System and utilized for daily weather forecast. The data will be also distributed world wide through Internet from JAMSTEC and PMEL home pages. All data will be archived at The JAMSTEC Mutsu Institute.

TRITON Homepage: http://www.jamstec.go.jp/jamstec/triton

7.1.2 Inter-comparison between shipboard CTD and TRITON data

(1) Personnel

Kentaro Andou (JAMSTEC): Plincipal Investigator(not on board)
Takeo Matsumoto (MWJ): Operation Leader
Keisuke Matsumoto(MWJ): Technical staff

(2) Objectives

TRITON CTD data validation.

(3) Measured parameters

・Temperature
・Conductivity
・Pressure

(4) Methods

TRITON buoy underwater sensors are equipped along a wire cable of the buoy below sea surface. We used the same CTD (SBE 9/11Plus) system with general CTD observation (See section 5) on R/V MIRAI for this intercomparision. We conducted 1 CTD cast at each TRITON buoy site before recovery, conducted 1 CTD cast at each TRITON buoy site after deployment. The cast was performed immediately after the deployment and before recovery. R/V MIRAI was kept the distance from the TRITON buoy within 2 nm.

TRITON buoy data was sampled every 1 hour except for transmition to the ship. We compared CTD observation by R/V MIRAI data with TRITON buoy data using the 1 hour averaged value.

As our temperature sensors are expected to be more stable than conductivity sensors, conductivity data and salinity data are selected at the same value of temperature data. Then, we calculate difference of salinity from conductivity between the shipboard CTD data on R/V MIRAI and the TRITON buoy data for each deployment and recovery of buoys.

Compared site

Observation No.	Latitude	Longtitude	Condition
01008	8N	156E	After Deployment
02008	5N	156E	After Deployment
03009	2N	156E	After Deployment
04009	EQ	156E	After Deployment
05007	2S	156E	After Deployment
06007	5S	156E	After Deployment
07007	5N	147E	After Deployment
08006	2N	147E	After Deployment
09007	EQ	147E	After Deployment
01007	8N	156E	Before Recover
02007	5N	156E	Before Recover
03008	2N	156E	Before Recover
04008	EQ	156E	Before Recover
05006	2S	156E	Before Recover
06006	5S	156E	Before Recover
08005	5N	147E	Before Recover
11004	5N	138E	Visit

(5) Results

Most of temperature, conductivity and salinity data from TRITON buoy showed good agreement with CTD cast data in T-S diagrams. See the Figures 7.1.2-1(a)(b)(c).

To evaluate the performance of the conductivity sensors on TRITON buoy, the data from had deployed buoy and shipboard CTD data at the same location were analysed.

The estimation were calculated as deployed buoy data minus shipboard CTD data. The salinity differences are from –0.045 to 0.094 for all depths. Below 300db, salinity differences are from –0.013 to 0.032 (See the Figures 7.1.2-2 (a) and Table 7.1.2-1 (a)). The average of salinity differences was 0.008 with standard deviation of 0.021 .

The estimation were calculated as recovered buoy data minus shipboard CTD (9Plus) data. The salinity differences are from –0.336 to 0.432 for all depths. Below 300db, salinity differences are from –0.007 to 0.060 (See the Figures 7.1.2-2(b) and Table 7.1.2-1 (b)). The average of salinity differences was 0.014 with standard deviation of 0.119 .

The estimation of time-drift were calculated as recovered buoy data minus deployed buoy data. The salinity change for 1 year are from –0.160 to 1.755 , for all depths. Below 300db, salinity change for 1 year are from 0.003 to 0.052 (See the figures 7.1.2-2(c)). The average of salinity differences was 0.034 with standard deviation of 0.214 .

(6) Data archive

All raw and processed CTD data files were copied on 3.5 inch magnetic optical disks and submitted to JAMSTEC TOCS group of the Ocean Observation and Research Department. All original data will be stored at JAMSTEC Mutsu brunch. (See section 5)

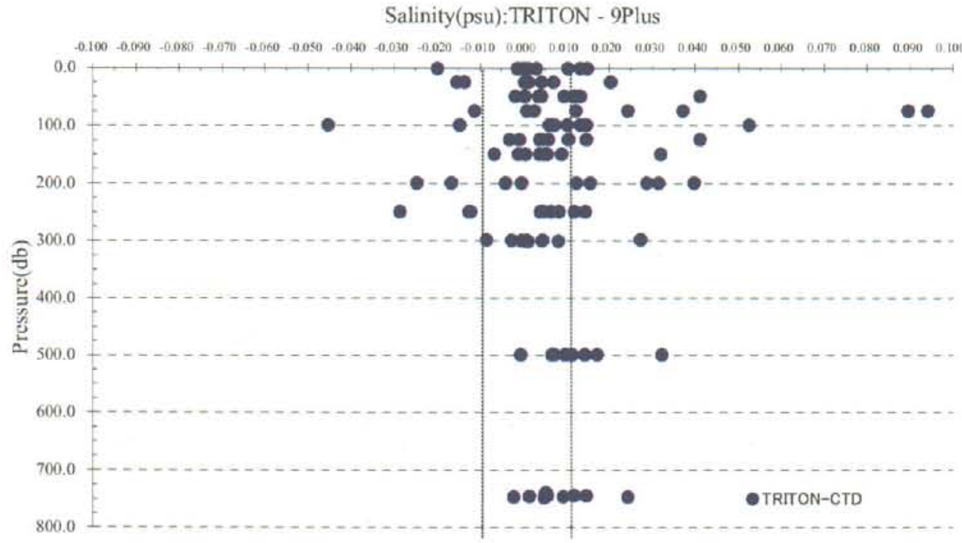


Fig.7.1.2.-2 (a) Salinity differences between TRITON buoys data and shipboard CTD data after deployment

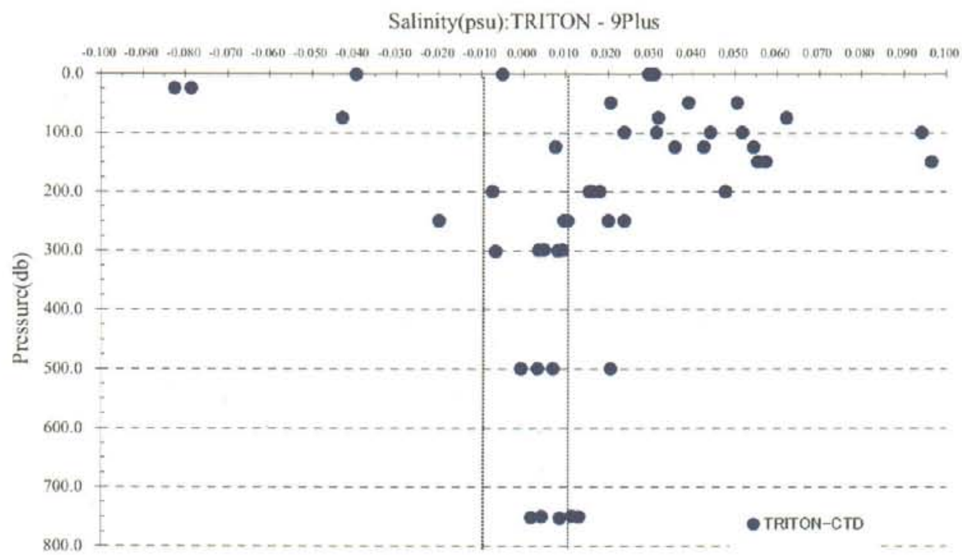


Fig.7.1.2.-2 (b) Salinity differences between TRITON buoys data and shipboard CTD data before recovery

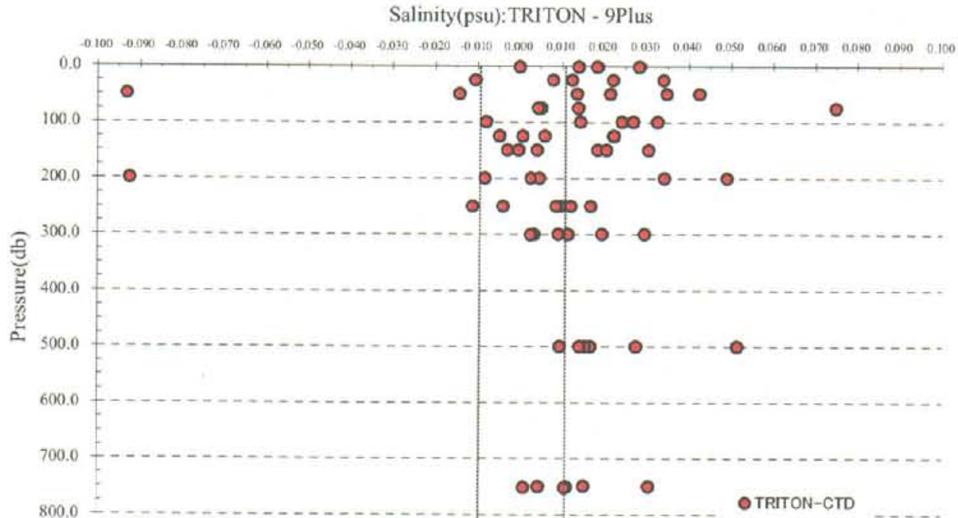


Fig.7.1.2.-2 (c) Salinity differences between deployment data and recovery data for 1year
Observation No.01,02,03,04,05,06

7.2 ADCP subsurface mooring

(1) Personnel

Shigeki Hosoda (JAMSTEC): Principal Investigator
Masaki Taguchi (MWJ): Technical Staff
Takeo Matsumoto (MWJ): Operation leader
Hiroshi Matsunaga (MWJ): Technical Staff
Kenichi Katayama (MWJ): Technical Staff
Keisuke Matsumoto (MWJ): Technical Staff
Akinori Murata (MWJ): Technical Staff
Kei Suminaga (MWJ): Technical Staff
Masaki Furuhata (MWJ): Technical Staff
Takayuki Hashimukai (MWJ): Technical Staff
Masanori Enoki (MWJ): Technical Staff
Ayaka Hatsuyama (MWJ): Technical Staff

(2) Objectives

The purpose is to get the knowledge of physical process in the western equatorial Pacific Ocean. We have been observing subsurface currents using ADCP moorings along the equator. In this cruise (MR04-08), we recovered three subsurface ADCP mooring at 2.5S-142E / Eq-147E / Eq-156E and deployed three ADCP moorings at 2.5S-142E / Eq-147E / Eq-156E.

(3) Parameters

・Current profiles
・Echo intensity
・Pressure, Temperature and Conductivity

(4) Methods

Two instruments are mounted at the top float of the mooring. One is ADCP(Acoustic Doppler Current Profiler) to observe upper ocean layer currents from subsurface to 320m depth. The other is CTD to observe pressure, temperature and salinity for correction of sound speed and depth variability. Details of the instruments and their parameters are as follows:

1) ADCP

(a) Self-Contained Broadband ADCP 150 kHz (RD Instruments)

Distance to first bin : 8 m
Pings per ensemble : 16
Time per ping : 2.00 seconds
Bin length : 8.00 m
Sampling Interval : 3600 seconds

Recovered ADCP

・ Serial Number : 1225(Mooring No.031119-2.5S142E)
・ Serial Number : 1224(Mooring No.031117-00147E)
・ Serial Number : 1155(Mooring No.040211-00156E)

Deployed ADCP

・ Serial Number : 1152(Mooring No.050118-2.5S142E)
・ Serial Number : 1221(Mooring No.050127-00147E)
・ Serial Number : 1222(Mooring No.050204-00156E)

2) CTD

(a)SBE-16 (Sea Bird Electronics Inc.)

Sampling Interval : 1800 seconds

Recovered CTD

- Serial Number : 1281 (Mooring No.031119-2.5S142E)
- Serial Number : 1285 (Mooring No.031117-00147E)
- Serial Number : 1284 (Mooring No.040211-00156E)

Deployed CTD

- Serial Number : 1274 (Mooring No.050118-2.5S142E)
- Serial Number : 1288 (Mooring No.050127-00147E)
- Serial Number : 1275 (Mooring No.050204-00156E)

3) Other instrument

(a) Acoustic Releaser (BENTHOS,Inc.)

Recovered Acoustic Releaser

- Serial Number : 677 (Mooring No.031119-2.5S142E)
- Serial Number : 712 (Mooring No.031119-2.5S142E)
- Serial Number : 955 (Mooring No.031117-00147E)
- Serial Number : 600 (Mooring No.031117-00147E)
- Serial Number : 963 (Mooring No.040211-00156E)
- Serial Number : 717 (Mooring No.040211-00156E)

Deployed Acoustic Releaser

- Serial Number : 631 (Mooring No.031119-2.5S142E)
- Serial Number : 634 (Mooring No.031119-2.5S142E)
- Serial Number : 667 (Mooring No.031117-00147E)
- Serial Number : 693 (Mooring No.031117-00147E)
- Serial Number : 916 (Mooring No.040211-00156E)
- Serial Number : 663 (Mooring No.040211-00156E)

(b) Transponder (BENTHOS,Inc.)

Recovered Transponder

- Serial Number : 67491 (Mooring No.031119-2.5S142E)
- Serial Number : 57069 (Mooring No.031117-00147E)
- Serial Number : 67492 (Mooring No.040211-00156E)

Deployed Transponder

- Serial Number : 57114 (Mooring No.050118-2.5S142E)
- Serial Number : 57068 (Mooring No.050127-00147E)
- Serial Number : 67491 (Mooring No.050204-00156E)

(5) Deployment

The ADCP mooring deployed at 2.5S-142E was planned to play the ADCP at about 341m depth, at Eq-147E was planned to play the ADCP at about 344m depth and at Eq-156E was planned to play the ADCP at about 343m depth. After we dropped the anchor, we monitored the depth of the acoustic releaser.

The position of the mooring No.050118-2.5S142E

Date: 18 Jan. 2005 Lat.: 02-28.74S Long.: 141-56.77E Depth: 3444m

The position of the mooring No.050127-00147E

Date: 27 Jan. 2005 Lat.: 00-00.41N Long.: 147-04.72E Depth: 4477m

The position of the mooring No.050204-00156E

Date: 04 Feb. 2005 Lat.: 00-00.07N Long.: 156-08.33E Depth: 1960m

(6) Recovery

We recovered three ADCP moorings. One was deployed on 19 Nov.2003 (KY03-12), the other was deployed on 17 Nov.2003 (KY03-12) and the other was deployed on 11 Feb.2004 (KY03-12). After the recovery, we uploaded ADCP and CTD data into a computer, then raw data were converted into ASCII code.

Results were shown in the figures in the following pages.

Fig.7.2.-1～Fig.7.2.-3 show the ADCP velocity data (zonal and meridional component) at bin#29, bin#24, bin#16（2.5S-142E）.

Fig.7.2.-4 shows CTD pressure, temperature and salinity data (2.5S-142E).

Fig.7.2.-5,～Fig.7.2.-7 show the ADCP velocity data (zonal and meridional component) at bin#28, bin#23, bin#15 (Eq-147E).

Fig.7.2.-8 shows CTD pressure, temperature and salinity data (Eq-147E).

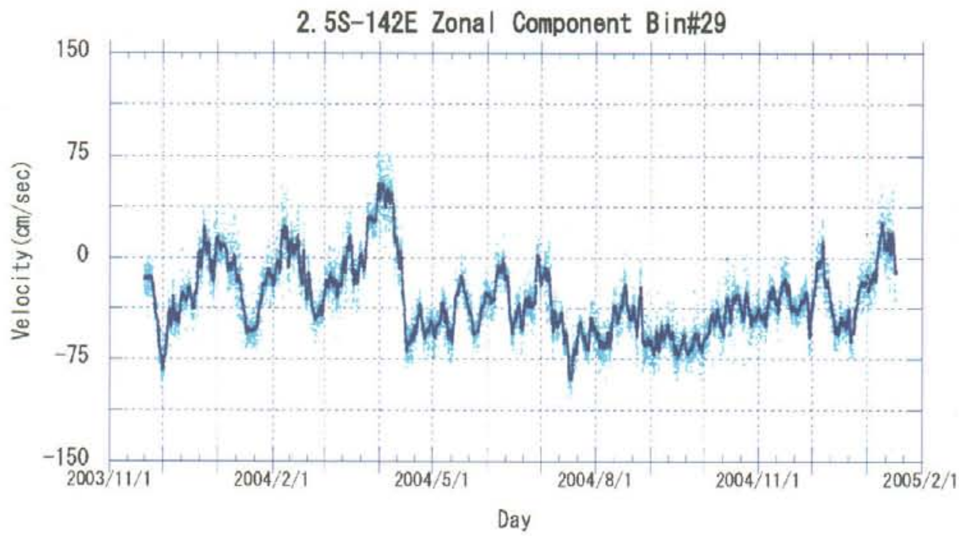
Fig.7.2.-9,～Fig.7.2.-11 show the ADCP velocity data (zonal and meridional component) at bin#27, bin#19, bin#11 (Eq-156E).

Fig.7.2.-4 shows CTD pressure, temperature and salinity data (Eq-156E).

(7) Data archive

The velocity data will be reconstructed using CTD depth data. The all data will be archived by the member of TOCS project at JAMSTEC.

All data will be submitted to DMO at JAMSTEC within 3 years after each recovery.



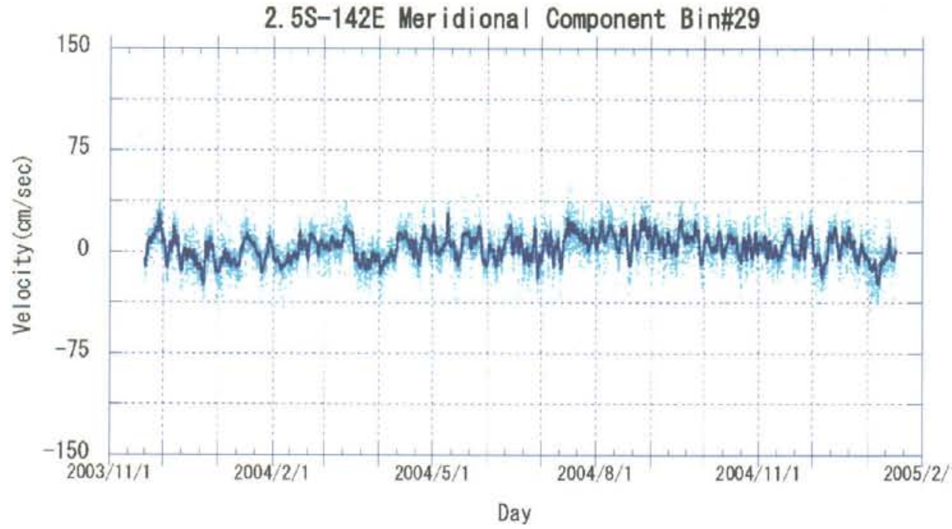
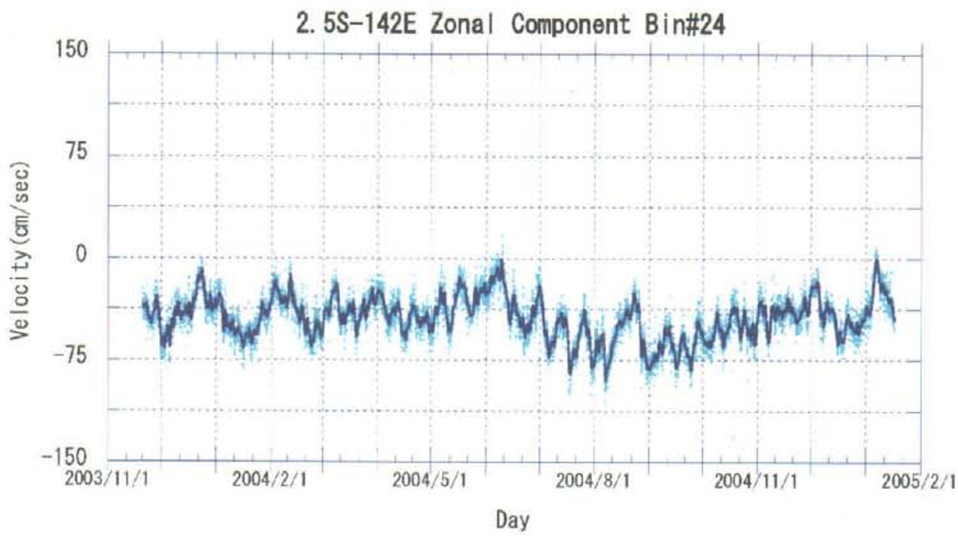


Fig.7.2.-1 Time Series of zonal and meridional velocities of 2.5S-142E mooring at bin#29



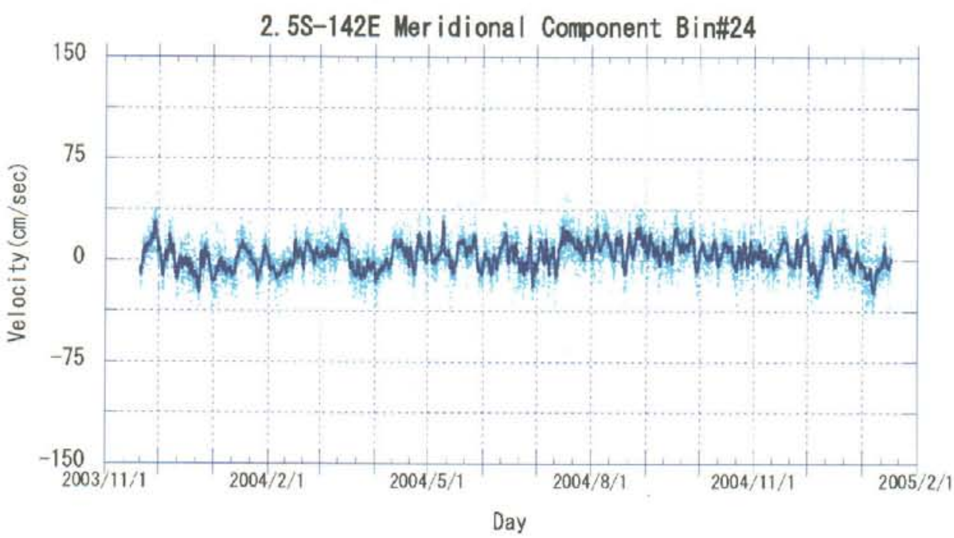
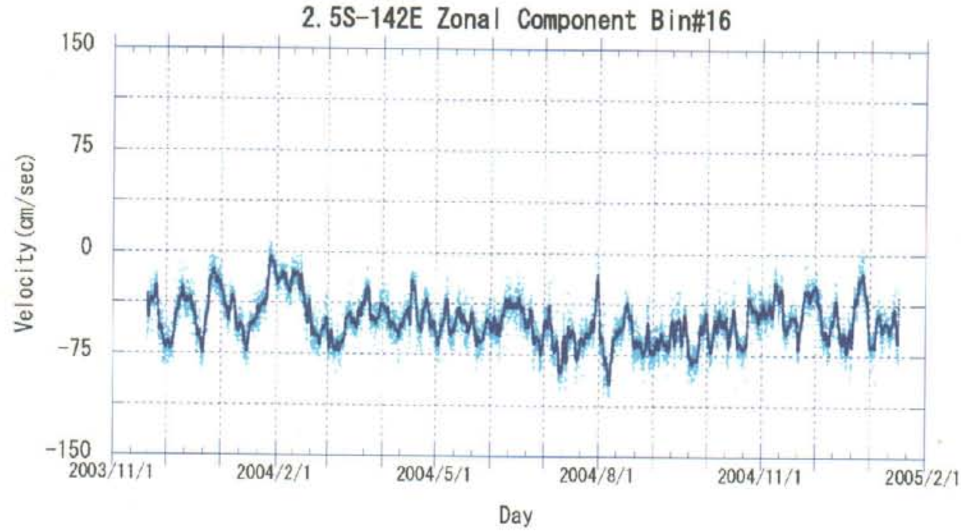


Fig.7.2.-2 Time Series of zonal and meridional velocities of 2.5S-142E mooring at bin#24



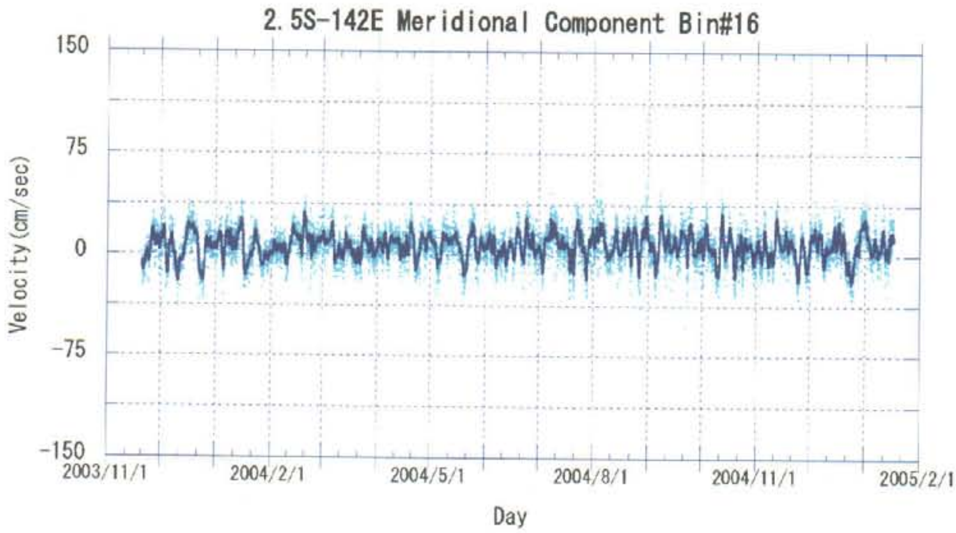


Fig.7.2.-3 Time Series of zonal and meridional velocities of 2.5S-142E mooring at bin#16

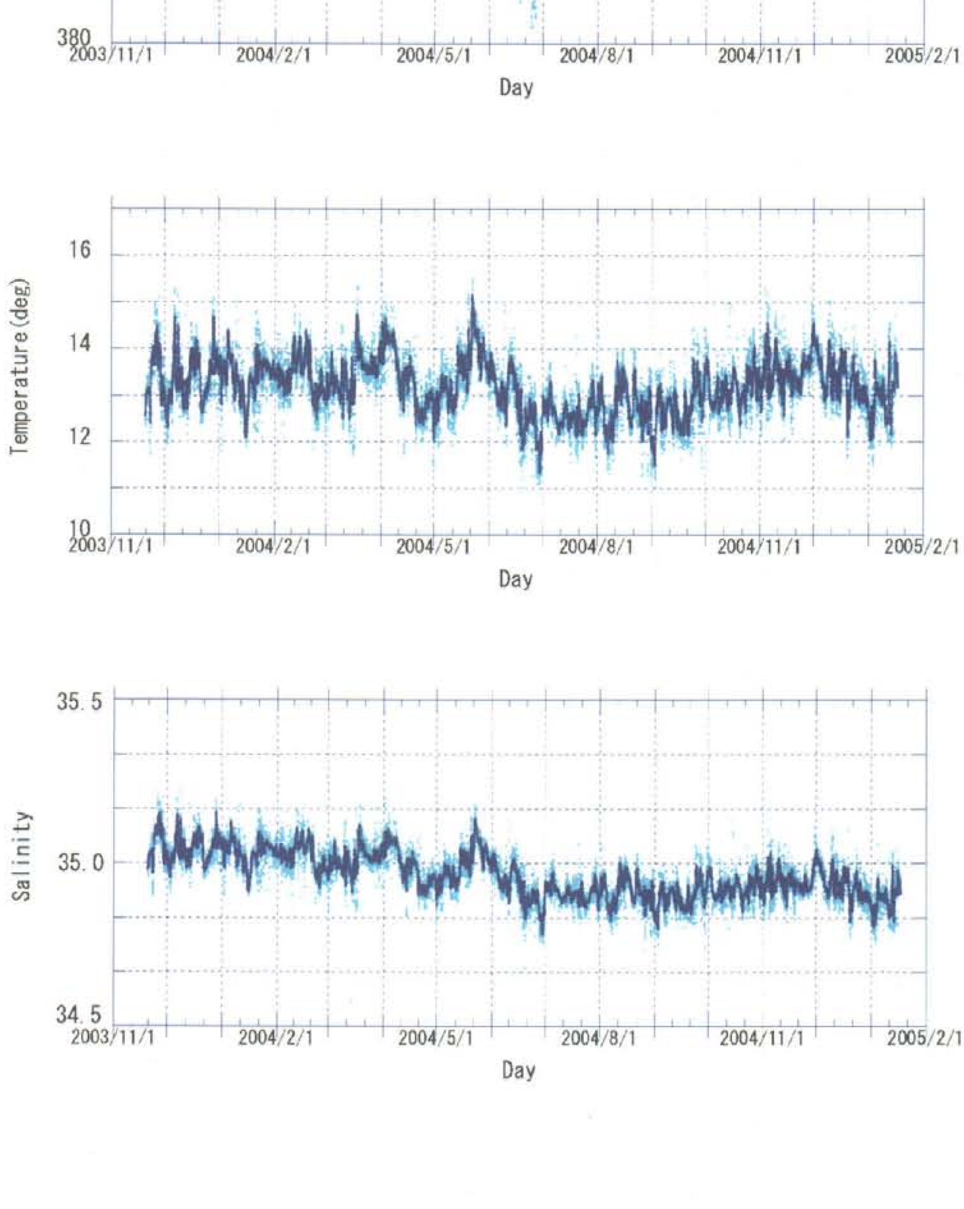
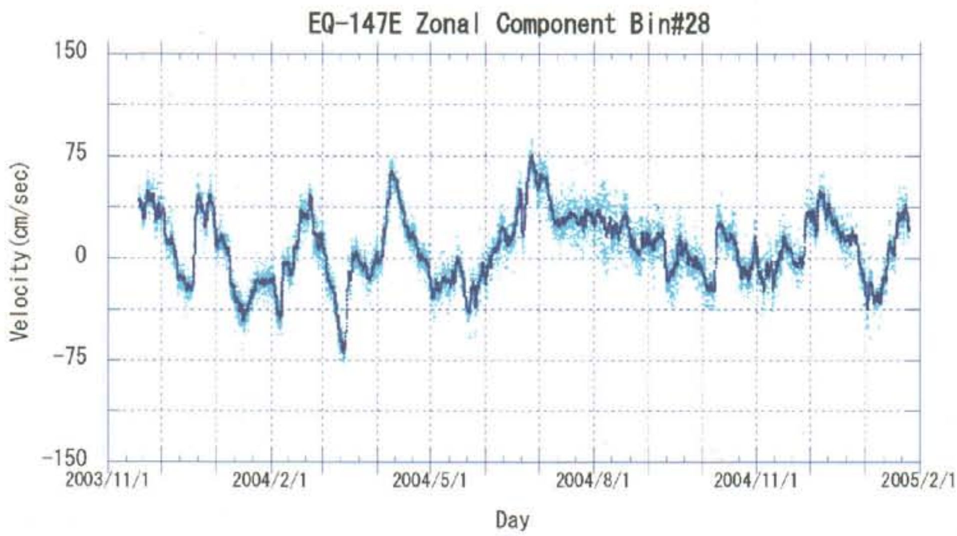


Fig.7.2.-5 Time Series of pressure, temperature, salinity of obtained with CTD of 2.5S-142E mooring



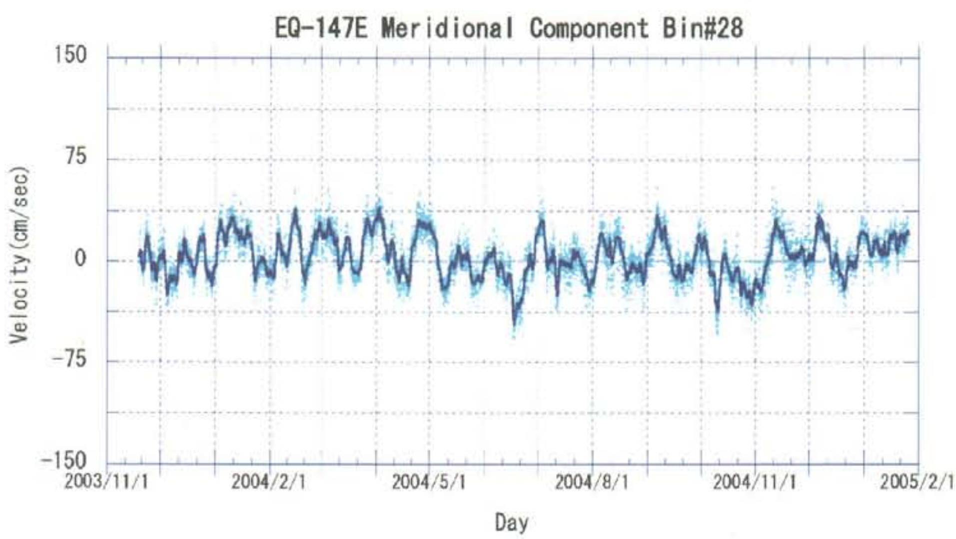
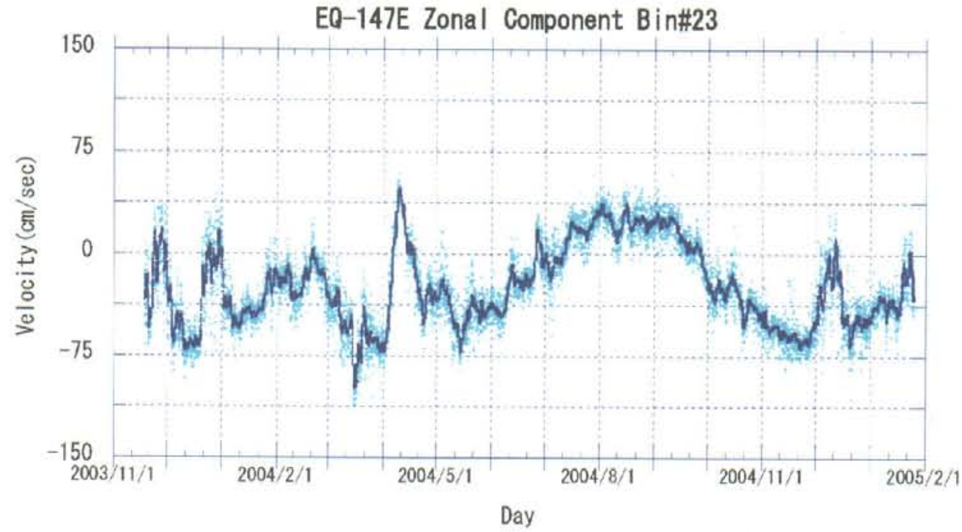


Fig.7.2.-5 Time Series of zonal and meridional velocities of EQ-147E mooring at bin#28



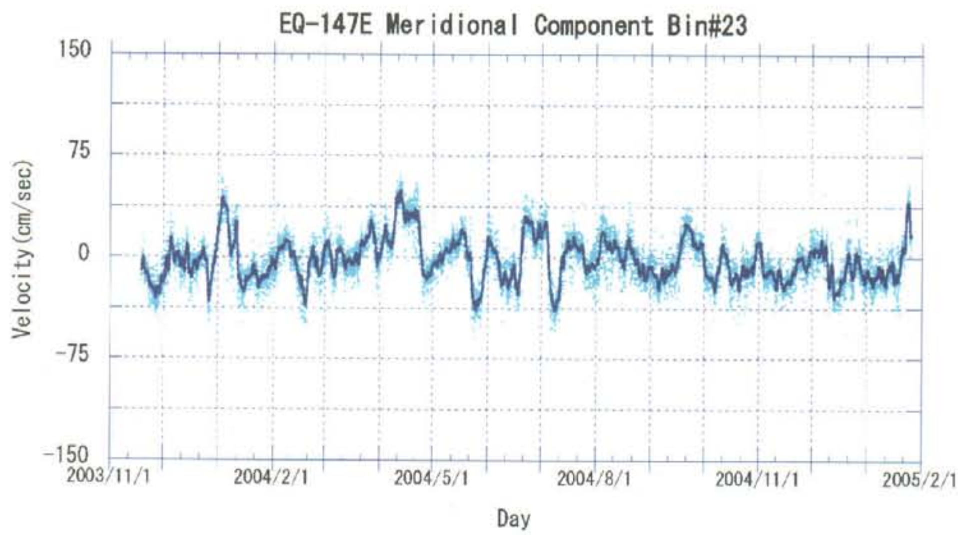
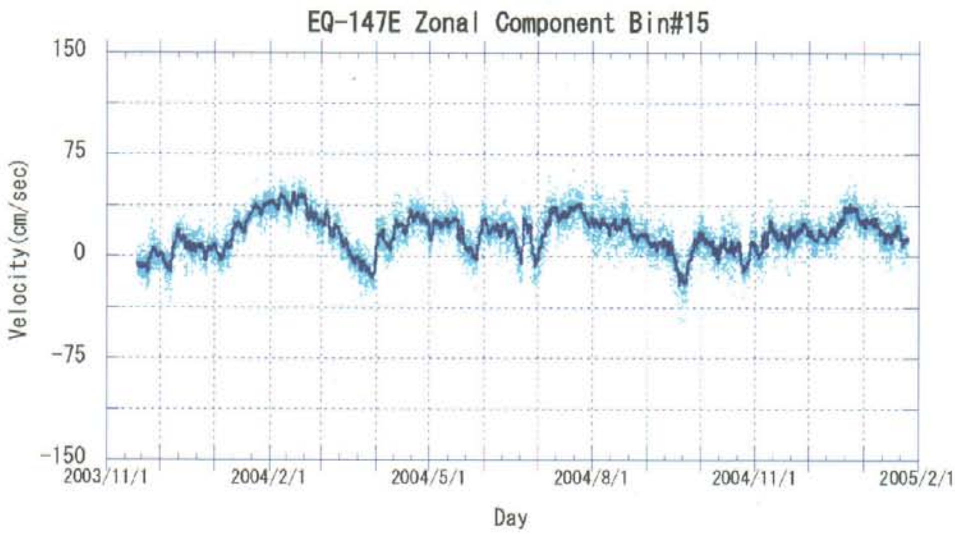


Fig.7.2.-6 Time Series of zonal and meridional velocities of EQ-147E mooring at bin#23



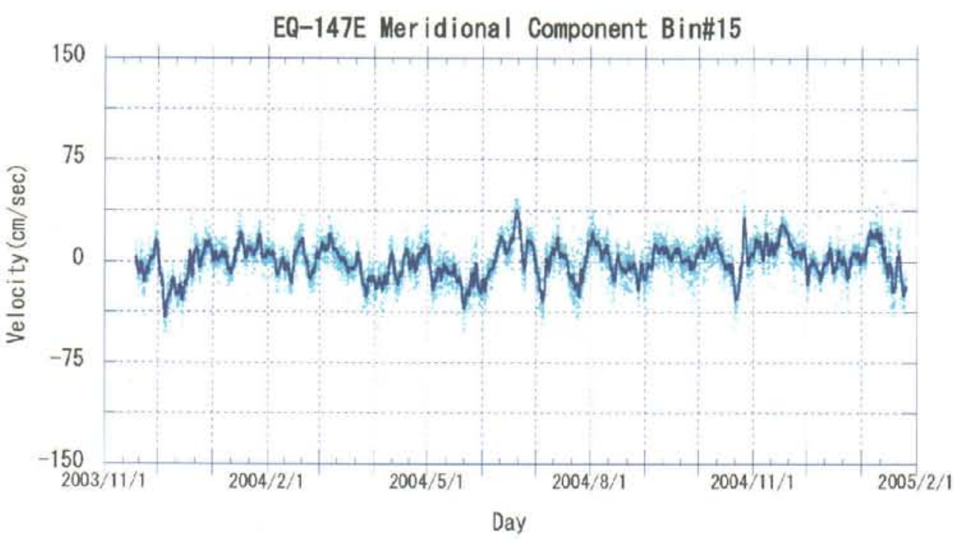


Fig.7.2.-7 Time Series of zonal and meridional velocities of EQ-147E mooring at bin#15

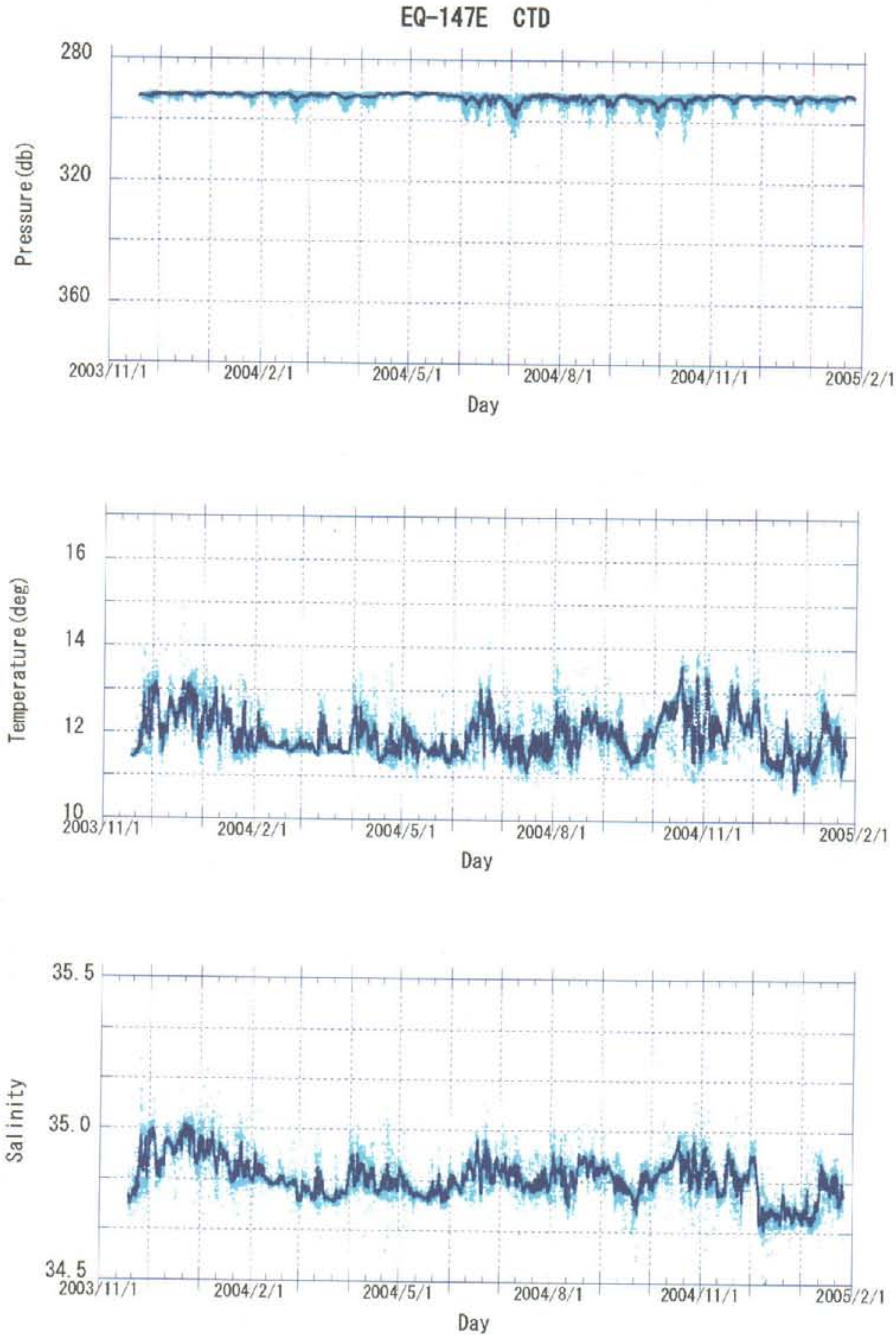
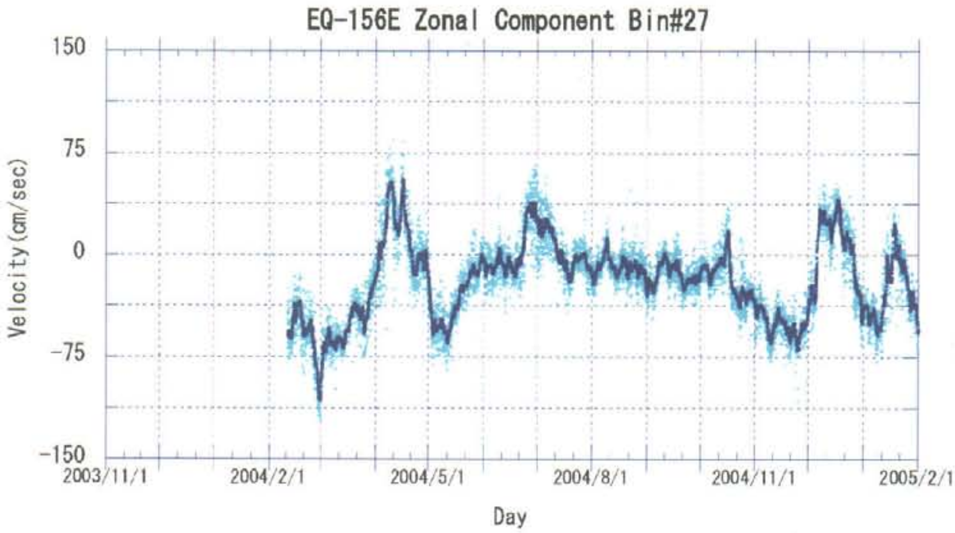


Fig.7.2.-8 Time Series of pressure, temperature, salinity of obtained with CTD of EQ-147E mooring



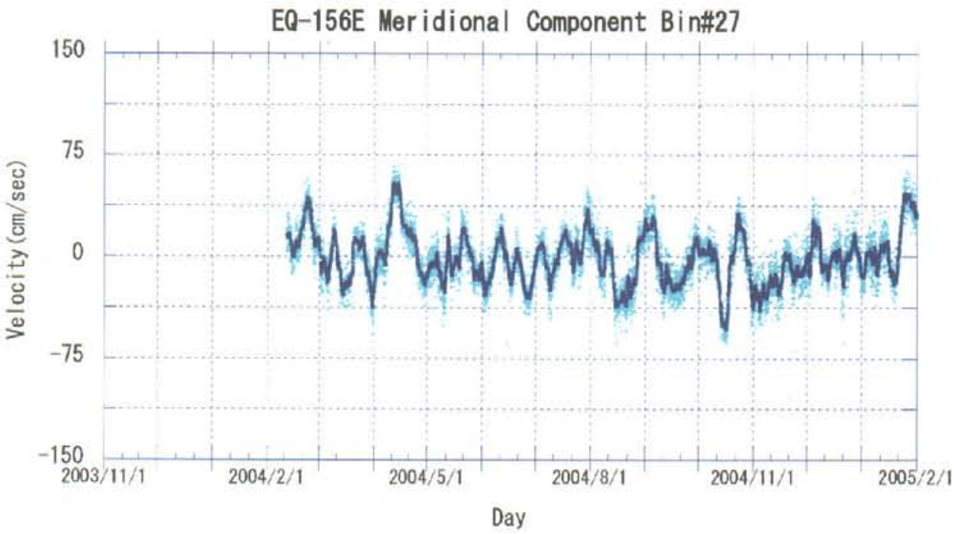
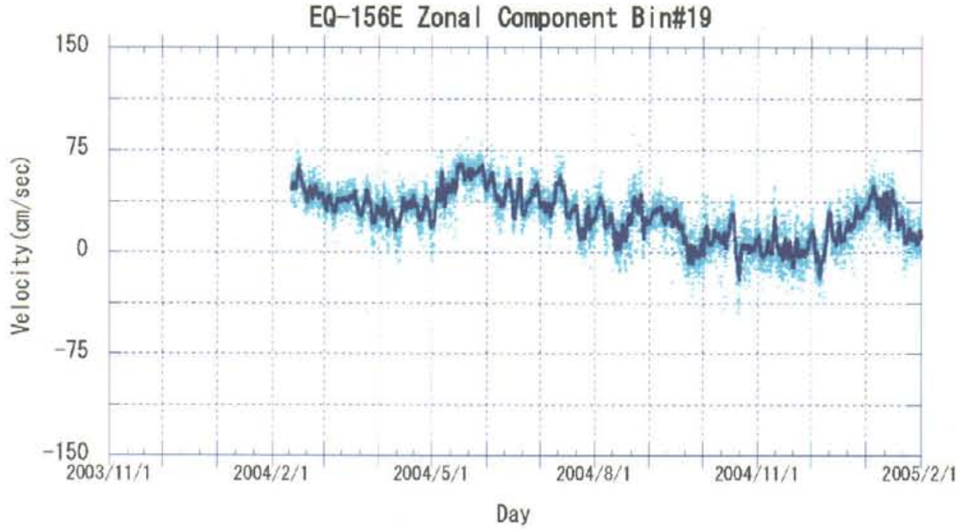


Fig.7.2.-9 Time Series of zonal and meridional velocities of EQ-156E mooring at bin#27



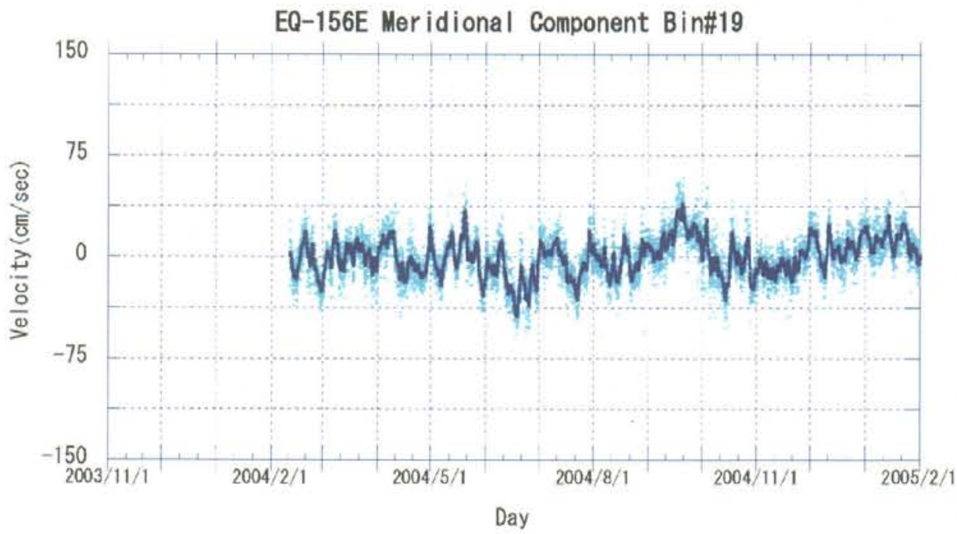
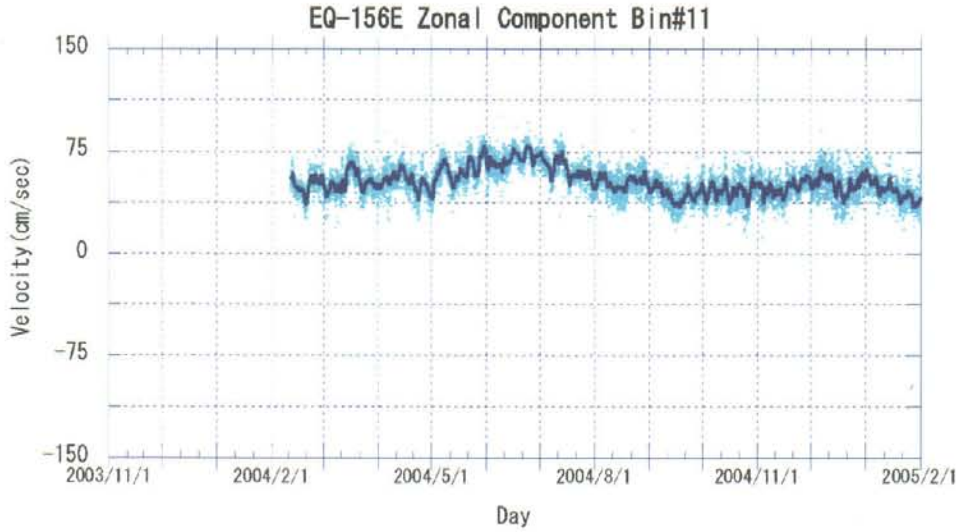


Fig.7.2.-10 Time Series of zonal and meridional velocities of EQ-156E mooring at bin#19



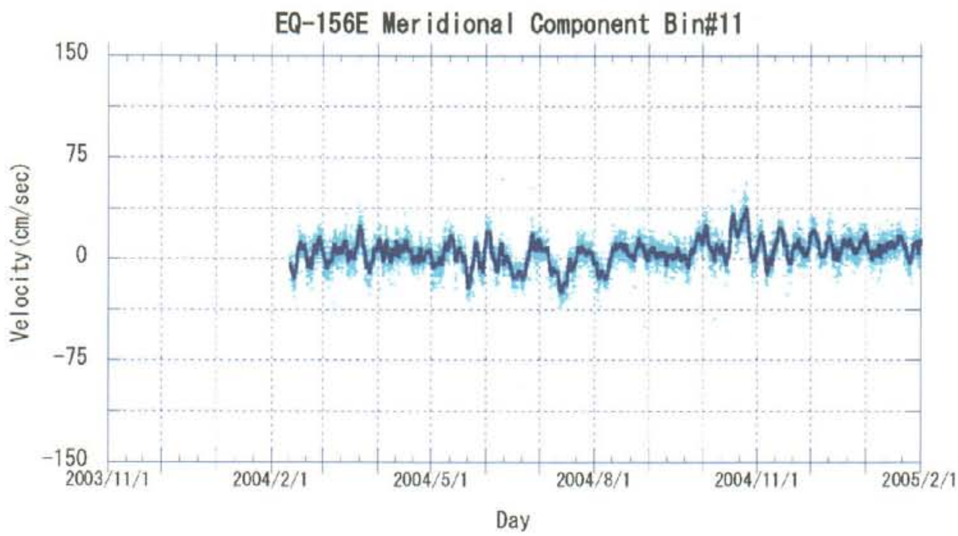


Fig.7.2.-11 Time Series of zonal and meridional velocities of EQ-156E mooring at bin#11

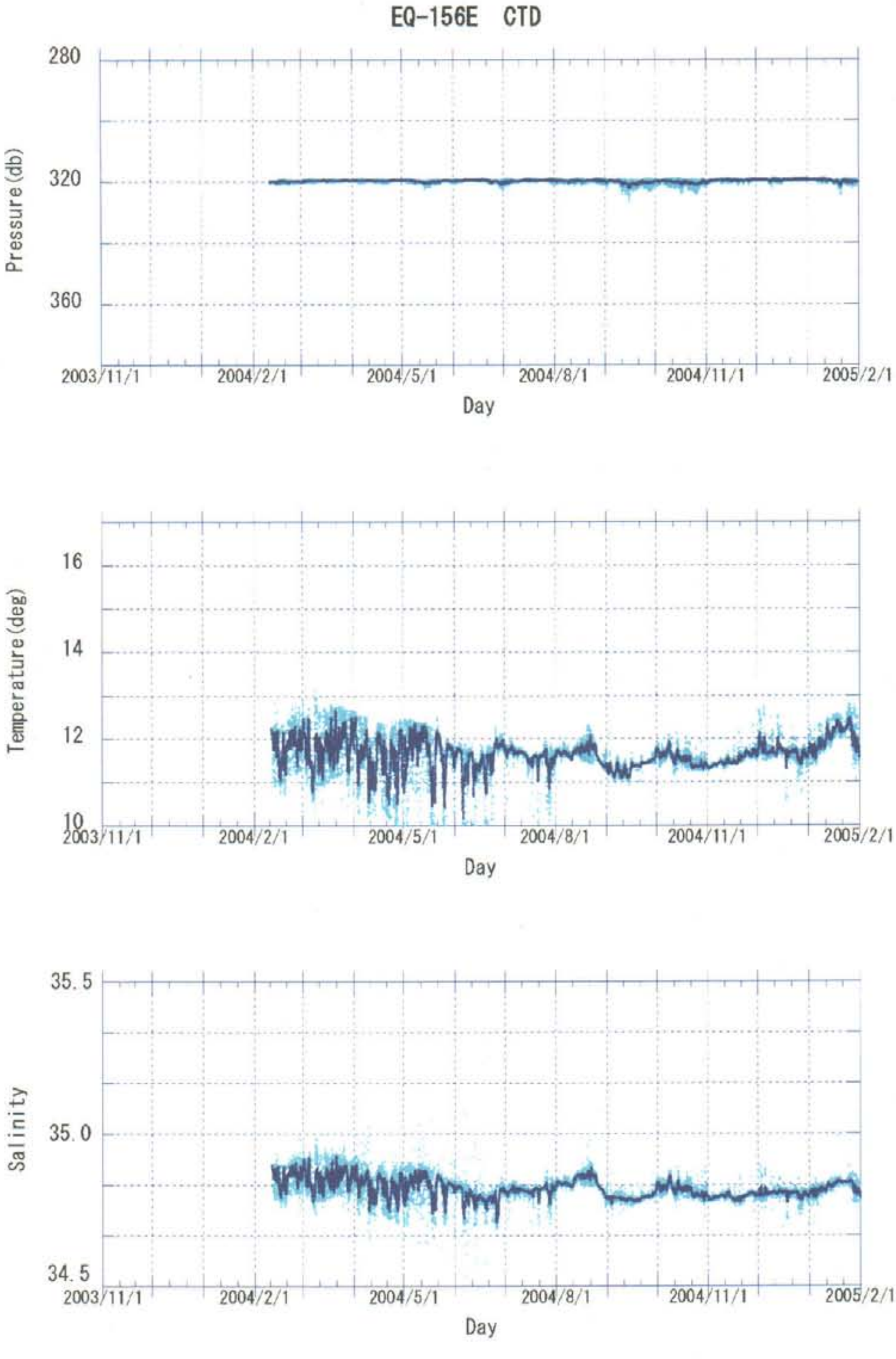


Fig.7.2.-12 Time Series of pressure, temperature, salinity of obtained with CTD of EQ-156E mooring

7.3 ARGO float (profiling float) deployment

(1) Personnel

Shigeki Hosoda	(JAMSTEC): Principal Investigator
Nobuyuki Shikama	(JAMSTEC): not on board
Eitarou Oka	(JAMSTEC): not on board
Mizue Hirano	(JAMSTEC): not on board
Hiroshi Matsunaga	(MWJ)
Masaki Furuhata	(MWJ)

(2) Objectives

The objective of deployment is to clarify the structure and temporal/spatial variability of water masses in the subtropical North Pacific such as the Subtropical Mode Water.

The profiling floats launched in this cruise obtain vertical profiles of temperature and salinity automatically every ten days. The data from the floats will enable us to understand the phenomenon mentioned above with time/spatial scales much smaller than those in the previous studies.

(3) Parameters

Water temperature, salinity and pressure.

(4) Methods

We launched 2 APEX floats of JAMSTEC. These floats equip an SBE41 CTD sensor manufactured by Sea-Bird Electronics Inc.

The type of the floats is Park and Profile. The floats drift at depth of 1000 db (called the parking depth), down to 2000 db and rise to the sea surface every ten days by increasing buoyancy. During the ascent, they measure temperature, salinity, and pressure. They stay at the sea surface for approximately nine hours, then transmit their positions and the CTD data to the land via the ARGOS system. After transmitting, they return to the parking depth by decreasing buoyancy. The status of floats and their launches are shown in Table 7.3-1.

(5) Data archive

All data acquired by the JAMSTEC floats through the ARGOS system is stored in JAMSTEC data management division. The real-time data are provided to meteorological organizations via Global Telecommunication System (GTS) and utilized for analysis and forecasts of ocean conditions.

Table 7.3-1 Status of floats and their launches.

Float (JAMSTEC)

Float Type	APEX floats manufactured by Webb Research Ltd.
CTD sensor	SBE41 manufactured by Sea-Bird Electronics Inc.
Cycle	10 days (approximately 9 hours at the sea surface)
ARGOS transmit interval	30 sec
Target Parking Pressure	1000
Sampling layers	71 (2000, 1900, 1800, 1700, 1600, 1500, 1400, 1300, 1250, 1200, 1150, 1100, 1050, 1000, 975, 950, 925, 900, 875, 850, 825, 800, 780, 760, 740, 720, 700, 680, 660, 640, 620, 600, 580, 560, 540, 520, 500, 480, 460, 440, 420, 400, 380, 360, 340, 320, 300, 280, 260, 240, 220, 200, 190, 180, 170, 160, 150, 140, 130, 120, 110, 100, 90, 80, 70, 60, 50, 40, 30, 20, 10 [dbar])

Launches

Owner	Type	S/N	ARGOS PTT ID	Date and Time of Reset (UTC)	Date and Time of Launch (UTC)	Location of Launch
JAMSTEC	APEX	1615	23810	04:20, Feb. 11	06:13, Feb. 11	13-56.17 N, 153-38.55E
JAMSTEC	APEX	1616	23811	00:02, Feb. 13	01:14, Feb. 13	23-00.01N, 150-00.19 E

7.4 Lidar observations of clouds and aerosol

(1) Personnel

Akihide Kamei (National Institute for Environment Studies)
Ichiro Matsui (Same as above; not on board)
Atsushi Shimizu (Same as above; not on board)
Nobuo Sugimoto (Same as above; not on board)
Toshiaki Takano (Chiba University; not on board)
Hajime Okamoto (Tohoku University; not on board)

(2) Objectives

Objectives of the observations in this cruise are

- to study distribution and optical characteristics of marine aerosols using a two-wavelength dual polarization lidar,
- to study distribution of water/ice clouds.

(3) Method

Vertical profiles of aerosols and clouds were measured with a two-wavelength dual polarization lidar. The lidar employs a Nd:YAG laser as a light source which generates the fundamental output at 1064 nm and the second harmonic at 532 nm. Transmitted laser energy is typically 100 mJ per pulse at 1064 nm and 50 mJ per pulse at 532 nm. The pulse repetition rate is 10 Hz. The receiver telescope has a diameter of 35 cm. The receiver has three detection channels to receive the lidar signals at 1064 nm and the parallel and perpendicular polarization components at 532 nm. An analog-mode avalanche photo diode (APD) is used as a detector for 1064 nm, and photomultiplier tubes (PMTs) are used for 532 nm. The detected signals are recorded with a transient recorder and stored on a hard disk with a computer. The lidar system was installed in a 20-ft container with the FM-CW (Frequency Modulated Continuous Wave) cloud profiling radar of Chiba University. The container has a glass window on the roof, and the lidar was operated continuously regardless of weather. Simultaneously, the observation of the small lidar in a sonde container and the FM-CW radar, the infrared radiometer of Tohoku University were also carried out.

(4) Results

Figure 7.4-1 shows the quick-look time-height indications of the range-corrected signal during of this cruise. The lower clouds at 600 m are continuously observed over western Pacific Ocean. Cirrus clouds and subvisible cirrus clouds are also frequently observed in an altitude range of 10 to 19 km.

(5) Data archive

- Raw data
  lidar signal at 532 nm (parallel polarization), lidar signal at 532 nm (perpendicular polarization)
  lidar signal at 1064 nm, temporal resolution 10 sec., vertical resolution 3.75 m
- Processed data
  cloud base height, apparent cloud top height, cloud phase, cloud fraction
  boundary layer height (aerosol layer upper boundary height)
  backscatter coefficient of aerosols, depolarization ratio

All data will be archived at National Institute for Environmental Studies, and submitted to JAMSTEC within 3-years.

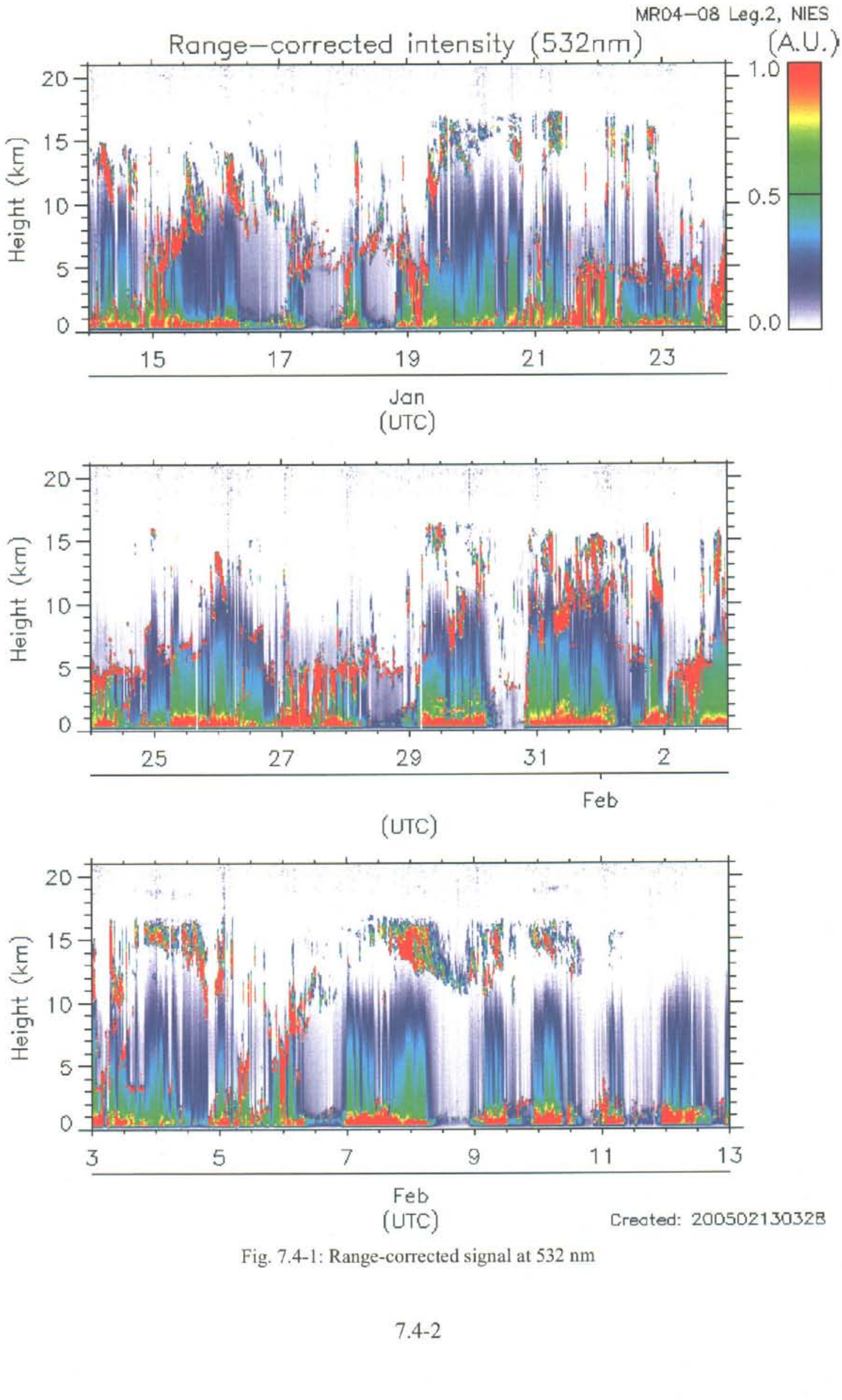


Fig. 7.4-1: Range-corrected signal at 532 nm

7.5. Studies on behaviors and climate influence of atmospheric aerosols over the ocean

(1) Personnel

Tatsuo Endoh (Tottori University of Environmental Studies: Not on board) Principal Investigator
Sachio Ohta (Engineering environmental resource laboratory, Graduate school of engineering, Hokkaido University, Not on board)
Tamio Takamura (Center of environmental remote sensing science, Chiba University, Not on board)
Teruyuki NAKAJIMA (Center of climate system research, University of Tokyo, Not on board)
Nobuo SUGIMOTO (National Institute for Environmental Studies, Japan, Not on board)

(2) Objects/Introduction

Objective theme:

Investigation of horizontal distribution on the concentration and size distribution and optical properties of atmospheric aerosols at the surface and optical thickness of columnar aerosol over the ocean.

Objects:

To clear and solve the problems of horizontal distribution and optical properties of aerosols, some observations were carried out over the western North Pacific Ocean. Furthermore, collections of the data for calibration and validation to the remote sensing data were performed simultaneously

Introduction:

One of the most important objects is the collection of calibration and validation data from the surface (Nakajima et al.1996, 1997 and 1999). It may be considered for the observation over the widely opening of the huge ocean to be desired ideally because of horizontal homogeneity. Furthermore, the back ground values of aerosol concentration are easily obtained over there (Ohta et al.1996, Miura et al. 1997 and Takahashi et al. 1996) and vertical profile of aerosol concentration are obtained by means of extrapolation up to the scale height. It is desired to compare the integrated value of these profile of aerosol concentration with optical thickness observed by the optical and radiative measurement (Hayasaka et al. 1998, Takamura et al.1994). Facing this object, the optical and radiative observations were carried out by mean of the Sky Radiometer providing more precise radiation data as the radiative forcing for global warming.

(3) Measuring parameters

Atmospheric optical thickness, Ångström coefficient of wave length efficiencies, Direct irradiating intensity of solar, and forward up to back scattering intensity with scattering angles of 2-140degree and seven different wave lengths GPS provides the position with longitude and latitude and heading direction of the vessel, and azimuth and elevation angle of sun. Horizon sensor provides rolling and pitching angles. Concentration and size distribution of atmospheric aerosol.

(4) Methods

The instruments used in this work are shown as following in Table-1. Sky Radiometer was measuring irradiating intensities of solar radiation through seven different filters with the scanning angle of 2-140 degree. These data will provide finally optical thickness, Ångström exponent, single scattering albado and size distribution of atmospheric aerosols with a kind of retrieval method. Optical Particle Counter was measuring the size of large aerosol particle and counting the number concentration with laser light scattering method and providing the size distribution in 0.3,0.5,1.0,2.0 and 5.0 micron of diameter with real time series display graphically.

(5) Results

Information of data and sample obtained are summarized in Table-2. The sky radiometer has been going well owing to more calm and silent condition and circumstances about shivering problems provided by the R/V Mirai whose engines are supported by well defined cushions. Therefore, measured values will be expected to be considerably stable and provide good calculated parameters in higher quality. However, some noise waves were found to interfere the 16,13 and 12channel marine bands of VHF from sky radiometer. Fortunately the origin and source were identified by using a VHF wide band receiver and the interference waves were kept by fairly separating from two VHF antennae and decreased to recovery of 100%.

Aerosols size distribution of number concentration have been measured by the Particle Counter and data obtained are displayed in real time by a kind of time series *in situ* with 5stages of size range of 0.3, 0.5, 1.0, 2.0, and 5.0 micron in diameter.

(6) Data archive

This aerosol data by the Particle Counter will be able to be archived soon and anytime. However, the data of other kind of aerosol measurements are not archived so soon and developed, examined , arranged and finally provided as available data after a certain duration. All data will archived at ILTS (Endoh), Hokkaido University, CCSR(Nakajima), University of Tokyo and CEReS (Takamura), Chiba University after the quality check and submitted to JAMSTEC within 3-year.

References

Takamura, T., et al., 1994: Tropospheric aerosol optical properties derived from lidar, sun photometer and optical particle counter measurements. Applied Optics, Vol. 33, No. 30,7132-7140.

Hayasaka, T., T. Takamura, et al., 1998: Stratification and size distribution of aerosols retrieved from simultaneous measurements with lidar, a sunphotometer, and an aureolemeter. Applied Optics, 37(1998), No 6, 961-970.

Nakajima, T., T. Endoh and others(7 parsons) 1999: Early phase analysis of OCTS radiance data for aerosol remote sensing., IEEE Transactions on Geoscience and Remote Sensing, Vol. 37, No. 2, 1575-1585.

Nakajima, T., et al., 1997: The current status of the ADEOS-Ⅱ/GLI mission. Advanced and Next-generation SatellitesⅡ, eds. H. Fujisada, G . Calamai, M. N. Sweeting, SPIE 2957, 183-190.

Nakajima, T., and A. Higurashi, 1996: AVHRR remote sensing of aerosol optical properties in the Persian Gulf region, the summer 1991. J . Geophys. Res., 102, 16935-16946.

Ohta, S., et al., 1997: Variation of atmospheric turbidity in the area around Japan. Journal of Global Environment Engineering, Vol.3, 9-21.

Ohta, S., et al., 1996: Chemical and optical properties of lower tropospheric aerosols measured at Mt. Lemmon in Arizona, Journal of Global Environment Engineering, Vol.2,67-78.

Takahashi, T., T. Endoh, et al., 1996: Influence of the growth mechanism of snow particles on their chemical composition. Atmospheric Environment, Vol.30, No. 10/11, 1683-1692.

Miura, K., S. Nakae, et al.,: Optical properties of aerosol particles over the Western Pacific Ocean, Proc. Int. Sym. Remote Sensing, 275-280, 1997.

Data inventory

Table-1. Information of obtained data inventory (Method)

Item, No.data	Name	Instrument	Site position
Optical thickness, Ångström exponent and Aerosol Size distribution.	Endoh	Sky Radiometer(Prede,POM-01MK2)	roof of stabilizer

Table-2. Data and Sample inventory

Data/Sample	rate	site	object	name	state	remarks
Sun & Sky Light	1/5min (fine& daytime)	roof of stabilizer	optical thickness Ångström expt.	Endoh	land analysis	14/01'05-19/02'05

7.6. Distribution and dispersal of airborne insects in the Pacific Ocean

Personnel

Kouhei Murata: Principal Investigator

(Agricultural Research Organization Kyushu Tokai University)

Abstract

Distribution and abundance of airborne insects in Pacific Ocean were investigated using nylon funnel nets and light trap during The MR04-08 Leg 2 cruise. A total of 30 insects were taken in the traps. Many species were caught for out to sea, although obviously abundances were higher in samples taken close to shore.

(1) Introduction

The study of the dispersal of insects in the air came to the early part of the last century. Systematic studies of airborne insects at sea, especially over the Pacific Ocean, have shown that many species occur far offshore. Many investigations followed various different routes over the sea but this route of cruise has never been studied. Here, I report the results of aerial trapping of insects at Pacific Ocean.

(2) Material and methods

Trapping of airborne insects was done using nylon funnel nets set at the masthead of the ship. The light trap set at the ship's back deck. The nets were in constant use at sea except when weather conditions interfered with operations. The net A was checked once a day between 11:00- 13:00 hrs. The net B was checked once an hour from 6:00 to 18:00 hrs. The light trap was checked once a day between 7:00 – 8:00 hrs. Some insect was caught by hand on the ship's deck. The ship was either cruising at a slow speed or making several stops during operations for TRITON.

(3) Results and discussion

In this cruise, a total of 30 insects were taken in the traps. Many species among the Diptera and Hymenoptera were collected. Regional difference in abundance was significantly varied with location. The higher number of these catches ranged from Parau to New Guinea. Many species were caught for out to sea, although obviously abundances were higher in samples taken close to shore. The specimens may be attributed to insects actively flying aboard generally while the ship was less than 100 km away from land. Large numbers of living insects were trapped in the air over the sea at shorter distances of up to about 100 km from the nearest land.

Of real importance to the carriage of insects within the tropics and subtropics are the zones of convergence on a global scale, for example, where the opposing trade winds in the Northern and Southern Hemispheres meet to from the Intertropical Front or the Inter Tropical Convergence Zone (ITCZ). This report is a preliminary report on insects trapped at Pacific Ocean including ITCZ.

Many scientists discuss their catches in relation to the dispersal of insects in the Pacific area. The ecological value of dispersal can be properly assessed only when there is a quantitative balance sheet of survival and mortality resulting from it, in a context of general population dynamics over a wide area.

In conclusion, data collected air bone insects in Pacific Ocean during this cruise showed that the population of air bone insects was higher in samples taken close to shore. It was not static but varied temporally and spatially.

(4) Data archive

Observed data will be archived at Agricultural Research Organization Kyushu Tokai University and submitted to the Data Management Division in JAMSTEC.

Acknowledgement

I would like to express to Captain, Yujiro Kita, officers and crew of the R/V Mirai, for their cooperation throughout the present cruise. I am also grateful thanks to Dr. Sigetoshi Hosoda, the chief scientist of the cruise, for his supervising during the MR04-08 Leg 2 cruise.