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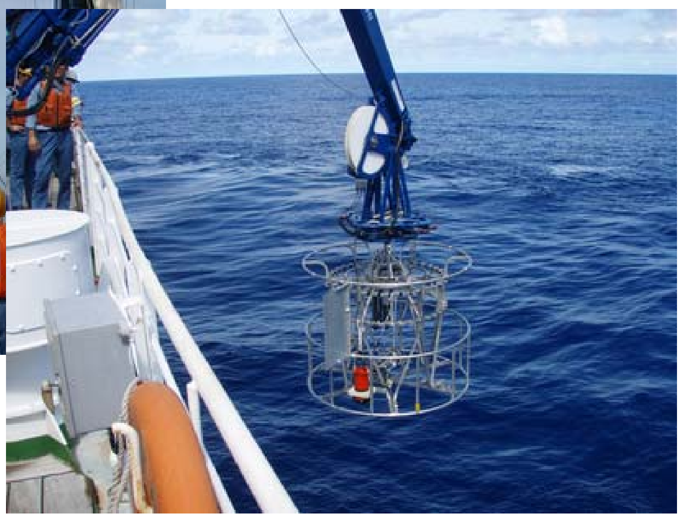
R/V Mirai Cruise Report
MR07-07 Leg 1

December 28, 2007 – January 25, 2008
Tropical Ocean Climate Study (TOCS)



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

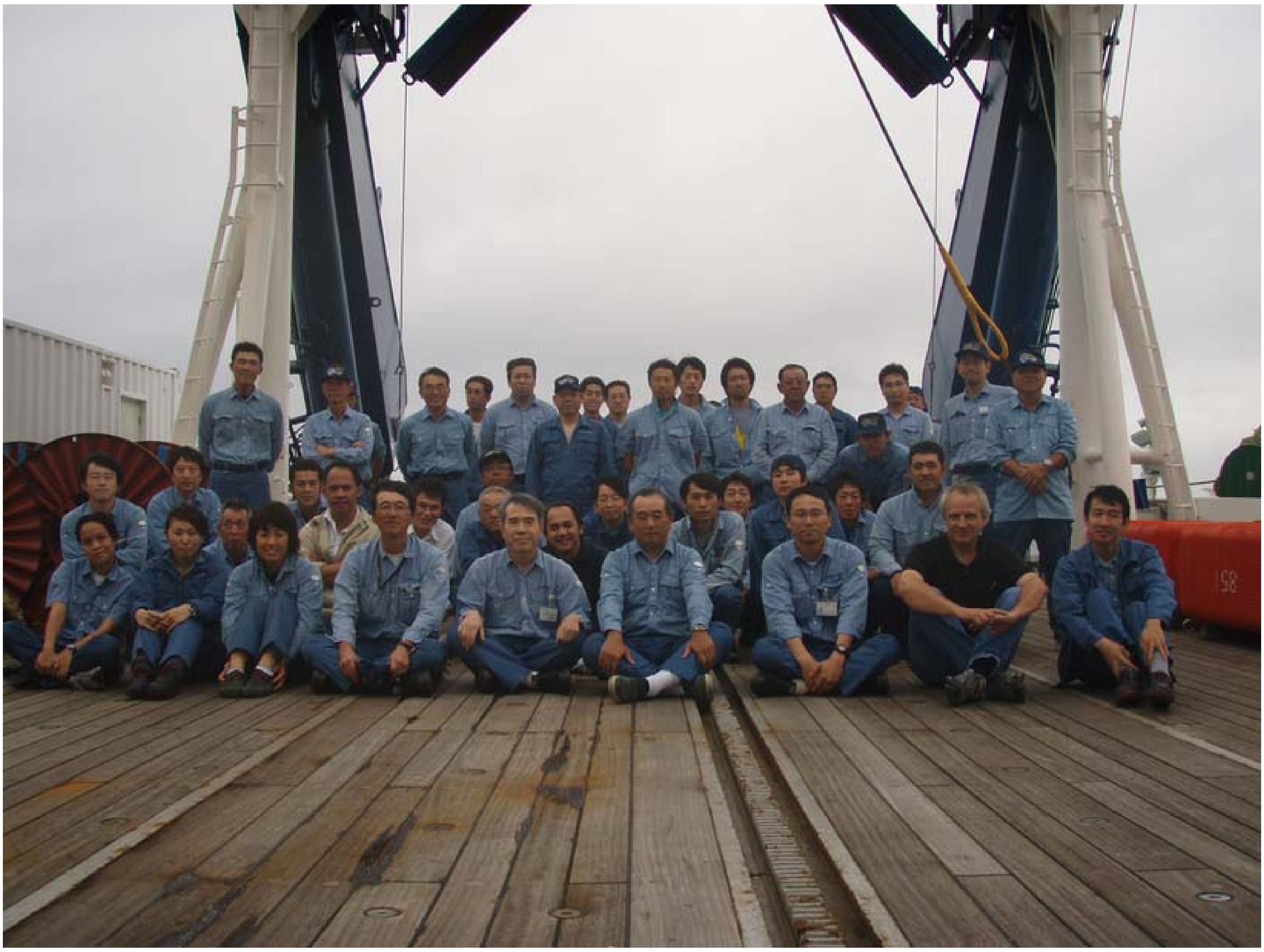


Table of contents

1. Cruise name and code

Tropical Ocean Climatology Study

MR07-07 Leg 1

Ship: R/V Mirai

Captain: Masaharu Akamine

2. Introduction and observation summary

2.1. Introduction

ENSO (El Nino/Southern Oscillation) phenomena are widely known because they largely influence economical and social activity in the world. Because El Nino and La Nina occurred associating with migration of the warm water pool (WWP) in the western equatorial Pacific, it is important to know variability of the warm water pool and its mechanism for better understanding El Nino and La Nina. For this purpose, we have been maintained TRIangle Trans Ocean Network (TRITON) buoys in the western equatorial Pacific since 1998. Main mission of this cruise is to maintain this TRITON buoy network. During this cruise, we maintained six TRITON buoys along 130E and 137-138E lines. Additionally, we conducted oceanic and meteorological observations around the TRITON buoy locations for investigation of climate in the tropical region.

The tropical ocean and atmosphere during this boreal winter were under the 2007-08 La Nina condition. Because similar observations, MR06-05 Leg3 cruise, were conducted at the same season of the last year under the 2006-07 El Nino, we can compare status of ocean and atmosphere between these conditions. Then, the comparison of the results from both cruises will show us interesting and important knowledge of El Nino and La Nina phenomena.

Second, we observed ocean current system near the western boundary of the western tropical Pacific because they contribute to water exchange between subtropics and equatorial region, and thought to impact the tropical climate variability. Particularly, the North Equatorial Current bifurcates to the Kuroshio and Mindanao Current east of the Philippines, and understanding of its structure and variability is an important objective of this cruise. Therefore, we carried out observations of these currents using XCTD/CTD and shipboard acoustic Doppler current profiler (ADCP) near the Philippine coast, where is in the Philippines territorial water and economical exclusive zone (EEZ).

Additionally, two special observations were conducted during this cruise: 1) observations of ocean mixing using a lowered ADCP, and 2) observations of atmospheric convection in the Philippine Sea using radiosondes and Doppler radar. These observations will also contribute to understanding of oceanic and atmospheric phenomena in the western tropical Pacific.

2.2. Overview

1) Ship

R/V Mirai

Captain Masaharu Akamine

2) Cruise code

MR07-07 Leg 1

3) Project name

Tropical Ocean Climate Study (TOCS)

4) Undertaking institution

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

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

5) Chief scientist

Yuji Kashino (JAMSTEC)

6) Period

December 28, 2007 (Auckland, New Zealand) – January 25, 2008 (Nakagusuku, Japan)

7) Research participants

Three scientists and fourteen technical staffs from three Japanese institutions and companies

One scientist from USA

One scientist from Philippines

Two scientists and one security officer from Indonesia

2.3. Observation summary

TRITON mooring recovery and re-installation:	6 moorings were deployed.
	5 moorings were recovered.
CTD (Salinity, Temperature and Depth) and water sampling:	24 casts
XCTD:	52 casts
Radiosondes:	57 casts
Rain sampling	20 casts
Current measurements by shipboard ADCP:	continuous (*1)
Sea surface temperature, salinity and dissolved oxygen measurements by intake method:	
	continuous (*1)
Surface meteorology:	continuous (*1)
Lidar observations of clouds and aerosol	continuous (*1)
Doppler radar observation:	continuous (*2)
Underway geophysics observations	continuous (*3)

*1) These observations were conducted along ship track except in Papua New Guinea territorial water.

*2) Observations were conducted from Jan. 02 to Jan. 23, 2008, except in the territorial water and

EEZ of Papua New Guinea.

*3) These observations were conducted along ship track except in Papua New Guinea territorial water and Indonesian EEZ.

Regarding TRITON buoy maintenance work, we recovered five buoys and re-installed six buoys at 130E and 137-138 lines during this cruise. Some recovered buoys were damaged by the vandalism as usual. In particular, tower of the buoys at 0N138E and 8N130E were broken perhaps due to ship crash or artificially cutting. We strongly hope that fishermen who work in this region take care of these buoys which are used for weather forecast. All buoy works were successful without troubles in spite of these vandalisms.

CTD observations were conducted at 24 stations. At first, we conducted a test cast at 30-40S, 172-53E, where is in the open sea north of New Zealand, for the lowered ADCP test. This test was successful and its result shows good agreement of current profiles between the lowered ADCP and shipboard ADCP. After then, we conducted CTD observations with the lowered ADCP at 13 stations along 137-138E line. Data showing complicated current profiles was obtained by these observations. After then, we conducted 10 CTD casts along 130E, 7N, 8N and 18-20N lines for performance check of the TRITON underwater sensors and XCTDs. Because there is large systematic offset (0.05-0.1 psu) in XCTD salinity data during MR06-05 Leg3 cruise, we checked XCTD performance.

XCTD observations were conducted along 18-20N, 130E, 8N, 7N and 137-138E lines. Particularly, we conducted concentrated observations near the Philippine coast where strong boundary currents flow. These observations were successful, however, comparison with CTD observations showed salinity offset of 0.05 psu. (XCTD salinity is lower than CTD salinity.) We will report these comparison results to the XCTD maker and ask to check.

After we left from Papua New Guinea EEZ, we started radiosonde observations every 6 hours from Jan 6, 6:00 (UTC) to Jan 20, 18:00. Because the Maddan Julian Oscillation (MJO) was active just when R/V Mirai arrived at the observational region, its convection structure was observed. Doppler radar was additionally used for observation of tropical atmospheric convection together with radiosonde.

Other oceanographical, meteorological and geophysical continuous observations were also successfully carried out during this cruise. The Shipboard ADCP of R/V Mirai did not work well during previous cruise (MR07-06), but, good data was fortunately obtained during this cruise.

Observed Oceanic and Atmospheric Conditions

The equatorial Pacific during this (boreal) winter was under strong La Nina condition (Figure 2-1) since 1998-99 La Nina. Moreover, the MJO also passed observation area when R/V Mirai cruised near the New Guinea (Figure 2-2) and westerly burst associating with it occurred at that timing.

Associating with this condition, the Mindanao Current (MC) was significantly weak than the last winter (Figure 2-3) and the New Guinea Coastal Current (NGCC) flowed reversely (southwestward). Because of the reversed NGCC and strong northwesterly wind near the New Guinea, observation schedule was delayed one day. Not only the MC and NGCC but also the structure/strength of the North Equatorial Counter Current and North Equatorial Current also differed from those in the last year; both currents were weaker than last year. North Equatorial Counter Current shifted to the north about 100km from the location in the last year.

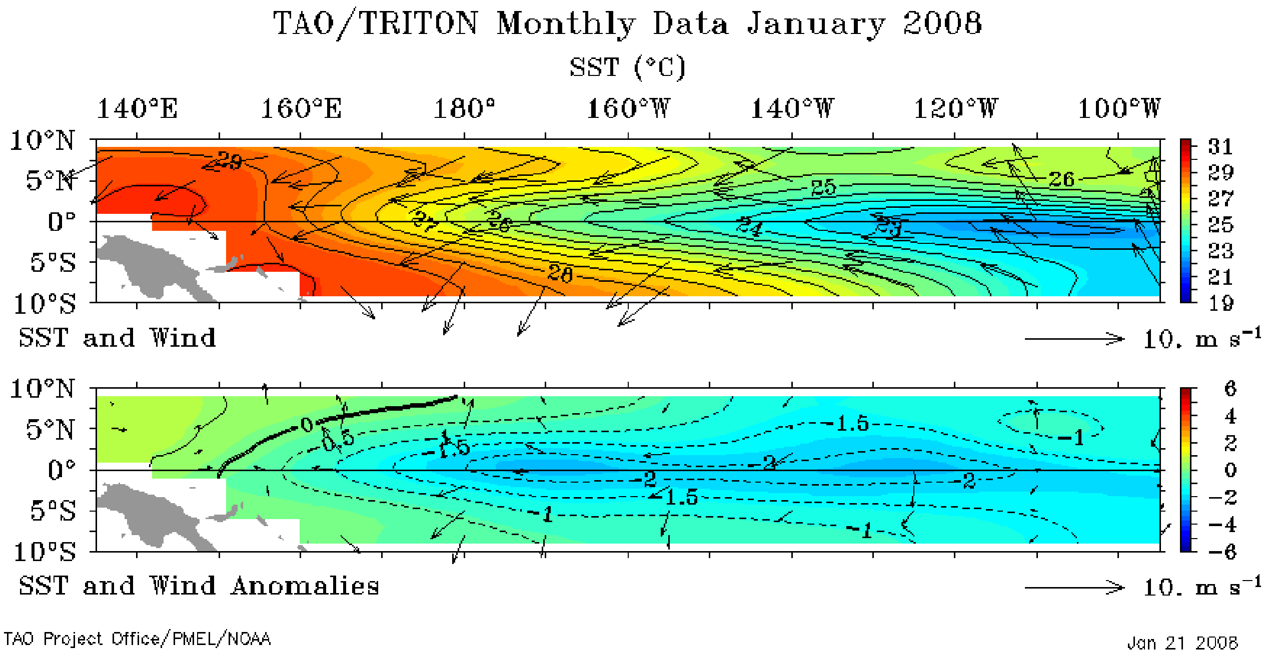


Figure 2-1. Map of monthly sea surface temperature and winds (upper panel), and their anomaly (lower panel) obtained from TAO/TRITON buoy array in January 2008. (http://www.pmel.noaa.gov/tao/jsdisplay/)

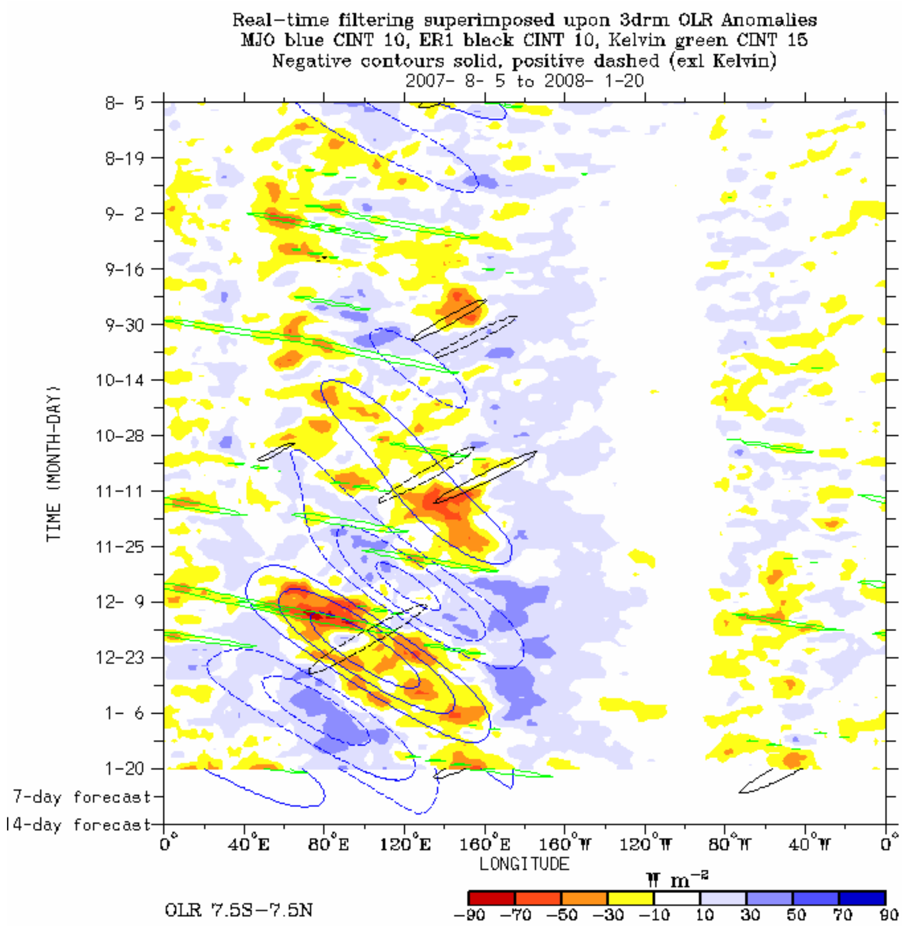


Figure 2-2. Outgoing radiation anomaly averaged over 7.5S-7.5N from the web page of the Climate Diagnostic Center (CDC), National Oceanic and Atmospheric Association (NOAA) (http://www.cdc.noaa.gov/map/clim/olr_modes/).

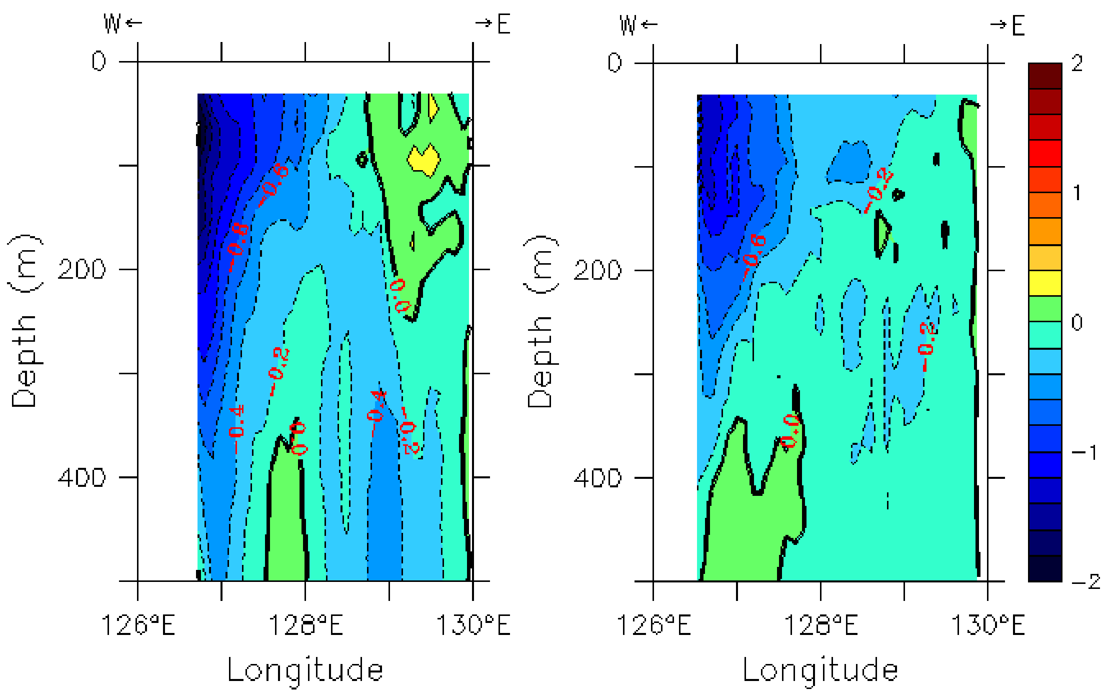


Figure 2-3. Meridional velocity sections along 7N line during MR06-05 Leg3 conducted in the last year (left panel), and during this cruise (right panel.) Unit is m/sec.

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

3.1 Period

December 28, 2007 – January 25, 2008

3.2 Port of call

Auckland, New Zealand (Departure; December 28, 2007)
Nakagusuku, Japan (Arrival; January 25, 2008)

3.3 Cruise log

SMT	UTC	Event
Dec. 28 (Fri) 2007		
12:00	23:00 (-1day)	Departure at Auckland [Ship Mean Time(SMT)= UTC+13 h]
15:00	02:00	Safety Guidance
16:30	03:30	Surface sea water sampling pump start
18:55	05:55	Continuous observation start
Dec. 29 (Sat) 2007		
09:00	20:00	Boat station drill
15:01-15:45	02:01-02:45	CTD/LADCP cast (test cast for LADCP; 800m)
16:45	03:45	Konpira Ceremony
22:00	09:00	Time adjustment -1h (SMT=UTC+12h)
Dec. 30 (Sun) 2007		
13:00	01:00	Meeting for MR07-07 Leg.1 observation
Dec. 31 (Mon) 2007		
22:00	11:00	Time adjustment -1h (SMT=UTC+11h)
Jan.03 (Thu) 2008		
12:00	01:00	Doppler radar observation start
22:00	12:00	Time adjustment -1h (SMT=UTC+10h)
Jan. 05 (Sat) 2008		
22:00	12:00	Time adjustment -1h (SMT=UTC+9h)
Jan. 06 (Sun) 2008		
14:30	05:30	Radiosonde (#RS001)
16:52-17:35	07:52-08	CTD/LADCP (# C1; 800m)
20:30	11:30	Radiosonde (#RS002)
Jan. 07 (Mon) 2008		
02:30	17:30	Radiosonde (#RS003)
08:13-10:55	23:13-01:55	Deployment of TRITON #13 (EQ138E) (Fixed position: 00-01.9345N, 137-53.3163E)
08:30	23:30	Radiosonde (#RS004)
11:46	02:46	XCTD observation (# X01)
13:56-14:36	04:56-05:56	CTD/LADCP (#C2; 800m)
14:37	05:37	Radiosonde (#RS005)
16:57-17:35	07:57-08:35	CTD/LADCP (#C3; 800m)

20:30	11:30	Radiosonde (#RS006)
Jan. 08 (Tue) 2008		
02:31	17:31	Radiosonde (#RS007)
08:13-11:41	23:13-02:14	Recovery of TRITON #13 (EQ138E)
08:30	23:30	Radiosonde (#RS008)
14:30	05:30	Radiosonde (#RS009)
17:50-18:31	08:50-19:31	CTD/LADCP (#C4; 800m)
20:30	11:30	Radiosonde observation (#RS010)
Jan. 09 (Wed) 2008		
02:30	17:30	Radiosonde (#RS011)
05:59-06:40	20:59-21:40	CTD/LADCP (#C5, 800m)
08:12-10:21	23:12-02:21	Deployment of TRITON #12 (2N138E)
		(Fixed position: 02-03.9030N, 138-03.8736E)
08:30	23:30	Radiosonde (#RS012)
12:17	03:17	XCTD observation (#X02)
13:05-16:15	0405:07:15	Recovery of TRITON #12 (2N138E)
14:30	05:30	Radiosonde (#RS013)
19:13-19:54	10:13-19:54	CTD/LADCP (#C6; 800m)
20:30	11:30	Radiosonde (#RS014)
Jan. 10 (Thu) 2008		
02:30	17:30	Radiosonde (#RS015)
05:54-06:37	20:54-21:37	CTD/LADCP (#C7; 800m)
		T, C, DO sensor trouble, changed C sensor.
07:22	22:22	XCTD (#X03)
07:57-08:36	22:57-23:36	CTD/LADCP (#C7; 800m)
08:21	23:21	Radiosonde (#RS016)
10:55-11:32	01:55-02:32	CTD/LADCP (#C8; 800m)
13:49:14:28	04:49-05:28	CTD/LADCP (#C9; 800m)
14:30	05:30	Radiosonde (#RS017)
16:48-17:28	07:48-08:28	CTD/LADCP (#C10; 800m)
20:30	11:30	Radiosonde (#RS018)
Jan. 11 (Fri) 2008		
02:30	17:30	Radiosonde (#RS019)
05:59-06:39	20:59-21:39	CTD/LADCP (#C11; 800m)
08:13-10:38	23:13-01:38	Deployment of TRITON#11 (5N137E)
		(Fixed position: 4-56.3677N, 137-18.2298E)
08:30	23:30	Radiosonde (#RS020)
13:17	04:17	XCTD (#X04)
14:30	05:30	Radiosonde (#RS021)
16:28-17:08	07:28-08:08	CTD/LADCP (#C12; 800m)
17:15-17:36	08:15-08-36	Figure eight turn
20:30	11:30	Radiosonde (#RS022)
Jan. 12 (Sat) 2008		
02:30	17:30	Radiosonde (#RS023)
08:13-12:09	23:13-03:09	Recovery of TRITON#11 (5N137E)

08:30	23:30	Radiosonde (#RS024)
14:30	05:30	Radiosonde (#RS025)
17:51-18:35	08:51-09:35	CTD/LADCP (#C13; 800m)
20:30	11:30	Radiosonde (#RS026)
Jan. 13 (Sun) 2008		
00:35	15:35	XCTD (#X05)
02:30	17:30	Radiosonde (#RS027)
05:26-06:10	20:26-21:10	CTD (#C14; 1000m)
08:10-10-12	23:10-01:12	Deployment of TRITON#10 (8N137E)
		(Fixed position: 7-38.9863N, 136-41.9348E)
08:23	23:23	Radiosonde (#RS028)
10:47	01:47	XCTD (#X06)
13:37-16:39	04:37-07:39	Recovery of TRITON#10 (8N137E)
14:30	05:30	Radiosonde (#RS029)
20:30	11:30	Radiosonde (#RS030)
Jan. 14 (Mon) 2008		
02:30	17:30	Radiosonde (#RS031)
08:30	23:30	Radiosonde (#RS032)
14:30	05:30	Radiosonde (#RS033)
20:30	11:30	Radiosonde (#RS034)
21:19	12:19	Radiosonde re-launch (#RS034)
Jan. 15 (Tue) 2008		
02:30	17:30	Radiosonde (#RS035)
08:11-10:19	23:11-01:19	Deployment of TRITON#16 (2N130E)
		(Fixed position: 02-00.7101N, 130-12.5979E)
08:30	23:30	Radiosonde (#RS036)
11:13-11:55	02:13-02:55	CTD (#C15; 1000m)
14:30	05:30	Radiosonde (#RS037)
16:57	07:57	XCTD (#X07)
20:30	11:30	Radiosonde (#RS038)
21:52	12:52	XCTD (#X08)
Jan. 16 (Wed) 2008		
02:20	17:20	XCTD (#X09)
02:25	17:25	XCTD (#X10)
02:33	17:33	Radiosonde (#RS039)
07:07	22:07	XCTD (#X11)
08:30	23:30	Radiosonde (#RS040)
12:57-13:42	03:57-04:42	CTD (#C16, 1000m)
14:30	05:30	Radiosonde (#RS041)
18:46	09:46	XCTD (#X12)
20:30	11:30	Radiosonde (#RS042)
23:55	14:55	XCTD (#X13)
Jan. 17 (Thu) 2008		
02:19	17:19	XCTD (#X14)
02:30	17:30	Radiosonde (#RS043)

03:43	18:43	XCTD (#X15)
05:11	20:11	XCTD (#X16)
06:34	21:34	XCTD (#X17)
07:26-08:15	18:26-19:15	CTD (#C17, 1000m)
08:19	23:19	XCTD (#X18)
08:48	23:48	XCTD (#X19)
13:46	04:46	XCTD (#X20)
14:25-15:11	05:25-06:11	CTD (#C18, 1000m)
15:09	06:09	XCTD (#X21)
15:57	06:57	XCTD (#X22)
16:44	17:44	XCTD (#X23)
17:55	08:55	XCTD (#X24)
19:04	10:04	XCTD (#X25)
20:57	11:57	Radiosonde (#RS044)
21:27	12:27	XCTD (#X26)
Jan. 18 (Fri) 2008		
01:47	16:47	XCTD (#X27)
02:30	17:30	Radiosonde (#RS045)
08:14-10:41	23:14-01:41	Deployment of TRITON#14
08:30	23:30	Radiosonde (#RS046)
13:16	04:16	XCTD (#X28)
13:44-1435	04:44-05:35	CTD (#C19, 1000m)
14:05	05:05	XCTD (#X29)
14:30	05:30	Radiosonde (#RS047)
15:18-19:40	06:18-10:40	CTD wire free-fall
20:30	11:30	Radiosonde (#RS048)
Jan. 19 (Sat) 2008		
02:30	17:30	Radiosonde (#RS049)
08:10-12:42	23:10-03:42	Recovery of TRITON#14
08:30	23:30	Radiosonde (#RS050)
14:24	05:30	Radiosonde (#RS051)
15:26	06:26	Radiosonde re-launch (#RS051)
16:42	07:42	XCTD (#X30)
20:30	11:30	Radiosonde (#RS052)
21:07	12:07	XCTD (#X31)
Jan. 20 (Sun) 2008		
01:16	16:16	XCTD (#X32)
02:30	17:30	Radiosonde (#RS053)
05:33	20:33	XCTD (#X33)
08:30	23:30	Radiosonde (#RS054)
09:54-10:38	00:54-01:38	CTD (#C20; 1000m)
10:47	01:47	XCTD (#X34)
14:30	05:30	Radiosonde (#RS055)
15:10	06:10	XCTD (#X35)
19:34	10:34	XCTD (#X36)

20:20	11:20	Radiosonde (#RS056)
Jan. 21 (Mon) 2008		
00:02	15:02	XCTD (#X37)
02:30	17:30	Radiosonde (#RS057)
04:19	19:19	XCTD (#X38)
07:00	22:00	XCTD (#X39)
09:50-10:33	00:50-01:33	CTD (#C21, 1000m)
10:43	01:43	XCTD (#X40)
14:31	05:31	XCTD (#X41)
18:15	09:15	XCTD (#X42)
21:56	12:56	XCTD (#X43)
Jan. 22 (Tue) 200		
01:33	16:33	XCTD (#X44)
05:55-06:40	20:55-21:40	CTD (#C22, 1000m)
06:46	21:46	XCTD (#X45)
10:15	01:15	XCTD (#X46)
12:06	03:06	XCTD (#X47)
13:02	04:02	XCTD (#X48)
13:58	04:58	XCTD (#X49)
14:56	05:56	XCTD (#X50)
15:36	06:36	CTD (#C23, 1000m)
16:26	07:26	XCTD (#X51)
17:02	08:02	XCTD (#X52)
Jan. 23 (Wed) 2008		
13:00	04:00	Doppler radar observation stop
17:00	08:00	EPCS stop
Jan. 24 (Thu) 2008		
09:00	00:00	Surface sea water sampling pump stop
Jan. 25 (Fri) 2008		
09:00	00:00	Arrival at Nakagusuku

3.4 Cruise track

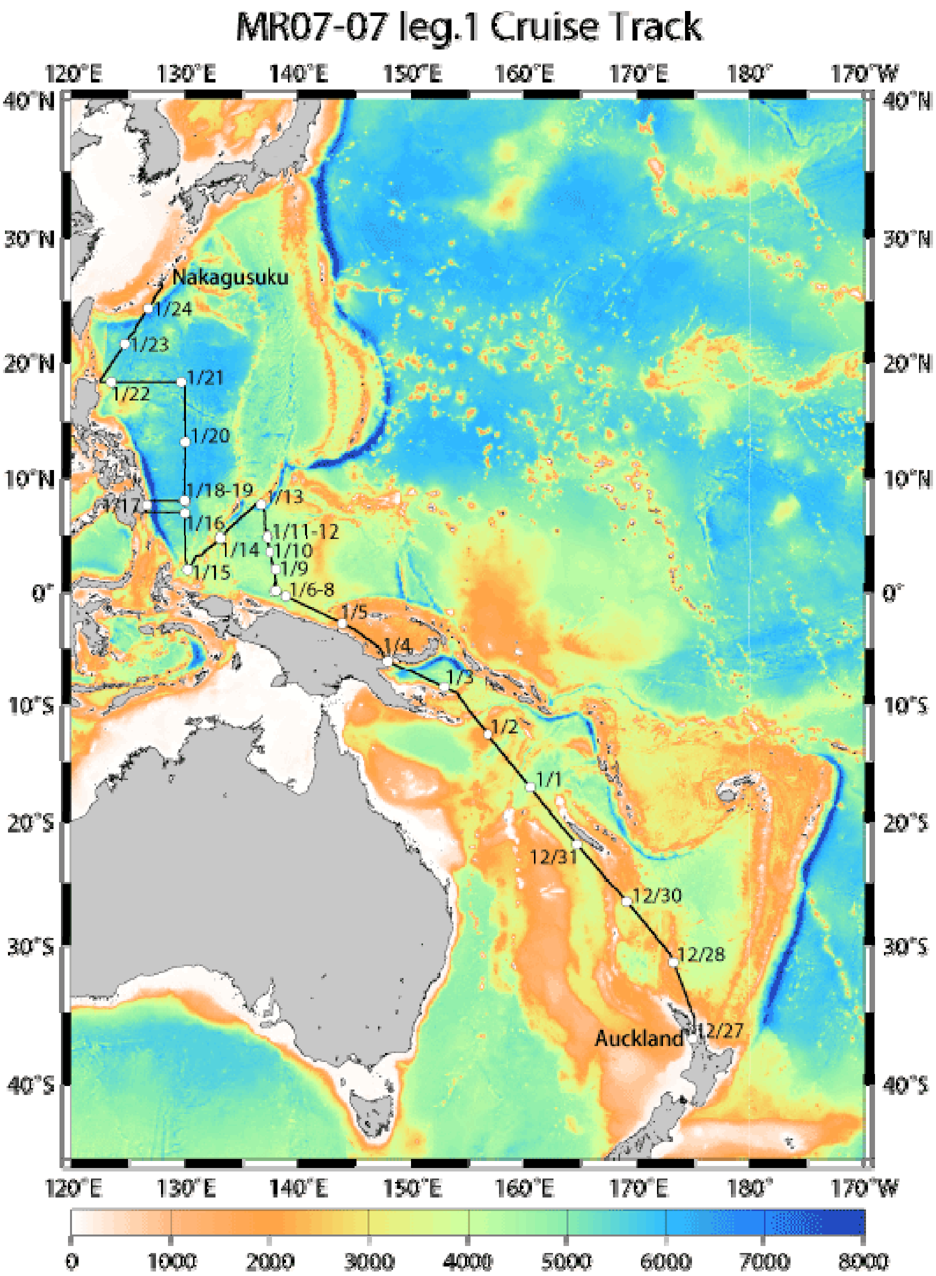


Fig 3-4.1 MR07-07 Leg.1 Cruise track and noon positions

4. Chief scientist

Chief Scientist

Yuji Kashino

Research Scientist

Institute of Observational Research for Global Change (IORGC),

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5.Participants list

5.1 R/V MIRAI scientist and technical staff

No	Name	Institute	Position
1	Yuji Kashino	JAMSTEC	Chief Scientist
2	Geng Biao	JAMSTEC	Research Scientist
3	Hisayuki Kubota	JAMSTEC	Research Scientist
4	Mekky Mukarrom	Indonesia Department of Defense	Security Officer
5	Syamsudin,Fadli	BPPT	Scientist
6	Setiawan,Agus	BPPT	Researcher
7	Kelvin Richards	IPRC	Professor
8	Norievill B. Espana	University of Philippines	Graduate Student
9	Hiroshi Matsunaga	MWJ	Technical Staff
10	Kenichi Katayama	MWJ	Technical Staff
11	Tomohide Noguchi	MWJ	Technical Staff
12	Keisuke Matsumoto	MWJ	Technical Staff
13	Hiroki Ushiromura	MWJ	Technical Staff
14	Akinori Murata	MWJ	Technical Staff
15	Yuichi Sonoyama	MWJ	Technical Staff
16	Miyo Ikeda	MWJ	Technical Staff
17	Masaki Furuhata	MWJ	Technical Staff
18	Takatoshi Kiyokawa	MWJ	Technical Staff
19	Tomoki Takimoto	MWJ	Technical Staff
20	Soichiro Sueyoshi	GODI	Technical Staff
21	Ryo Kimura	GODI	Technical Staff
22	Harumi Ota	GODI	Technical Staff

JAMSTEC: Japan Agency for Marine-Earth Science and Technology, Japan

BPPT: Badan Pengkajian Dan Penerapan Teknologi, Indonesia

IPRC: International Pacific Research Center, Univ. of Hawaii, USA

MWJ: Marine Works Japan Co. Ltd.

GODI: Global Ocean Development Inc.

5.2 R/V MIRAI crew member

No	Name	Position
1	Masaharu Akamine	Master
2	Yasushi Ishioka	Chief Officer
3	Takeshi Isohi	1st Officer
4	Tomoo Hikichi	2nd Officer
5	Hajime Matsuo	3rd Officer
6	Noriyuki Hatachi	Jr.3rd Officer
7	Hideaki Nomura	Chief Engineer
8	Koji Masuno	1st Engineer
9	Kaoru Minami	2nd Engineer
10	Hiroyuki Tohken	3rd Engineer
11	Shuji Nakabayashi	C/Radio Officer
12	Hisao Oguni	Boatswain
13	Keiji Yamauchi	Able Seaman
14	Masami Sugami	Able Seaman
15	Yukiharu Suzuki	Able Seaman
16	Takashi Soejima	Able Seaman
17	Kazuyoshi Kudo	Able Seaman
18	Tsuyoshi Monzawa	Able Seaman
19	Masashige Okada	Able Seaman
20	Shuji Komata	Able Seaman
21	Norimichi Aosaki	Sailor
22	Yusuke Asano	Sailor
23	Sadanori Honda	No.1 Oiler
24	Yukitoshi Horiuchi	Oiler
25	Toshimi Yoshikawa	Oiler
26	Shigeaki Kinoshita	Oiler
27	Nobuo Boshita	Oiler
28	Daisuke Taniguchi	Oiler
29	Hitoshi Ota	Chief Steward
30	Hatsuji Hiraishi	Cook
31	Tatsuya Hamabe	Cook
32	Kozo Uemura	Cook
33	Yoshiteru Hiramatsu	Cook

6. General Observations

6.1 Meteorological measurement

6.1.1 Surface Meteorological Observation

(1) Personnel

Souichiro Sueyoshi	(Global Ocean Development Inc., GODI)
Ryo Kimura	(GODI)
Harumi Ohta	(GODI)
Not on-board :	
Kunio Yoneyama	(JAMSTEC) : Principal Investigator

(2) Objectives

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.

(3) Methods

Surface meteorological parameters were observed throughout the MR07-07 Leg.1 cruise. During this cruise, we used two systems for the observation.

i. MIRAI Surface Meteorological observation (SMET) system
ii. Shipboard Oceanographic and Atmospheric Radiation (SOAR) system

i. 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 were collected and processed by KOAC-7800 weather data processor made by Koshin-Denki, Japan. The data set consists of 6-second averaged data.

ii. Shipboard Oceanographic and Atmospheric Radiation (SOAR) system

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

a) Portable Radiation Package (PRP) designed by BNL – short and long wave downward radiation.
b) Zeno Meteorological (Zeno/Met) system designed by BNL – wind, air temperature, relative humidity, pressure, and rainfall measurement.
c) 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 Table.6.1.1-3 and measured parameters are listed in Table.6.1.1-4.

We have checked the following sensors, before and after the cruise for the quality control as post processing.

i. Young Rain gauge (SMET and SOAR)

Inspect of the linearity of output value from the rain gauge sensor to change Input value by adding fixed quantity of test water.

ii. Barometer (SMET and SOAR)

Comparison with the portable barometer value, PTB220CASE, VAISALA.

iii. Thermometer (air temperature and relative humidity) (SMET and SOAR)

Comparison with the portable thermometer value, HMP41/45, VAISALA.

(4) Preliminary results

Figures 6.1.1 shows the time series of the following parameters;

Wind (SOAR)
Air temperature (SOAR)
Relative humidity (SOAR)
Precipitation (SOAR, Optical rain gauge)
Short/long wave radiation (SOAR)
Pressure (SOAR)
Sea surface temperature (SMET)
Significant wave height (SMET)

(5) Data archives

These meteorological data will be submitted to the Marine-Earth Data and Information Department (MEDID) of JAMSTEC just after the cruise. Corrected data sets will be available from K. Yoneyama of JAMSTEC.

(6) Remarks

i. We did not collect data in the territorial waters of New Zealand and Papua New Guinea during the following periods.

23:00UTC 27 Dec. 2007 – 05:55UTC 28 Dec. 2007, the New Zealand
21:38UTC 03 Jan. 2008 – 11:50UTC 05 Jan. 2008, the Papua New Guinea

ii. SST (Sea Surface Temperature) data were available in the following periods.

18:55 28 Dec. 2007 – 21:38 03 Jan. 2008
11:50 05 Jan. 2008 – 08:00 23 Jan 2008.

Table.6.1.1-1 Instruments and installations of MIRAI Surface Meteorological observation 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	AP370	Koshin Denki, Japan	captain deck (13 m) weather observation room
Rain gauge	50202	R. M. Young, USA	compass deck (19 m)
Optical rain gauge	ORG-115DR	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

Parameter	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/m2	6sec. averaged
20 Down welling infra-red radiation	W/m2	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 Instruments 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 (23 m)
Barometer	61201	R.M. Young, USA	
with 61002 Gill pressure port		R.M. Young, USA	foremast (22 m)
Rain gauge	50202	R.M. Young, USA	foremast (24 m)
Optical rain gauge	ORG-115DA	Osi, USA	foremast (24 m)

Sensors (PRP)	Type	Manufacturer	Location (altitude from surface)
Radiometer (short wave)	PSP	Epply Labs, USA	foremast (24 m)
Radiometer (long wave)	PIR	Epply Labs, USA	foremast (24m)
Fast rotating shadowband radiometer		Yankee, USA	foremast (24 m)

Table.6.1.1-4 Parameters of SOAR system

Parameter		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/m2	
13	Down welling infra-red radiation	W/m2	
14	Defuse irradiance	W/m2	

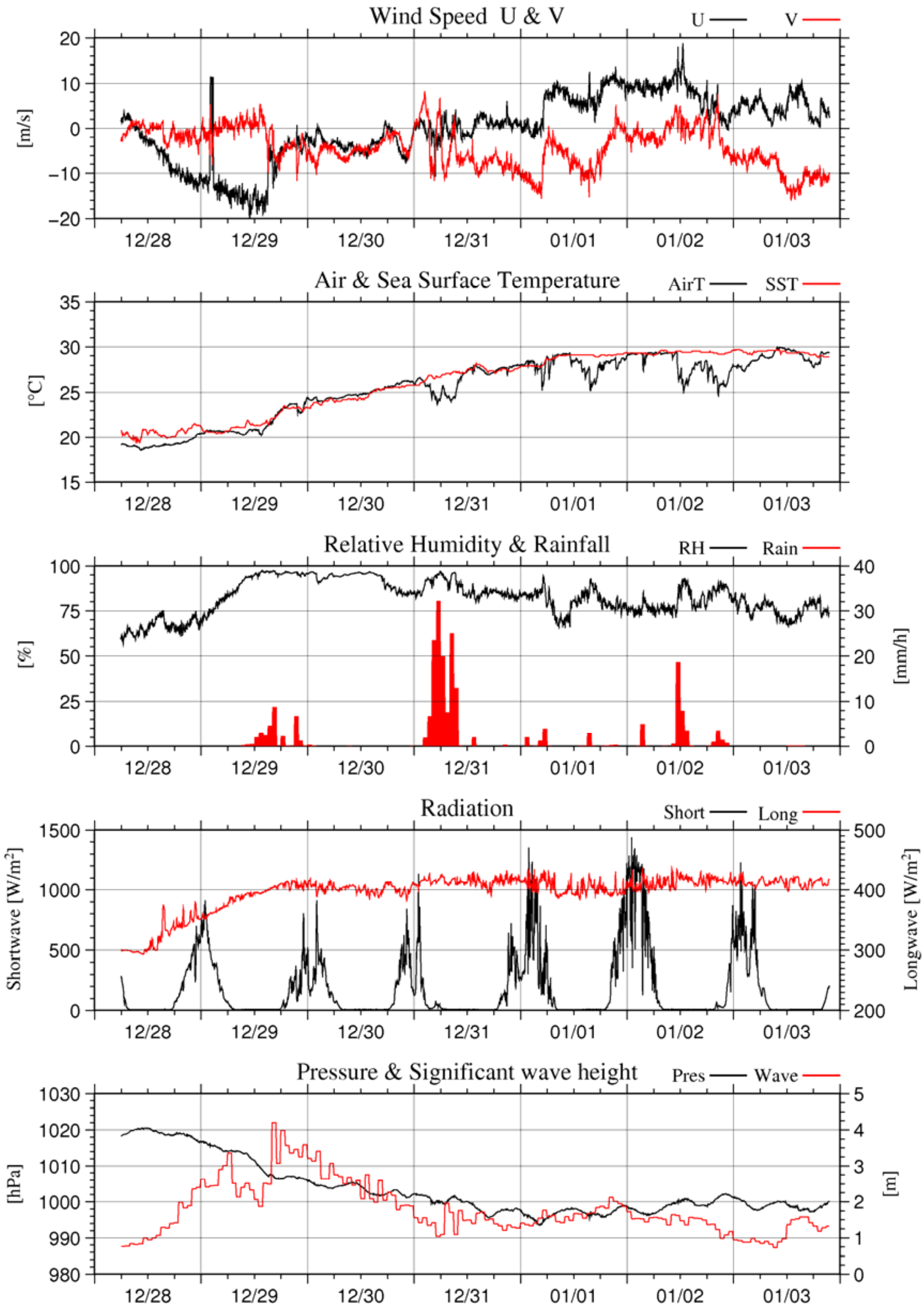


Fig.6.1.1 Time series of surface meteorological parameters during the MR07-07 Leg.1 cruise

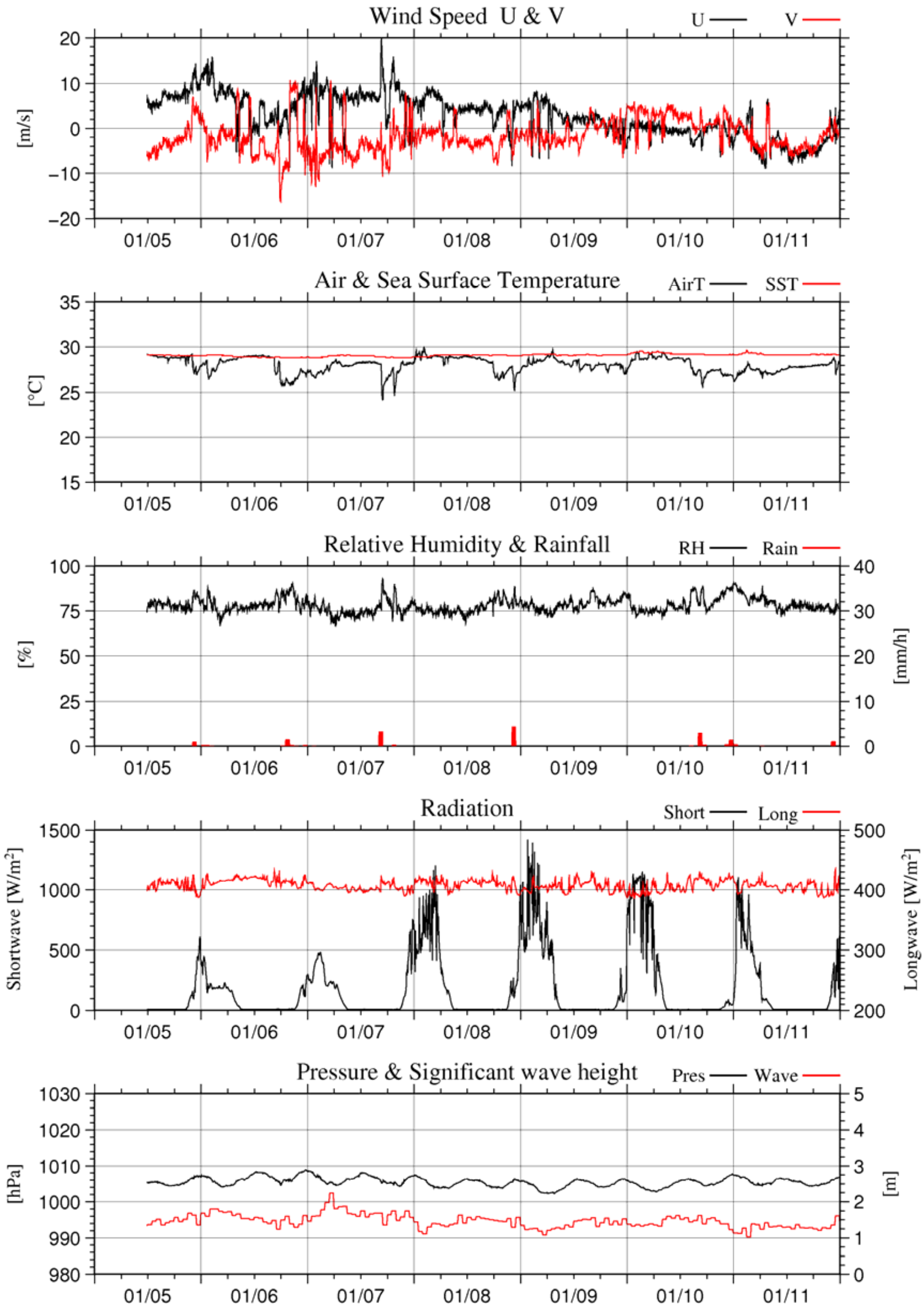


Fig.6.1.1 (Continued)

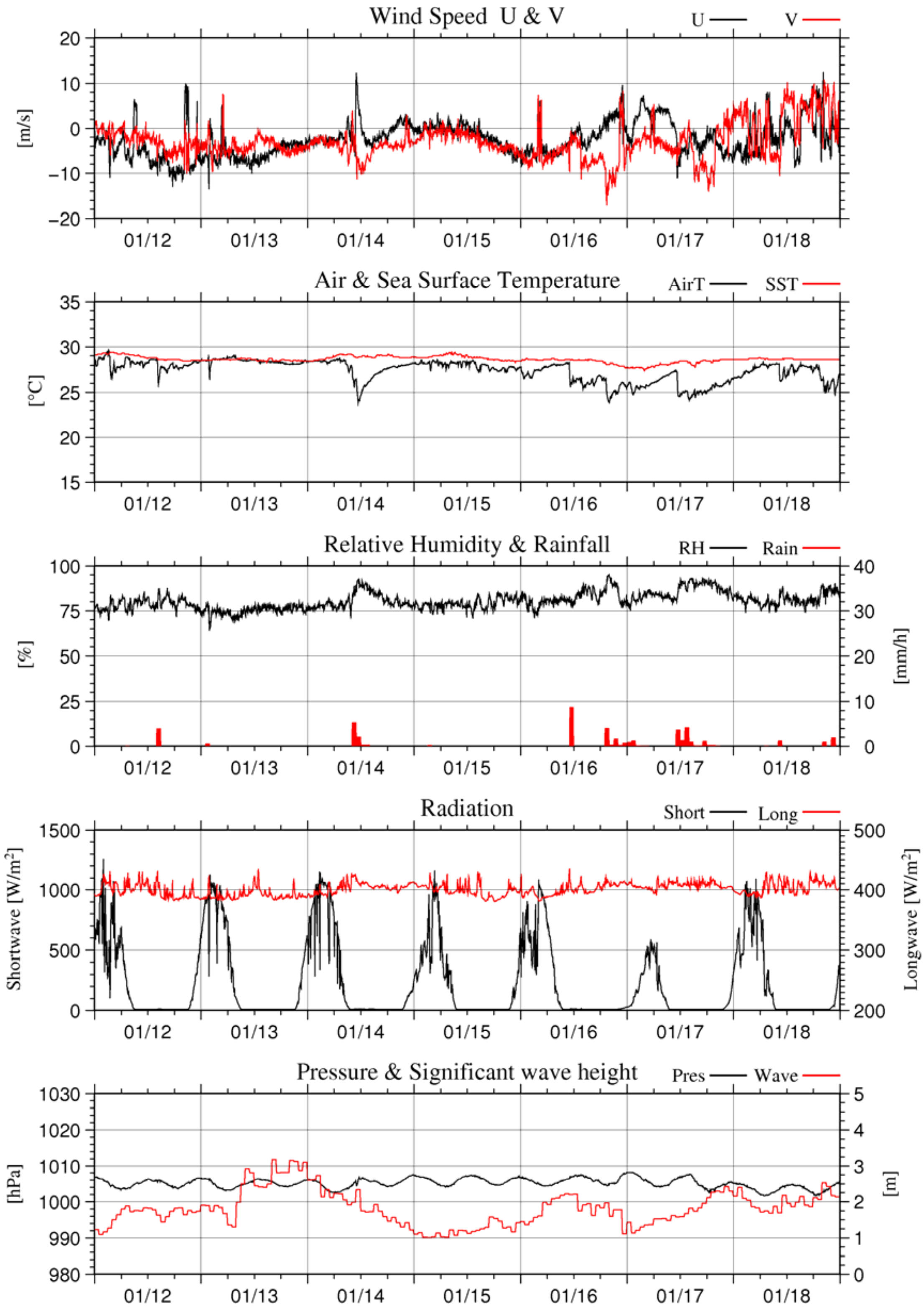


Fig.6.1.1 (Continued)

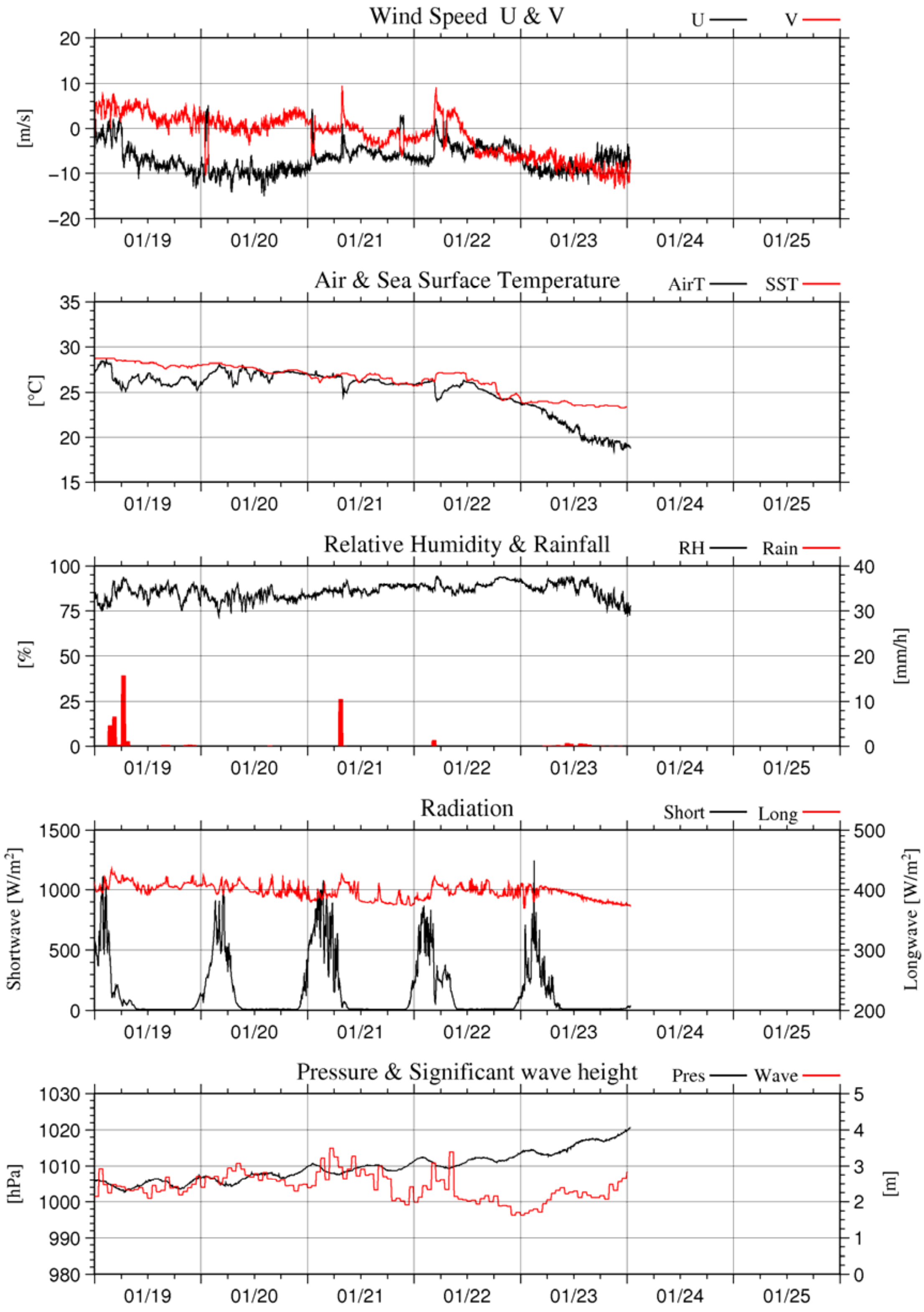


Fig.6.1.1 (Continued)

6.1.2 Ceilometer Observation

(1) Personnel

Souichiro Sueyoshi	(Global Ocean Development Inc., GODI)
Ryo Kimura	(GODI)
Harumi Ohta	(GODI)
Not on-board:	
Kunio Yoneyama	(JAMSTEC) : Principal Investigator

(2) Objectives

The information of cloud base height and the liquid water amount around cloud base is important to understand the process on formation of the cloud. As one of the methods to measure them, the ceilometer observation was carried out.

(3) 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.

(4) Methods

We measured cloud base height and backscatter profile using ceilometer (CT-25K, VAISALA, Finland) throughout the MR07-07 Leg.1 cruise from the departure of Auckland on 27 December 2007 to arrival of Nakagusuku on 25 January 2008.

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).

(5) Preliminary results

Figures 6.1.2 shows the time series of the lowest, second and third cloud base height during the cruise.

(6) Data archives

The raw data obtained during this cruise will be submitted to the Marine-Earth Data and Information Department (MEDID) in JAMSTEC.

(7) Remarks

1. We did not collect data in the territorial waters of New Zealand and Papua New Guinea during the following periods.
   23:00UTC 27 Dec. 2007 – 05:55UTC 28 Dec. 2007, the New Zealand
   21:38UTC 03 Jan. 2008 – 11:50UTC 05 Jan. 2008, the Papua New Guinea

2. Window cleaning;
   05:34UTC 04 Jan. 2008
   02:06UTC 09 Jan. 2008
   02:55UTC 18 Jan. 2008

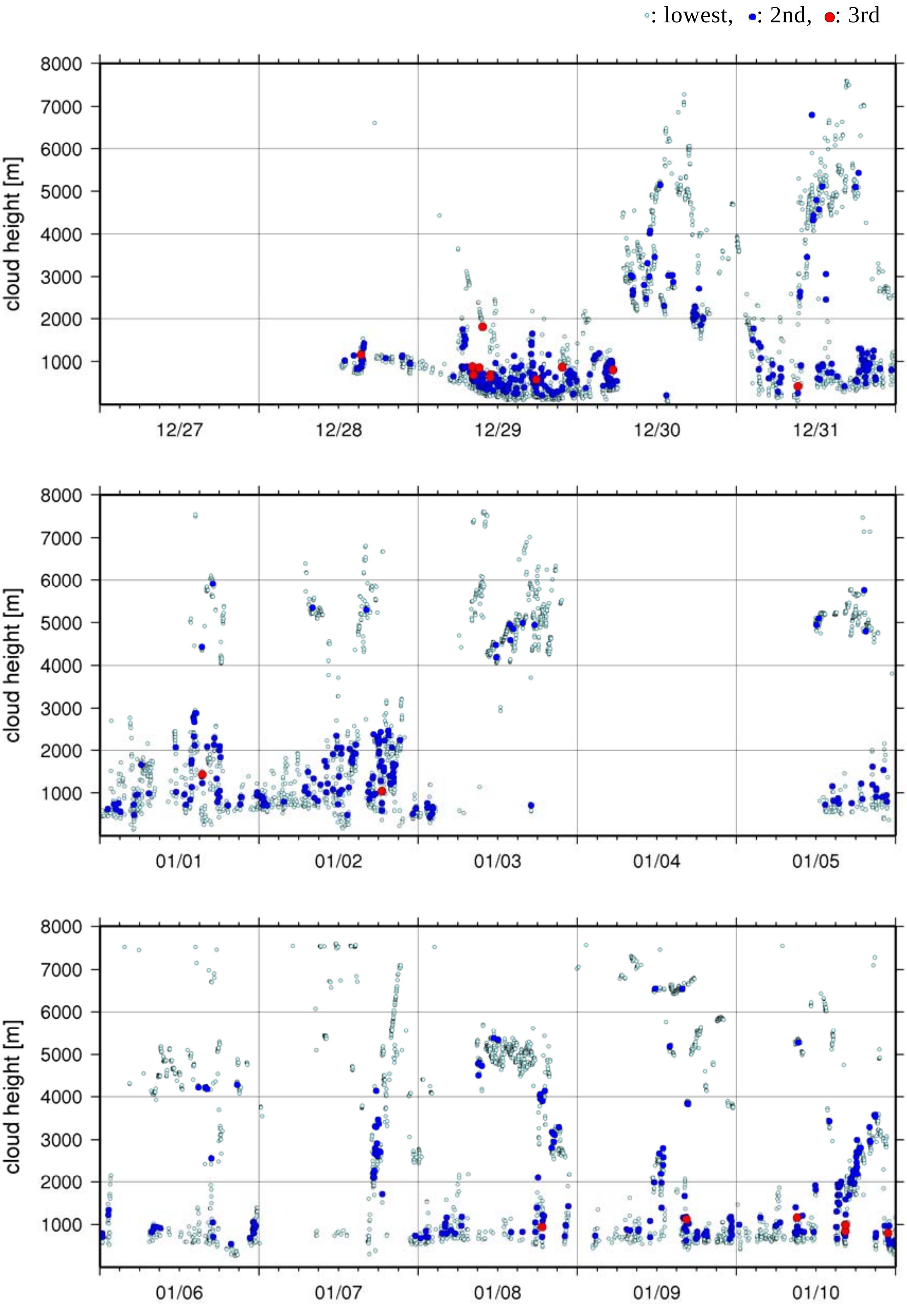


Fig.6.1.2 Lowest, 2nd and 3rd cloud base height during the cruise.

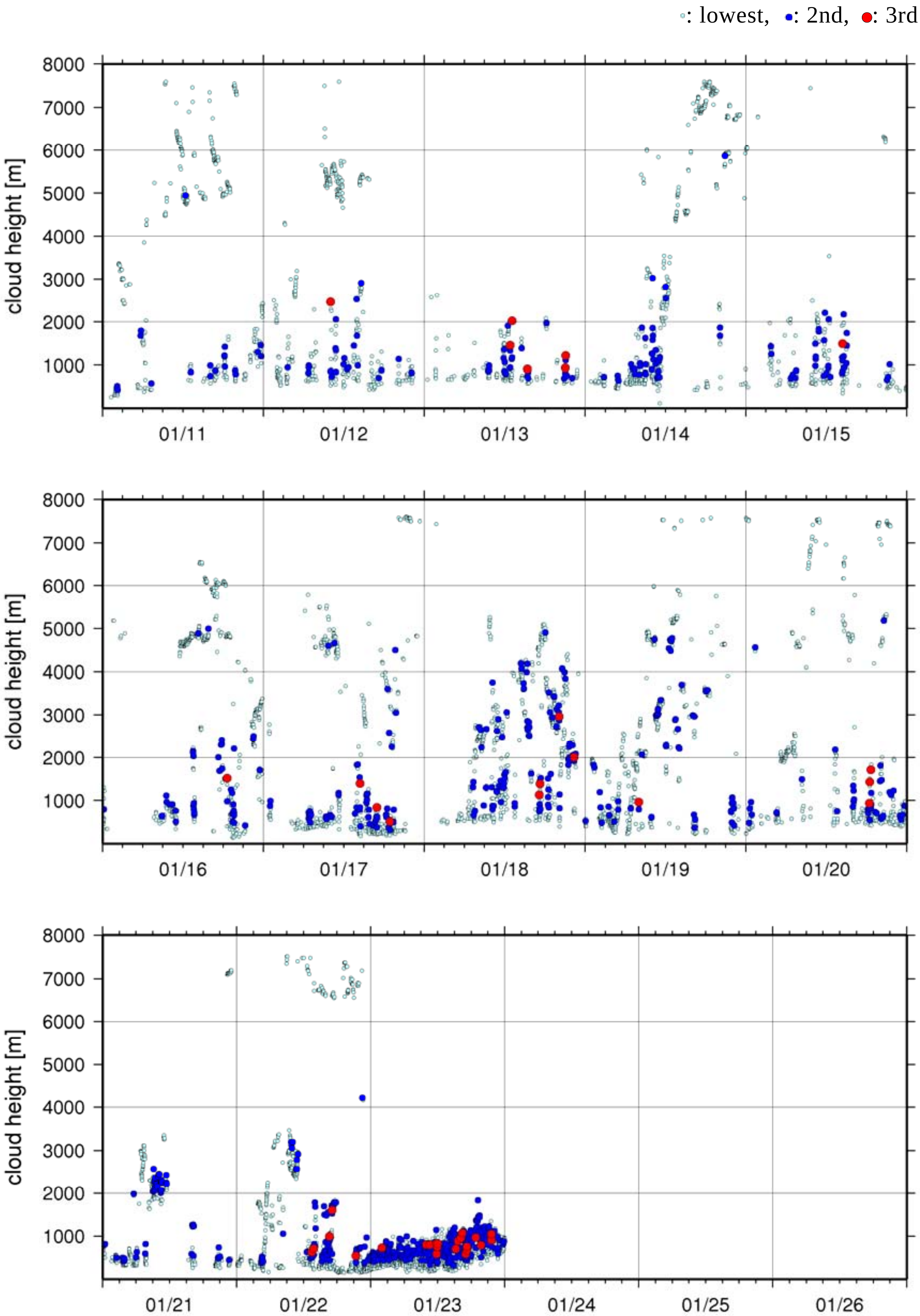


Fig.6.1.2 (Continued)

6.2 CTD/XCTD

6.2.1. CTD

Personnel	Yuji Kashino	(JAMSTEC): Principal investigator
	Kenichi Katayama	(MWJ): Operation leader
	Akinori Murata	(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 36-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, 25 casts of CTD observation were carried out (see Table 6.2.1-1). At Stn.C07, we deployed twice since the first cast had the problem with jellyfish which came into the sampling line. To avoid this kind of problem, we attached the secondary sensors (temperature, conductivity) from the cast of Stn.C09.

(3) List of sensors and equipments

Under water unit:	SBE, Inc., SBE 9plus, S/N 0677
Temperature sensor:	SBE, Inc., SBE 03-04/F, S/N 031524 (Primary)
Temperature sensor:	SBE, Inc., SBE 03-04/F, S/N 031359 (Secondary: Stn.C09-C23)
Conductivity sensor:	SBE, Inc., SBE 04C, S/N 041203
	(Primary: Stn.Test-C06, Secondary: Stn.C09-C23)
Conductivity sensor:	SBE, Inc., SBE 04C, S/N 041088 (Primary: Stn.C07-C23)
Oxygen sensor:	SBE, Inc., SBE 43, S/N 430394 (Primary)
Pump:	SBE, Inc., SBE 5T, S/N 054595 (Primary)
Pump:	SBE, Inc., SBE 5T, S/N 053293 (Secondary: Stn.C09-C23)
Altimeter:	Benthos, Inc., PSA-916T, S/N 1100 (Stn.C14-C23)
Deck unit:	SBE, Inc., SBE 11plus, S/N 11P7030-0272
Carousel Water Sampler:	SBE, Inc., SBE 32, S/N 3227443-0391
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, time elapsed, temperature, conductivity, oxygen voltage, altitude, 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. Scan number, pressure, depth, temperature, conductivity, oxygen voltage, altimeter and descent rate were over 3.0 seconds. And oxygen, salinity, sigma-theta and potential temperature were computed.

ALIGNCTD converted the time-sequence of oxygen sensor outputs into the pressure sequence to ensure that all calculations were made using measurements from the same parcel of water. For a SBE 9plus CTD with the ducted temperature and conductivity sensors and a 3000 rpm pump, the typical net advance of the conductivity relative to the temperature is 0.073 seconds. So, the SBE 11plus deck unit was set to advance the primary conductivity for 1.73 scans (1.75/24 = 0.073 seconds). Oxygen data are also systematically delayed with respect to depth mainly because of the long time constant of the oxygen sensor and of an additional delay from the transit time of water in the pumped plumbing line. This delay was compensated by 6 seconds advancing oxygen sensor output (oxygen voltage) relative to the pressure.

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, depth, temperature, conductivity, oxygen voltage, altitude, decent rate and oxygen 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.

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

DERIVE was used to compute oxygen.

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 pressure greater than the minimum and less than or equal to the maximum were averaged. Scans were interpolated so that a data record exists in every dbar.

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

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 6.2.1-1. Vertical profile (down cast) of temperature, salinity and oxygen with pressure are shown in Figure 6.2.1-1, 6.2.1-2, 6.2.1-3, 6.2.1-4, 6.2.1-5, 6.2.1-6.

(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.

Table 6.2.1-1 CTD Cast table

Stnnbr	Castno	Date(UTC) (mmddyy)	Time(UTC) Start	Time(UTC) End	Bottom Position Latitude	Bottom Position Longitude	Depth	Wire Out	HT Above	Max Depth	Max Pressure	CTD Filename	Remark
Test	1	122907	02:06	02:42	30-39.55S	172-52.59E	1108.0	795.9	-	794.9	801.9	T01M01	Test Cast(LADCP)
C01	1	010608	07:57	08:32	00-04.21N	138-04.77E	4141.0	801.9	-	795.9	801.8	C01M01	TRITON(T15) Recovery, LADCP
C02	1	010708	05:01	05:34	00-29.76N	138-00.22E	4009.0	803.5	-	797.5	802.7	C02M01	LADCP
C03	1	010708	08:00	08:32	00-59.86N	138-00.09E	4205.0	798.2	-	793.1	799.0	C03M01	LADCP
C04	1	010808	08:55	09:28	01-29.76N	137-59.97E	4389.0	804.8	-	796.1	801.9	C04M01	LADCP
C05	1	010808	21:03	21:37	01-58.71N	138-06.68E	4309.0	797.5	-	795.2	801.3	C05M01	TRITON(T06) Recovery, LADCP
C06	1	010908	10:17	10:50	02-29.70N	137-49.67E	4436.0	807.8	-	794.8	800.4	C06M01	LADCP
C07	1	010908	21:01	21:34	03-00.05N	137-39.66E	4781.0	799.3	-	796.5	802.5	C07M01	T,C, DO sensor had a problem(jellyfish?) Changed C sensor (041203 => 041088)
C07	2	010908	23:03	23:33	02-59.92N	137-39.77E	4577.0	801.3	-	794.5	800.1	C07M02	LADCP
C08	1	011008	02:00	02:30	03-29.97N	137-29.92E	4344.0	798.2	-	793.8	799.9	C08M01	LADCP
C09	1	011008	04:54	05:26	03-59.96N	137-19.86E	4650.0	800.4	-	796.1	802.2	C09M01	LADCP
C10	1	011008	07:52	08:25	04-29.93N	137-09.79E	4939.0	799.5	-	793.6	799.6	C10M01	LADCP
C11	1	011008	21:04	21:36	04-50.43N	137-17.43E	4184.0	798.2	-	795.5	801.4	C11M01	TRITON(T05) Recovery, LADCP
C12	1	011108	07:33	08:06	05-29.83N	137-00.10E	4698.0	800.2	-	796.3	802.2	C12M01	LADCP
C13	1	011208	08:57	09:31	05-59.61N	137-00.10E	4446.0	800.8	-	795.4	801.8	C13M01	LADCP
C14	1	011208	20:31	21:07	07-52.08N	136-27.45E	3348.0	1000.3	-	992.7	1000.9	C14M01	TRITON(T04) Recovery
C15	1	011508	02:18	02:51	01-59.68N	130-12.42E	4366.0	1000.7	-	993.9	1002.1	C15M01	TRITON(T20) Deploy
C16	1	011608	04:03	04:41	07-00.08N	129-59.97E	5560.0	998.1	-	994.1	1002.0	C16M01	X-CTD
C17	1	011608	22:31	23:12	06-59.10N	126-35.35E	2335.0	1165.4	-	988.4	997.7	C17M01	#2 Niskin bottle miss-fired, X-CTD
C18	1	011708	05:30	06:08	07-59.38N	126-41.90E	1646.0	1069.0	-	992.1	1001.0	C18M01	X-CTD
C19	1	011808	04:49	05:24	07-59.15N	129-59.46E	5713.0	997.4	-	992.9	1000.8	C19M01	TRITON(T07) Recovery
C20	1	012008	00:59	01:35	13-00.19N	129-59.83E	5934.0	998.9	-	991.7	999.8	C20M01	X-CTD
C21	1	012108	00:55	01:30	18-20.20N	129-59.95E	5963.0	997.4	-	993.2	1001.9	C21M01	X-CTD
C22	1	012108	21:00	21:37	18-20.05N	124-59.37E	5479.0	1008.6	-	993.5	1001.7	C22M01	X-CTD
C23	1	012208	06:42	07:19	18-20.78N	122-36.20E	2812.0	1075.8	-	991.7	1000.6	C23M01	X-CTD

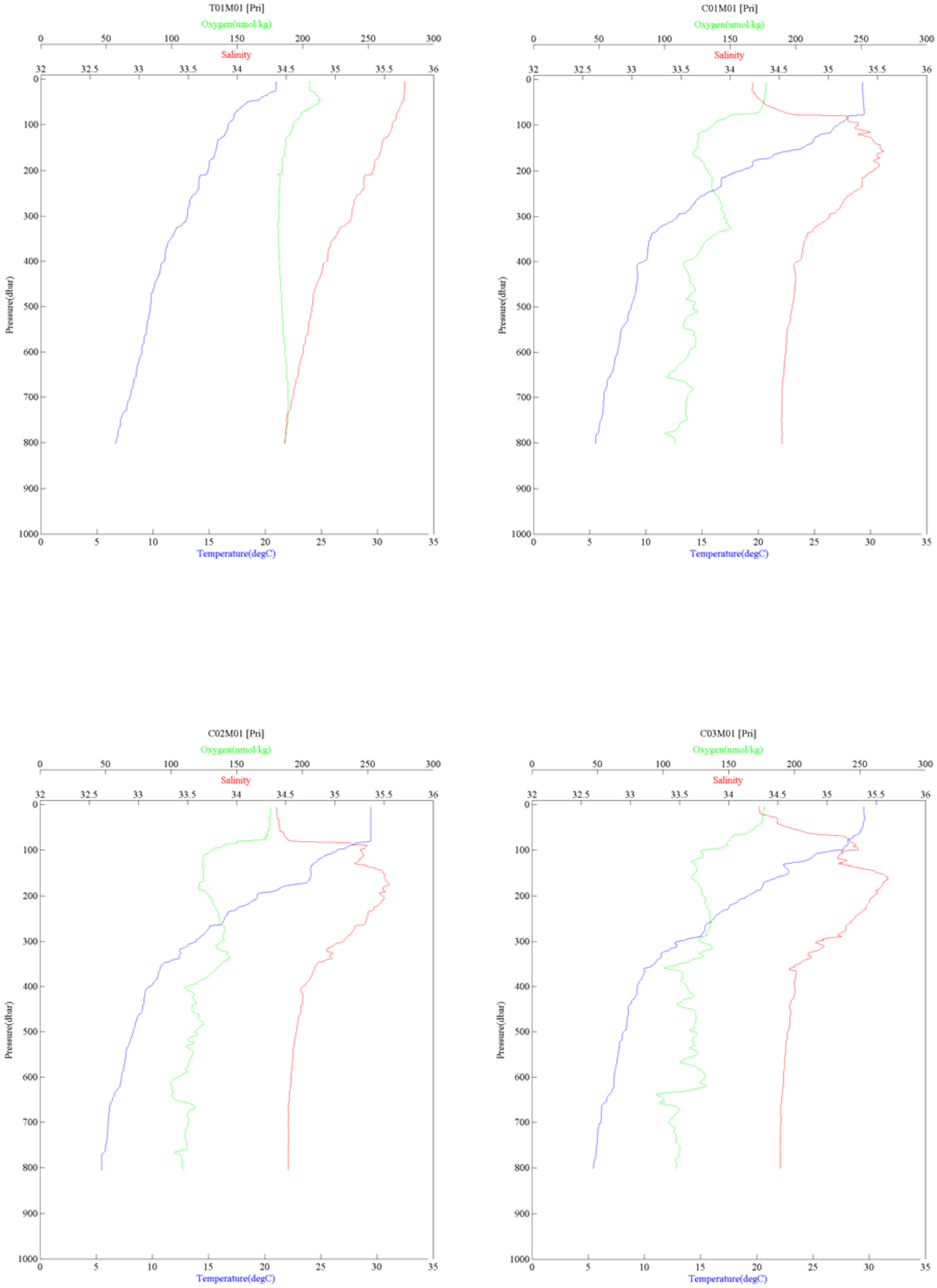


Figure 6.2.1-1 CTD profile (Test-C03)

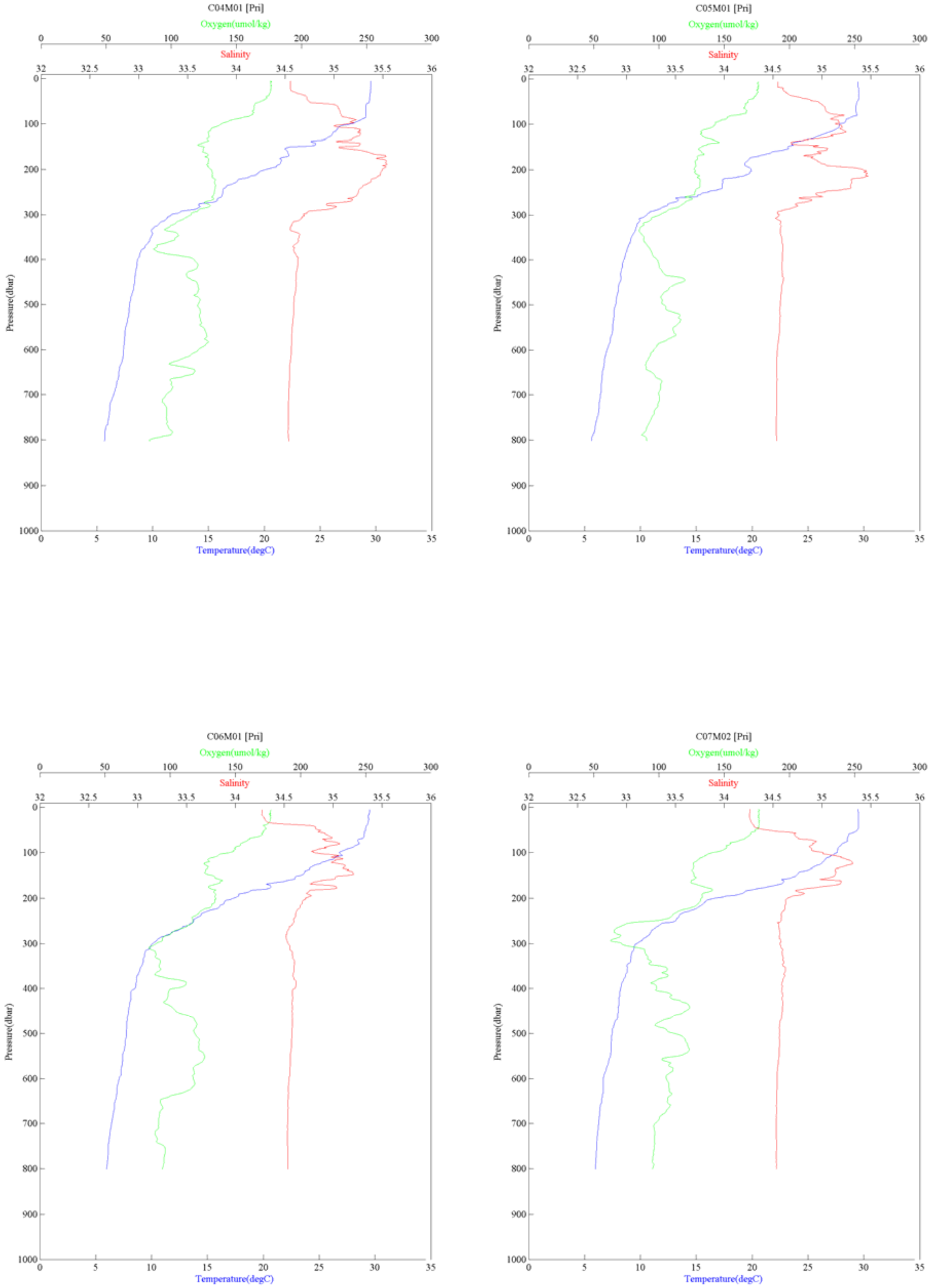


Figure 6.2.1-2 CTD profile (C04-C07)

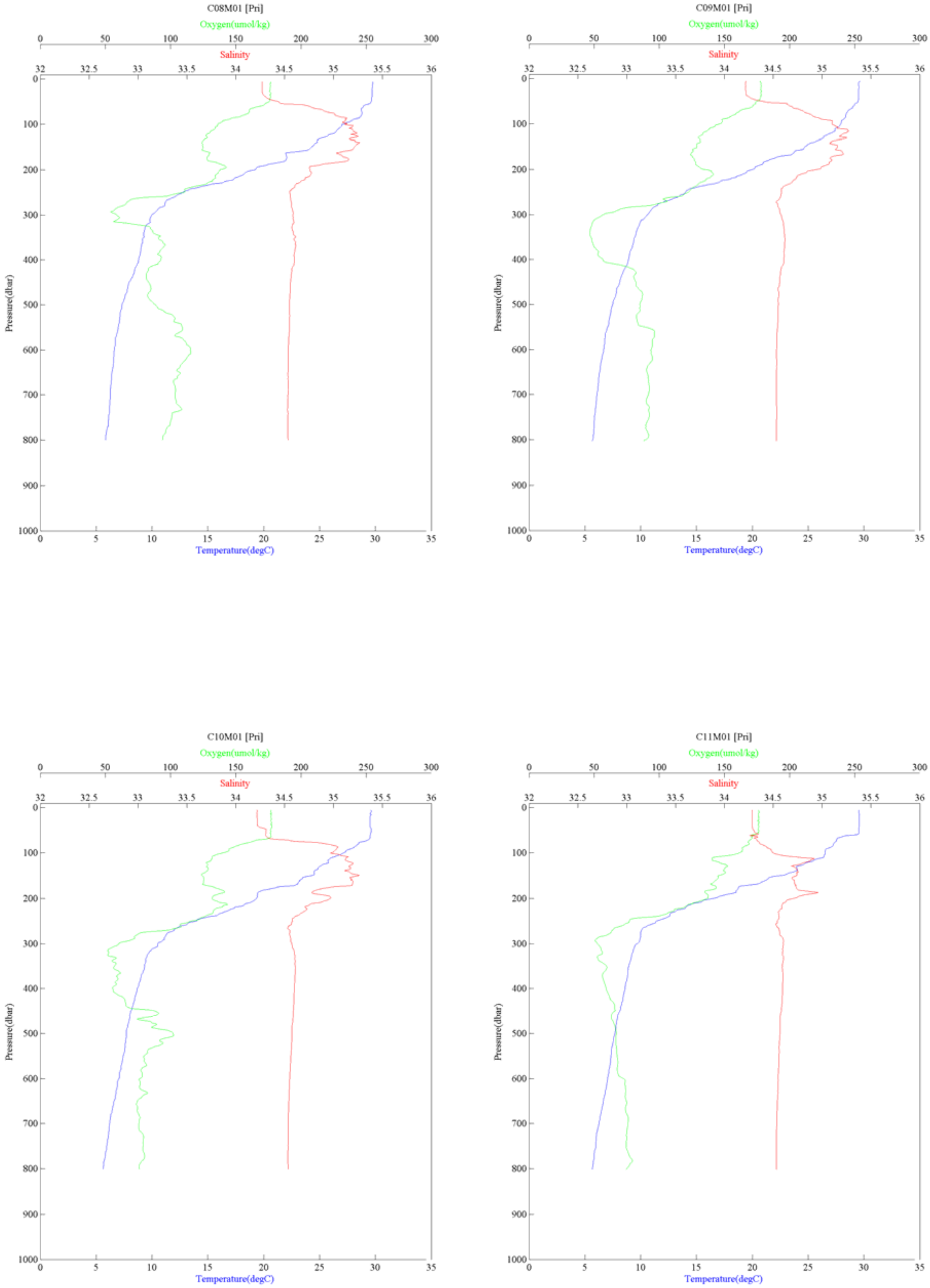


Figure 6.2.1-3 CTD profile (C08-C11)

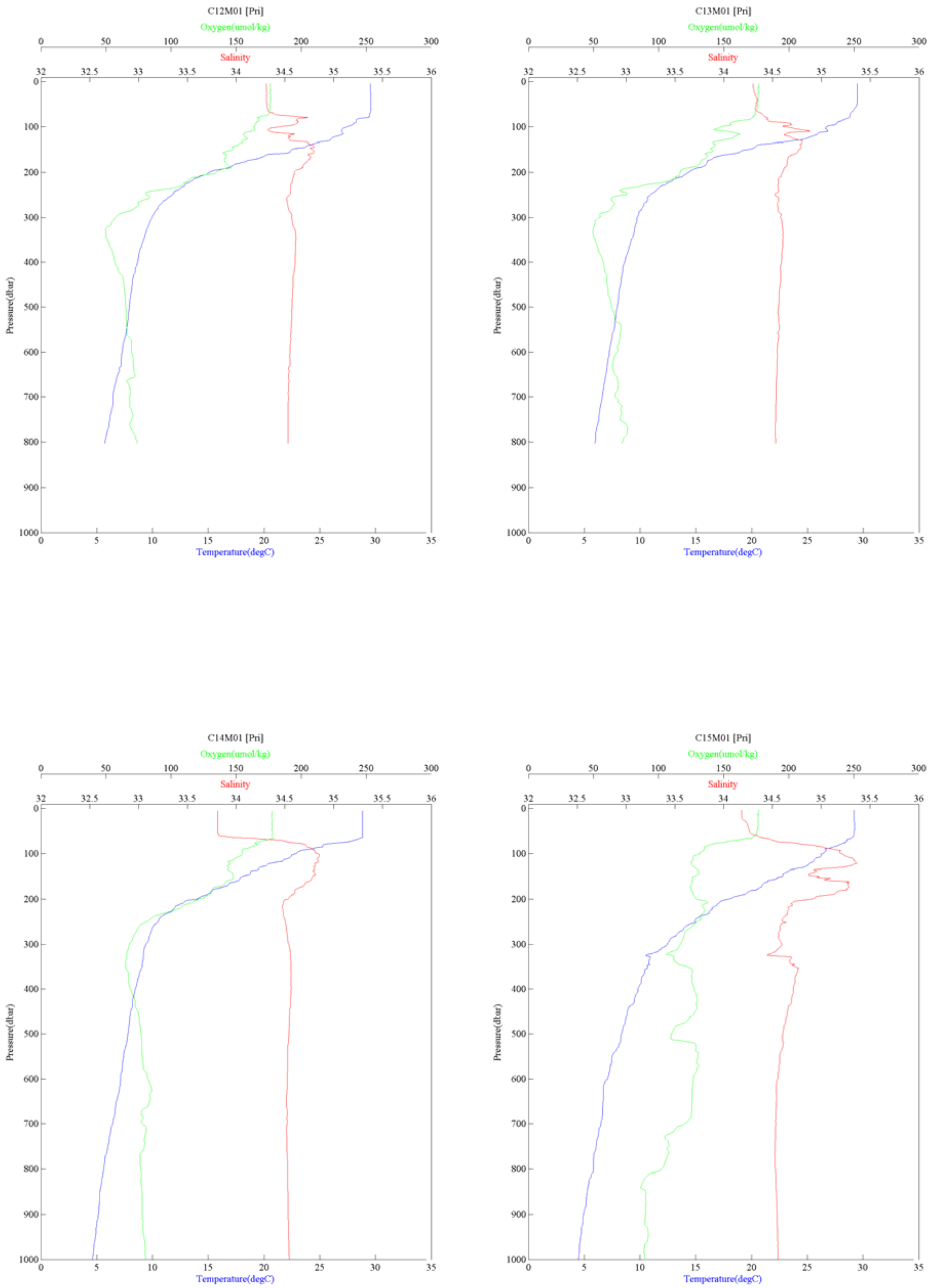


Figure 6.2.1-4 CTD profile (C12-C15)

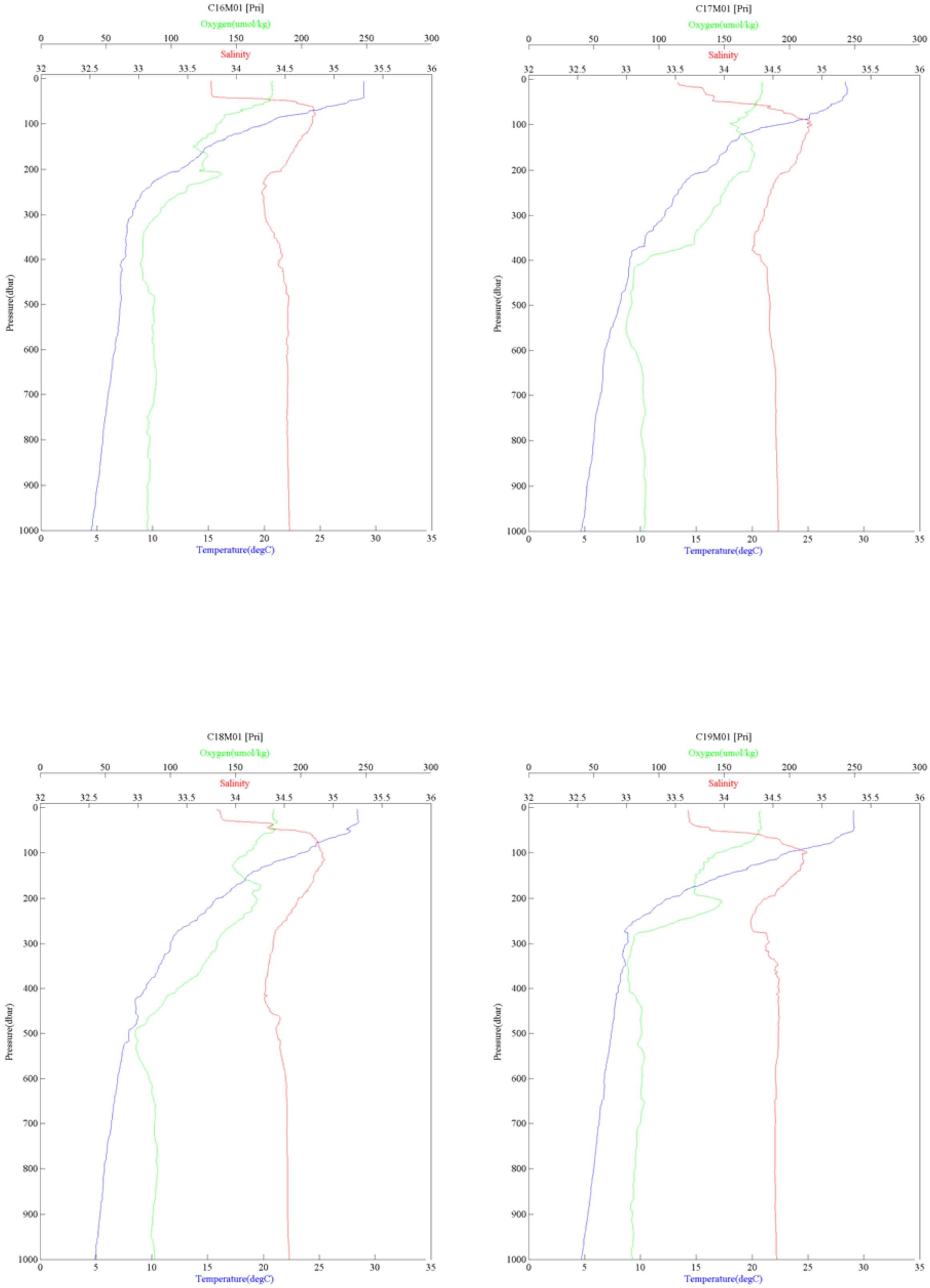


Figure 6.2.1-5 CTD profile (C16-C19)

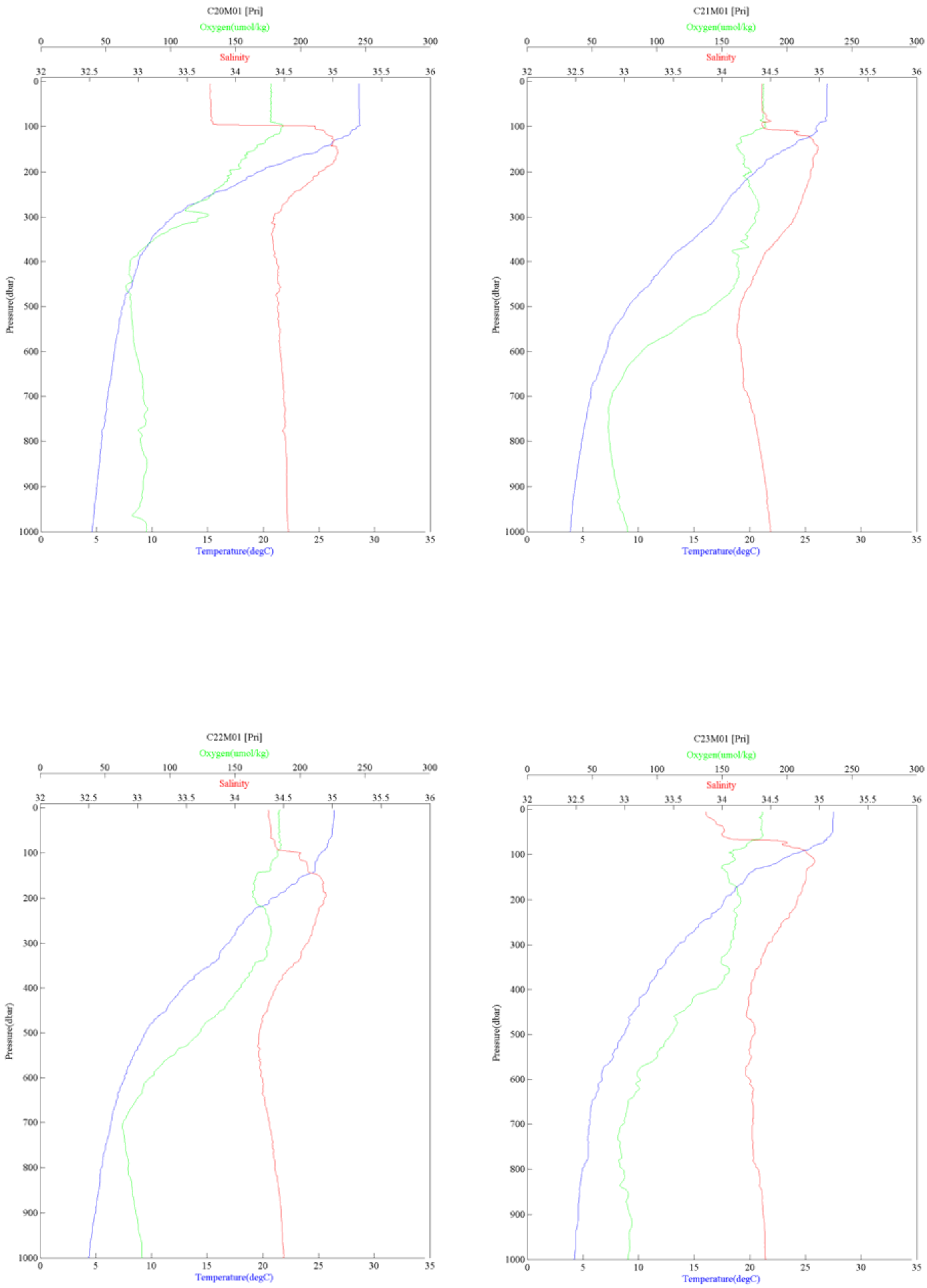


Figure 6.2.1-6 CTD profile (C20-C23)

6.2.2 XCTD

(1) Personnel

Yuji Kashino (JAMSTEC): Principal Investigator
Souichiro Sueyoshi (Global Ocean Development Inc.: GODI)
Ryo Kimura (GODI)
Harumi Ota (GODI)

(2) Objectives

Investigation of oceanic structure.

(3) 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	

(4) 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.1.08) provided by Tsurumi-Seiki Co.. We launched 52 probes (X01-X051, two probes at X09) by using automatic launcher. The summary of XCTD observations and launching log were shown in Table 6.2.2-1.

(5) Preliminary results

Position map of XCTD observations, Vertical sections of temperature and salinity were shown in Fig. 6.2.2-1 to 6.2.2-5

(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.

Table 6.2.2-1 Summary of XCTD observation and launching log

Station No.	Date	Time	Latitude	Longitude	Measured Depth[m]	Water Depth[m]	SST [deg-C]	SSS [PSU]	Probe S/N
X01	2008/01/07	02:46:44	00-02.1288N	137-53.7177E	1036	4348	29.252	34.322	07033418
X02	2008/01/09	03:17:05	02-02.9153N	138-04.4538E	1035	4321	29.614	34.584	07033414
X03	2008/01/09	22:22:10	02-59.6837N	137-39.2231E	1035	4196	29.487	34.272	07033421
X04	2008/01/11	04:17:39	04-56.2976N	137-18.4575E	1035	4133	29.729	34.296	07033404
X05	2008/01/12	15:35:08	06-59.9828N	137-00.0039E	1035	4253	28.972	33.767	07033419
X06	2008/01/13	01:47:36	07-38.6812N	136-41.6136E	1035	3167	28.957	33.795	07033390
X07	2008/01/15	07:57:38	02-59.9947N	130-00.0000E	1035	3059	29.851	34.192	07033423
X08	2008/01/15	12:52:26	04-00.0053N	130-00.0035E	1036	4723	29.274	33.801	07033392
X09	2008/01/15	17:25:06	05-00.7324N	130-00.0058E	486	5053	29.036	33.820	07033391
X10	2008/01/15	17:25:06	05-00.7324N	130-00.0058E	1035	5053	29.036	33.820	07033391
X11	2008/01/15	22:07:03	06-00.0005N	130-00.0046E	1035	5493	28.877	33.798	07033393
X12	2008/01/16	09:46:30	06-59.9337N	128-59.9556E	1036	5087	28.994	33.748	07033399
X13	2008/01/16	14:55:32	06-59.9646N	127-59.9927E	1036	4587	28.981	33.814	07033397
X14	2008/01/16	17:19:54	07-00.0011N	127-30.2226E	1036	7212	28.865	33.743	07033395
X15	2008/01/16	18:43:36	06-59.9867N	127-14.9965E	1035	8259	28.756	33.726	07033396
X16	2008/01/16	20:11:47	07-01.2245N	126-59.9992E	1035	5548	28.610	33.640	07033394
X17	2008/01/16	21:34:25	06-59.5329N	126-44.9982E	1035	3639	28.497	33.735	07064598
X18	2008/01/16	23:19:54	06-58.7883N	126-34.3992E	1035	2272	28.357	33.579	07033398
X19	2008/01/16	23:48:51	07-00.8216N	126-30.0019E	1013	1016	28.177	33.616	07064599
X20	2008/01/17	04:46:37	07-59.9902N	126-35.9482E	700	703	28.151	33.533	07064592
X21	2008/01/17	06:09:57	07-59.2068N	126-41.8472E	1035	1636	28.287	33.738	07064596
X22	2008/01/17	06:57:03	07-59.9914N	126-50.0163E	1034	2923	28.449	33.789	07064595
X23	2008/01/17	07:44:07	08-00.0061N	126-59.9993E	1036	5934	28.527	33.720	07064591
X24	2008/01/17	08:55:14	08-00.0260N	127-15.0072E	1036	8248	28.505	33.609	07064597
X25	2008/01/17	10:04:03	08-00.0018N	127-29.9976E	1036	6759	28.624	33.539	07064593
X26	2008/01/17	12:27:21	07-59.9984N	128-00.0097E	1035	4790	28.840	33.702	07064594
X27	2008/01/17	16:47:44	08-00.0022N	129-00.0036E	1035	4713	28.859	33.620	07064588
X28	2008/01/18	04:16:51	07-56.1066N	130-03.3294E	1036	5635	29.118	33.661	07064589
X29	2008/01/18	05:05:33	07-59.1438N	129-59.4702E	1036	5716	29.144	33.653	07064590
X30	2008/01/19	07:42:02	09-00.0189N	129-59.9950E	1036	5935	28.845	33.707	07064602
X31	2008/01/19	12:07:47	09-59.9957N	129-59.9909E	1035	5967	28.662	33.606	07064605
X32	2008/01/19	16:16:31	11-00.0051N	130-00.0049E	1035	5794	28.128	32.819	07064603
X33	2008/01/19	20:33:45	12-00.4504N	130-00.0450E	1035	5697	28.370	33.510	07064600
X34	2008/01/20	01:47:17	13-01.1845N	129-59.6935E	1036	5901	28.576	33.753	07064604
X35	2008/01/20	06:10:44	14-00.0004N	130-00.0087E	1036	5691	28.427	33.832	07064606
X36	2008/01/20	10:34:23	15-00.0027N	130-00.0053E	1036	5569	28.218	34.070	07064611
X37	2008/01/20	15:02:32	15-59.9804N	129-59.9950E	1035	5488	27.573	34.272	07064607
X38	2008/01/20	19:19:34	17-00.0008N	130-00.0112E	1035	5221	27.862	34.041	07064610
X39	2008/01/20	22:00:11	17-39.9962N	130-00.0502E	1035	5822	27.817	34.092	07064608
X40	2008/01/21	01:43:23	18-20.4633N	129-59.5761E	1035	5958	27.103	34.361	07064609
X41	2008/01/21	05:31:17	18-19.9911N	128-59.9429E	1036	5394	27.102	34.235	07064616
X42	2008/01/21	09:15:56	18-19.9859N	128-00.0046E	1036	4674	27.446	34.310	07064612
X43	2008/01/21	12:56:24	18-20.0030N	126-59.9922E	1035	4697	27.139	34.322	07064615
X44	2008/01/21	16:33:56	18-20.0009N	125-59.9937E	1035	5447	27.028	34.387	07064613
X45	2008/01/21	21:46:42	18-20.1818N	124-58.2514E	1035	5478	26.412	34.363	07064614
X46	2008/01/22	01:15:12	18-20.1034N	123-59.9946E	1035	5050	26.332	34.424	07064646
X47	2008/01/22	03:06:12	18-20.0029N	123-30.0013E	1035	5271	26.930	34.215	07064645
X48	2008/01/22	04:02:30	18-20.0012N	123-14.9987E	1035	2835	26.885	34.108	07064647
X49	2008/01/22	04:58:15	18-19.9755N	123-00.0091E	1036	4027	27.362	34.004	07064644
X50	2008/01/22	05:56:08	18-20.0059N	122-44.9913E	1035	3713	27.604	33.888	07064650
X51	2008/01/22	07:26:51	18-21.2070N	122-35.8413E	1035	2869	27.517	33.861	07064648
X52	2008/01/22	08:02:50	18-20.2217N	122-30.0862E	1035	1632	27.471	33.881	07064649

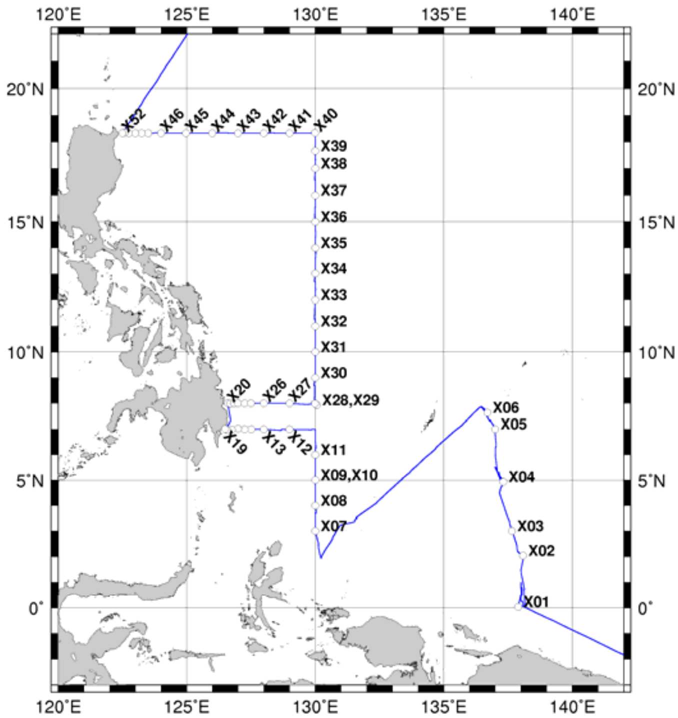


Fig. 6.2.2-1 Position map of XCTD observations.

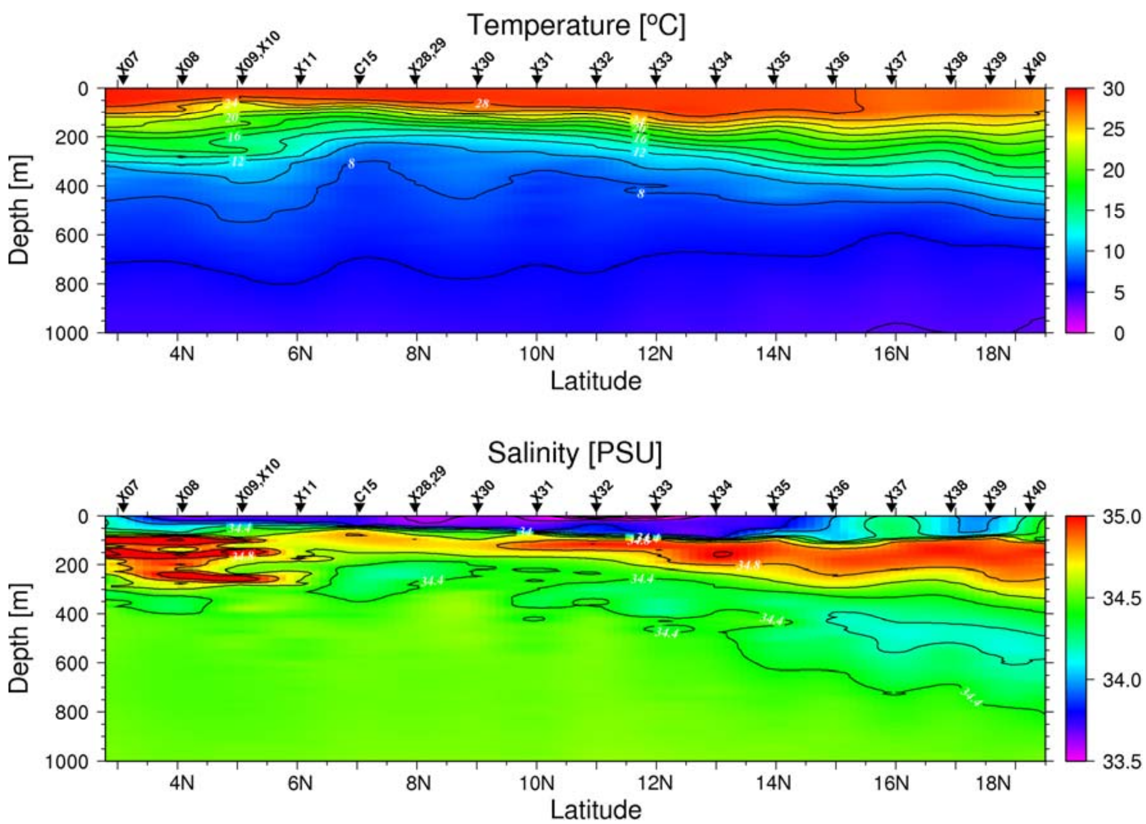


Fig. 6.2.2-2 Vertical section of temperature (upper) and salinity(lower) along 130E line with CTD data (C15).

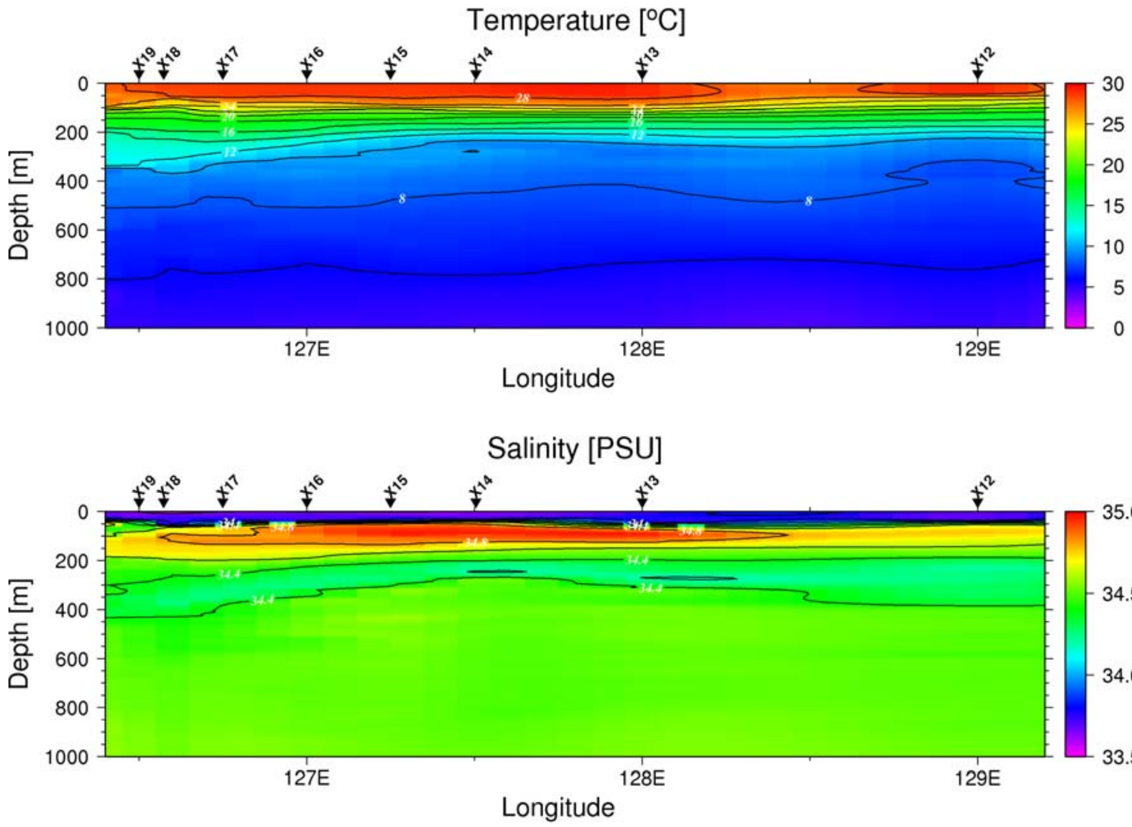


Fig. 6.2.2-3 Vertical section of temperature (upper) and salinity (lower) along 7N line.

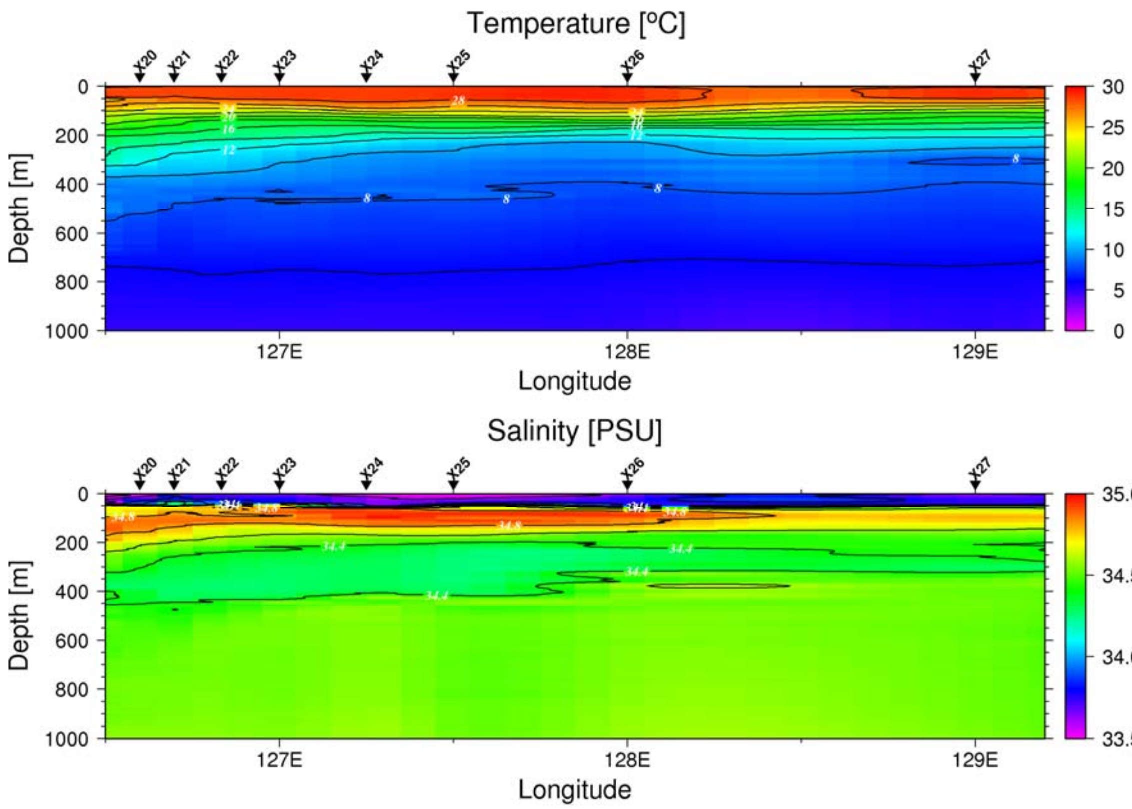


Fig. 6.2.2-4 Vertical section of temperature (upper) and salinity (lower) along 8N line.

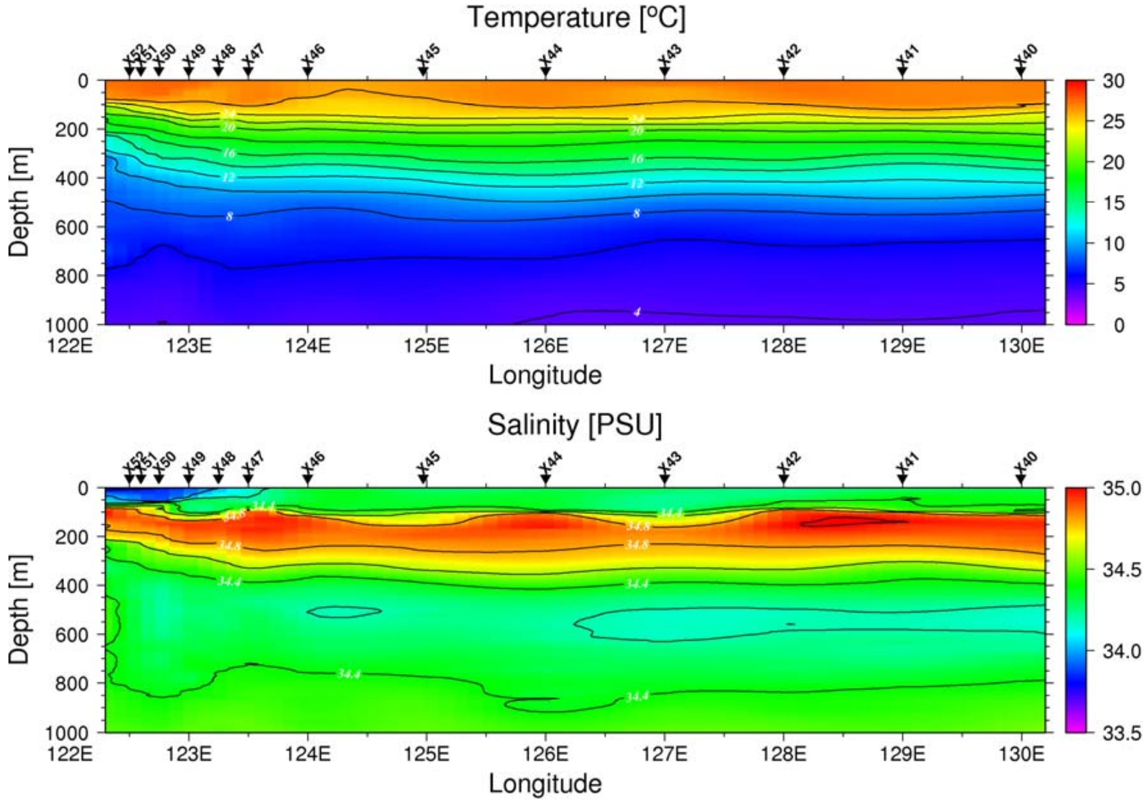


Fig. 6.2.2-5 Vertical section of temperature (upper) and salinity (lower) along 18-20N line.

6.3 Water sampling

6.3.1 Salinity

(1) Personnel

Akinori Murata (MWJ) : Operation reader

(2) Objectives

To provide a calibration for the measurement of salinity of bottle water collected on the CTD casts and EPCS.

(3) Instrument and Method

a. Salinity Sample Collection

Seawater samples were collected with 12 liter Niskin-X bottles and EPCS. The salinity sample bottle of the 250ml brown glass bottle with screw cap was used for collecting the sample water. Each bottle was rinsed three times with the sample water, and was filled with sample water to the bottle shoulder. The sample bottle was sealed with a plastic insert thimble and a screw cap ; the thimble being thoroughly rinsed before use. The bottle was stored for more than 24 hours in the laboratory before the salinity measurement.

The kind and number of samples taken are shown as follows ;

Table 6.3.1-1 Kind and number of samples

Kind of Samples	Number of Samples
Samples for CTD and Bucket	94
Samples for EPCS	51
Total	145

b. Instruments and Method

The salinity analysis was carried out on R/V MIRAI during the cruise of MR07-07Leg1 using the salinometer (Model 8400B “AUTOSAL” ; Guildline Instruments Ltd.: S/N 62827) with an additional peristaltic-type intake pump (Ocean Scientific International, Ltd.). A pair of precision digital thermometers (Model 9540 ; Guildline Instruments Ltd.) were used. The thermometer monitored the ambient temperature and the other monitored a bath temperature.

The specifications of the 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 re-standardization
Maximum Resolution : Better than ±0.0002 (PSU) at 35 (PSU)

Thermometer (Model 9540 ; Guildline Instruments Ltd.)

Measurement Range	:	-40 to +180 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.* (2002). The salinometer was operated in the air-conditioned ship's laboratory at a bath temperature of 24 deg C. The ambient temperature varied from approximately 22 deg C to 24 deg C, while the bath temperature was very stable and varied within +/- 0.004 deg C on rare occasion. The measurement for each sample was done with a double conductivity ratio and defined as the median of 31 readings of the salinometer. Data collection was started 5 seconds after filling the cell with the sample and it took about 15 seconds to collect 31 readings by a personal computer. Data were taken for the sixth and seventh filling of the cell. In the case of the difference between the double conductivity ratio of these two fillings being smaller than 0.00002, the average value of the double conductivity ratio was used to calculate the bottle salinity with the algorithm for the practical salinity scale, 1978 (UNESCO, 1981). If the difference was greater than or equal to 0.00003, an eighth filling of the cell was done. In the case of the difference between the double conductivity ratio of these two fillings being smaller than 0.00002, the average value of the double conductivity ratio was used to calculate the bottle salinity. The measurement was conducted in about 6 hours per day and the cell was cleaned with soap after the measurement of the day.

(4) Preliminary Result

a. Standard Seawater

Standardization control of the salinometer was set to 456 and all measurements were done at this setting. The value of STANDBY was 5396 +/- 0001 and that of ZERO was 0.0+0000 or 0.0+0001. The conductivity ratio of IAPSO Standard Seawater batch P148 was 0.99982 (double conductivity ratio was 1.99964) and was used as the standard for salinity. 8 bottles of P148 were measured.

Fig.6.3.1-1 shows the history of the double conductivity ratio of the Standard Seawater batch P148. The average of the double conductivity ratio was 1.99963 and the standard deviation was 0.00001, which is equivalent to 0.0002 in salinity.

Fig.6.3.1-2 shows the history of the double conductivity ratio of the Standard Seawater batch P148 after correction. The average of the double conductivity ratio after correction was 1.99964 and the standard deviation was 0.00001, which is equivalent to 0.0001 in salinity.

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

batch	:	P148
conductivity ratio	:	0.99982
salinity	:	34.993
preparation date	:	10-October-2006

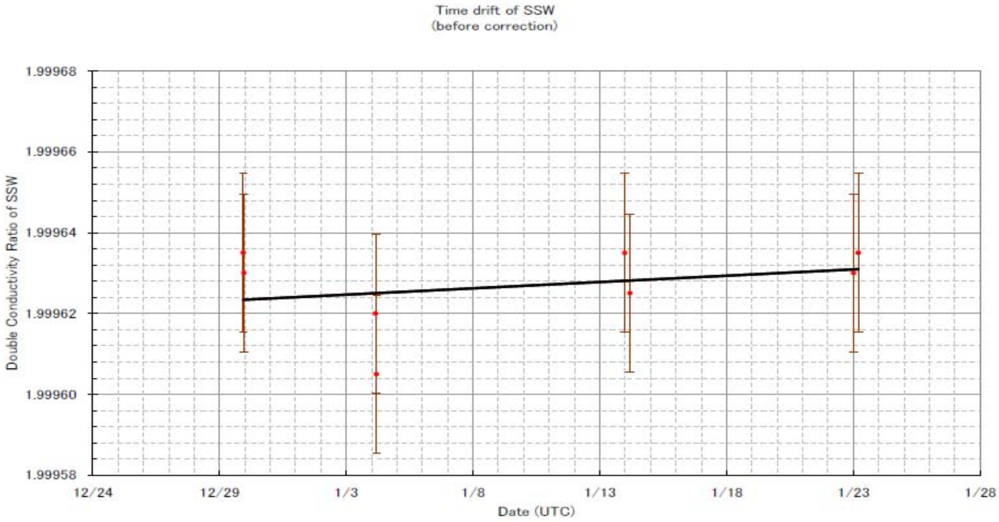


Fig. 6.3.1-1 History of double conductivity ratio for the Standard Seawater batch P148 (before correction)

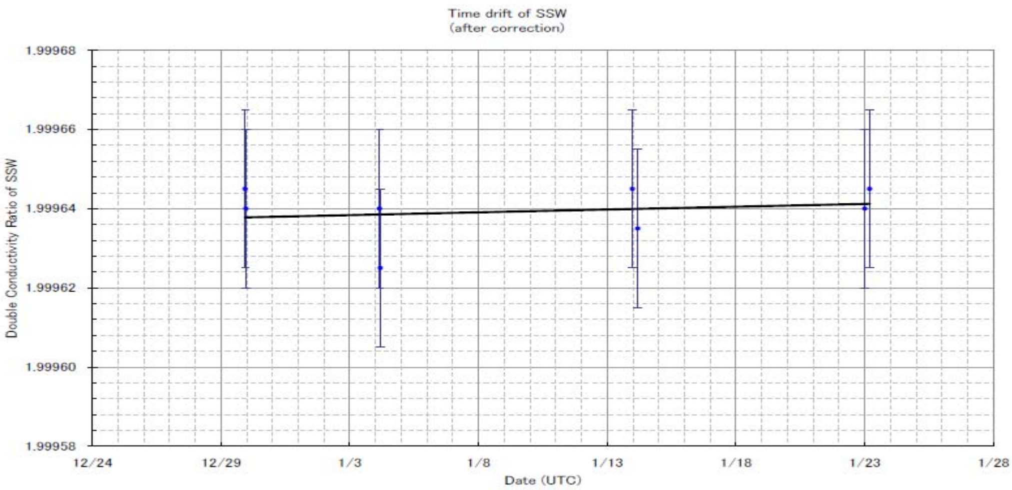


Fig. 6.3.1-2 History of double conductivity ratio for the Standard Seawater batch P148 (after correction)

b. Sub-Standard Seawater

Sub-standard seawater was made from deep-sea water filtered by a pore size of 0.45 micrometer and stored in a 20 liter container made of polyethylene and stirred for at least 24 hours before measuring. It was measured about every 8 samples in order to check for the possible sudden drifts of the salinometer.

c. Replicate Samples

We estimated the precision of this method using 24 pairs of replicate samples taken from the same Niskin bottle. The average and the standard deviation of absolute difference among 24 pairs of replicate samples were 0.0002 and 0.0002 in salinity, respectively.

(5) Data archive

All data will be submitted to JAMSTEC Data Management Office (DMO) and is currently under its control.

(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 Tech. Papers in Mar. Sci., 36, 25 pp., 1981

6.4 Continuous monitoring of surface seawater

(1) Personnel

Yuji Kashino	(JAMSTEC): Principal Investigator
Miyo Ikeda	(MWJ): Operation leader
Yuichi Sonoyama	(MWJ): Technical Staff

(2) Objective

Measurement of temperature, salinity, dissolved oxygen and fluorescence of the sea surface water in the western Pacific Ocean.

(3) Methods

The *Continuous Sea Surface Water Monitoring System* (Nippon Kaiyo Co. Ltd.) has five kind of sensors and can automatically measure salinity, temperature (two systems), dissolved oxygen and fluorescence in near-sea surface water continuously, every 1-minute. Salinity is calculated by conductivity on the basis of PSS78. 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 hard disk of PC every 1-minute together with time and position of ship, and displayed in the data management PC machine.

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 except with fluorometer (about 0.5L/min). The flow rate is measured with two flow meters.

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

a) Temperature and Conductivity sensor

SEACAT THERMOSALINOGRAPH

Model:	SBE-21, SEA-BIRD ELECTRONICS, INC.	
Serial number:	2118859-2641	
Measurement range:	Temperature -5 to +35℃,	Conductivity 0 to 6.5 S m-1
Accuracy:	Temperature 0.01℃ 6month-1,	Conductivity 0.001 S m-1 month-1
Resolution:	Temperatures 0.001℃,	Conductivity 0.0001 S m-1

b) Bottom of ship thermometer

Model:	SBE 3S, SEA-BIRD ELECTRONICS, INC.
Serial number:	032607
Measurement range:	-5 to +35℃
Resolution:	±0.001℃
Stability:	0.002℃ year-1

c) Dissolved oxygen sensor

Model:	2127A, HACH ULTRA ANALYTICS JAPAN, INC.
Serial number:	44733
Measurement range:	0 to 14 ppm
Accuracy:	±1% at 5℃ of correction range
Stability:	1% month-1

d) Fluorometer

Model:	10-AU-005, TURNER DESIGNS
Serial number:	5562 FRXX
Detection limit:	5 ppt or less for chlorophyll a

Stability: 0.5% month-1 of full scale

e) 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.

Start : 2007/12/28 05:55 Stop : 2008/01/04 00:39
Start : 2008/01/05 11:51 Stop : 2008/01/23 08:00

(4) Preliminary Result

Preliminary data of temperature, salinity, dissolved oxygen, fluorescence at sea surface are shown in Fig.6.4-1. We took the surface water samples to compare sensor data with bottle data of salinity and dissolved oxygen for 1~2 times per day, and measured. They are shown in Fig.6.4-2~3. All the salinity samples were analyzed by the Guildline 8400B, dissolve oxygen samples were analyzed by Winkler method.

(5) Date archive

The data were stored on a CD-R, 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 homepage.

(6) Remarks

We did not collect the data in the closed sea of Papua New Guinea from 0:40-04-January to 11:50-05-January 2008.

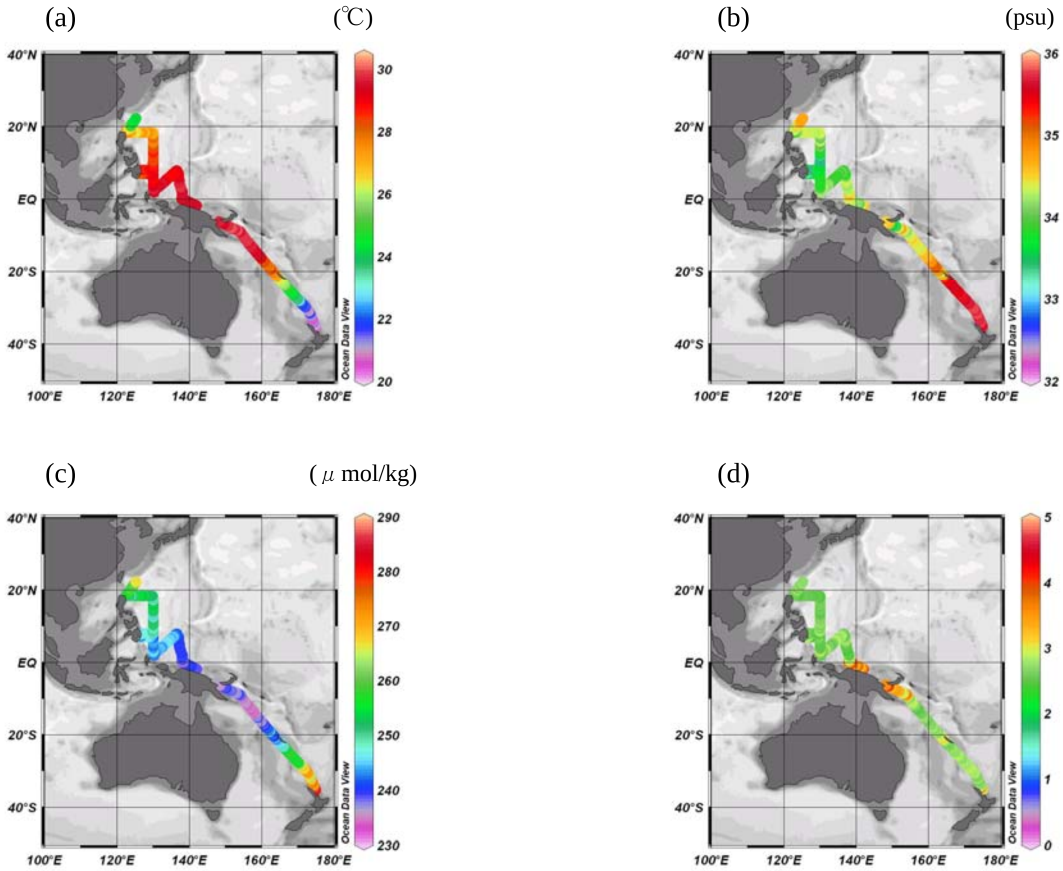


Fig.6.4-1 Spatial and temporal distribution of temperature (a), salinity (b), dissolved oxygen (c) and fluorescence (d). Fluorescence is relative value.

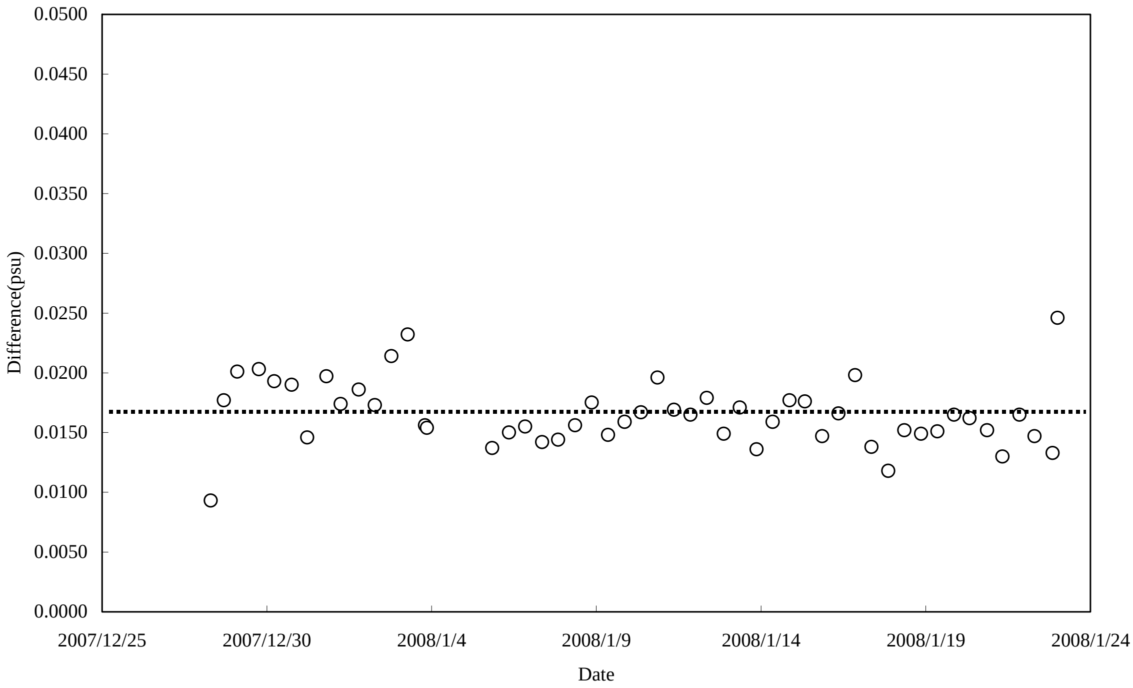


Fig.6.4-2　Variability of difference between sensor data and bottle data in salinity.　The mean of the difference was 0.0165psu.

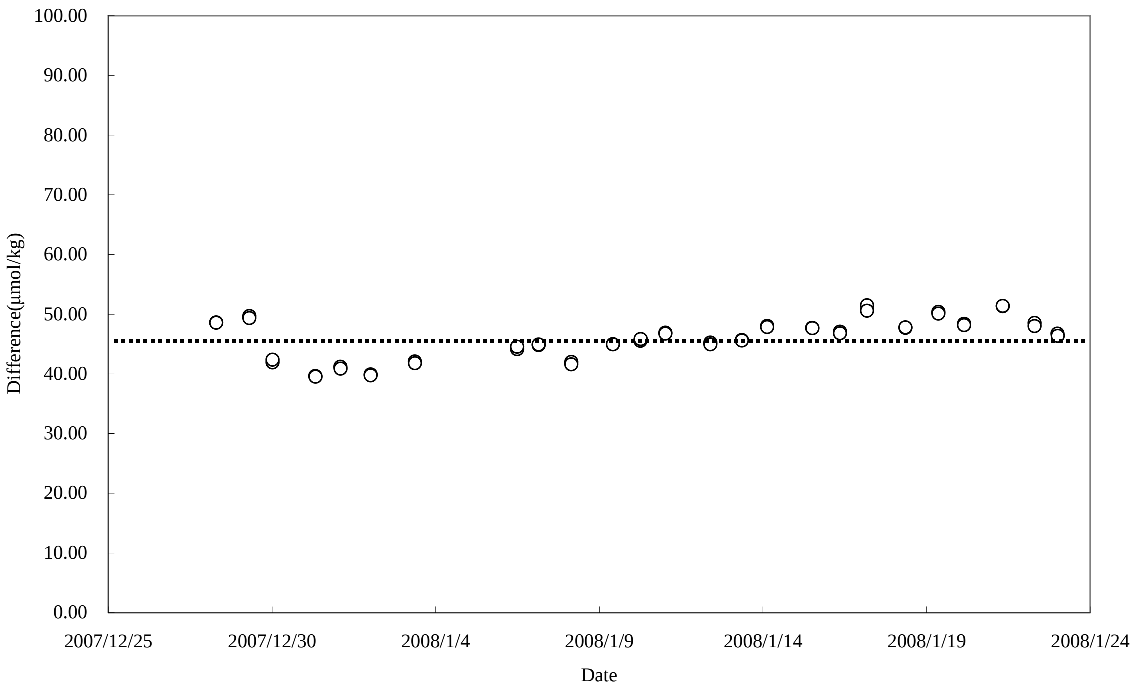


Fig.6.4-3　Variability of difference between sensor data and bottle data in dissolved oxygen.　The mean of the difference was 45.91 μ mol/kg.

6.5 Shipboard ADCP

(1) Personnel

Yuji Kashino	(JAMSTEC): Principal Investigator
Souichiro Sueyoshi	(Global Ocean Development Inc., GODI)
Ryo Kimura	(GODI)
Harumi Ota	(GODI)

(2) Objective

To obtain continuous measurement of the current profile along the ship's track.

(3) Methods

Upper ocean current measurements were made throughout MR07-07Leg1 cruise, using the hull-mounted Acoustic Doppler Current Profiler (ADCP) system that is permanently installed on the R/V MIRAI. For most of its operation, the instrument was configured for water-tracking mode recording. 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. The system consists of following components;

i) 75 kHz Broadband (coded-pulse) profiler with 4-beam Doppler sonar operating (RD Instruments, USA), mounted with beams pointing 30 degrees from the vertical and 45 degrees azimuth from the keel;
ii) The Ship's main gyro compass (Tokimec, Japan), continuously providing ship's heading measurements to the ADCP.
iii) A GPS navigation receiver (Trimble 4000DS) providing position fixes.
iv) A personal computer running data acquisition software (VmDas version 1.4.0, RD Instruments, USA). The clock of the logging PC are adjusted to GPS time every 3 minutes.
v) High-precision attitude information, heading, pitch and roll, are also stored in N2R data files with a time stamp.

The ADCP was configured for 16 m processing bin and 8 m blanking distance. The sound speed at the transducer is calculated from temperature, salinity (constant value; 35.0 PSU) and depth (6.5 m; transducer depth) by equation in Medwin (1975). Data was made at 16-m intervals starting 31-m below the surface. Every ping was recorded as raw ensemble data (.ENR). Also, 60 seconds and 300 seconds averaged data were recorded as short term average (.STA) and long term average (.LTA) data, respectively. Major parameters for the measurement (Direct Command) are shown Table 6.5-1 Major parameters.

(4) Preliminary results

Fig. 6.5-1 and Fig. 6.5-2 were shown 50 – 100m and 200 – 300m averaged current vector along the ship track. These data were processed LTA data using CODAS (Common Oceanographic Data Access System) software, developed at the University of Hawaii.

(5) Data archive

These data obtained in this cruise will be submitted to the Marine-Earth Data and Information Department （MEDID） of JAMSTEC, and will be opened to the public via "R/V MIRAI Data Web Page" in JAMSTEC home page.

(6) Remarks

1) Data acquisition was stopped in the territorial water of Papua New Guinea.
   19:01, 03 January 2008 - 11:50, 05 January 2008

Table 6.5-1 Major parameters

Bottom-Track Commands	
BP = 001	Pings per Ensemble (almost less than 1000m depth) 28 Dec. 2007 05:57 UTC – 28 Dec. 2007 08:04 UTC 24 Jan. 2008 09:22 UTC – 25 Jan. 2008 00:00 UTC
BP = 000	Disable bottom-track ping (almost over 1000m depth) 28 Dec. 2007 08:04 UTC – 24 Jan. 2008 09:22 UTC
Environmental Sensor Commands	
EA = +00000	Heading Alignment (1/100 deg)
EB = +00000	Heading Bias (1/100 deg)
ED = 00065	Transducer Depth (0 - 65535 dm)
EF = +0001	Pitch/Roll Divisor/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) C (1): Sound velocity calculates using ED, ES, ET (temp.) D (0): Manual ED H (2): External synchro P (0), R (0): Manual EP, ER (0 degree) S (0): Manual ES T (1): Internal transducer sensor
Timing Commands	
TE = 00:00:02.00	Time per Ensemble (hrs:min:sec.sec/100)
TP = 00:02.00	Time per Ping (min:sec.sec/100)
Water-Track Commands	
WA = 255	False Target Threshold (Max) (0-255 count)
WB = 1	Mode 1 Bandwidth Control (0=Wid, 1=Med, 2=Nar)
WC = 064	Low Correlation Threshold (0-255)
WD = 111 111 111	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%)
WI = 0	Clip Data Past Bottom (0 = OFF, 1 = ON)
WJ = 1	Rcvr Gain Select (0 = Low, 1 = High)
WM = 1	Profiling Mode (1-8)
WN = 040	Number of depth cells (1-128)
WP = 00001	Pings per Ensemble (0-16384)
WS = 1600	Depth Cell Size (cm)
WT = 000	Transmit Length (cm) [0 = Bin Length]
WV = 999	Mode 1 Ambiguity Velocity (cm/s radial)

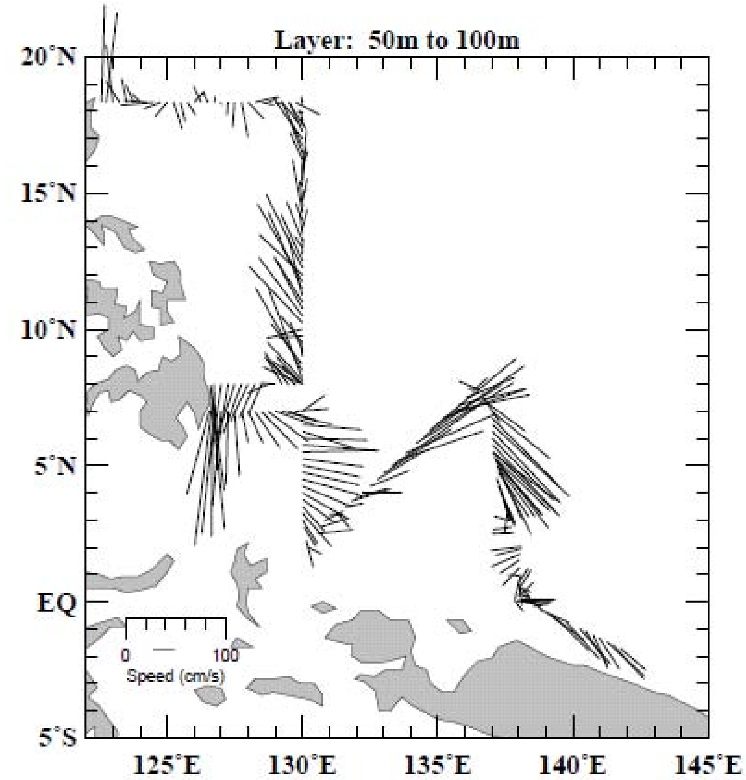


Fig. 6.5-1: 50-100m averaged current vector along the ship track.

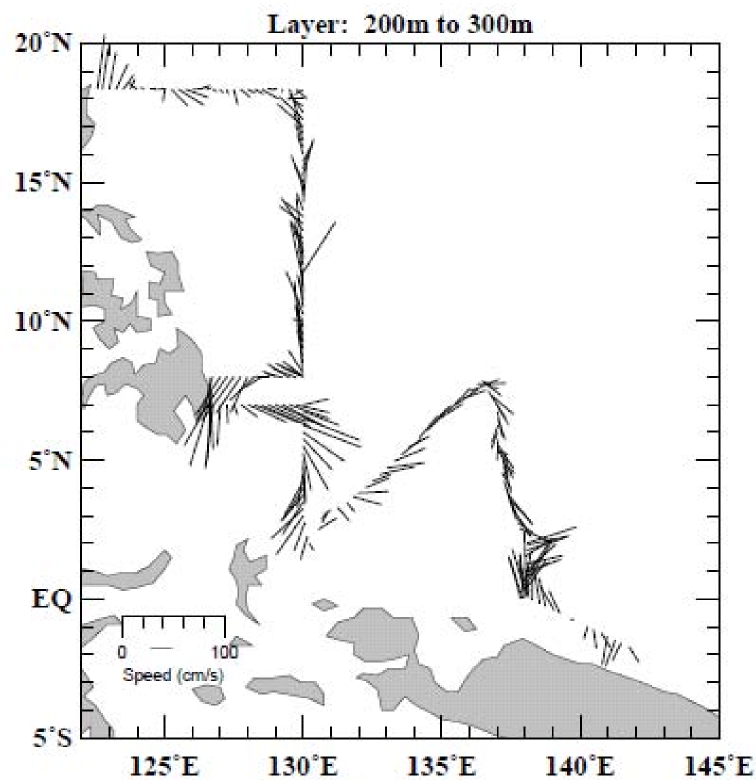


Fig. 6.5-2: 200-300m averaged current vector along the ship track.

6.1 Underway Geophysics

6.6.1 Sea surface gravity

(1) Personnel

Souichiro Sueyoshi	(Global Ocean Development Inc.: GODI)
Ryo Kimura	(GODI)
Harumi Ohta	(GODI)
Not on-board :	
Takeshi Matsumoto	(University of the Ryukyus) : Principal Investigator

(2) Introduction

The local gravity is an important parameter in geophysics and geodesy. We collected gravity data at the sea surface.

(3) Parameters

Relative Gravity [CU: Counter Unit]

[mGal] = (coef1: 0.9946) * [CU]

(4) Data Acquisition

We measured relative gravity using LaCoste and Romberg air-sea gravity meter S-116 (Micro-g LaCoste, LLC) during the MR07-07 Leg.1 cruise from 28 December 2007 to 25 January 2008, except for the territorial waters of New Zealand, and the territorial waters and the EEZ of Papua New Guinea and Republic of Indonesia.

To convert the relative gravity to absolute one, we measured gravity, using portable gravity meter (Scintrex gravity meter CG-3M), at Sekinehama (before MR07-06 Leg.1 cruise) and Nakagusuku as the reference point.

(5) Preliminary Results

Absolute gravity shown in Tabel 6.6.1

Table 6.6.1

No.	Date	U.T.C.	Port	Absolute Gravity [mGal]	Sea Level [cm]	Draft [cm]	Gravity at Sensor *[1] [mGal]	L&R *[2] Gravity [mGal]
#1	07 Oct. 2007	00:29	Sekinehama	980371.93	281	628	980372.84	12642.66
#2	25 Jan. 2008	03:53	Nakagusuku	979114.70	285	628	979115.62	11386.68

*[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

Differential	#2 - #1	
Gravity at sensor	-1257.22 mGal --- (a)	
L&R value	-1255.98 mGal --- (b)	
L&R drift value (b)-(a)	1.239 mGal	111.14 days
Daily drift ratio	0.011 mGal/day	

(6) Data Archives

Surface gravity data obtained during this cruise will be submitted to the Marine-Earth Data and Information Department (MEDID) in JAMSTEC, and will be archived there.

(7) Remark

1. Following periods, we did not collect data in the territorial waters and the EEZ.

   23:00 27 Dec. 2007 - 05:55 28 Dec. 2007 (the territorial waters of New Zealand)

   21:38 03 Jan. 2008 - 20:34 08 Jan. 2008 (the territorial waters and the EEZ of Papua New Guinea and Republic of Indonesia)

   21:38 14 Jan. 2008 - 03:00 15 Jan. 2008 (the EEZ of Republic of Indonesia)

6.6.2 Sea Surface three-component magnetic field

(1) Personnel

Souichiro Sueyoshi	(Global Ocean Development Inc.: GODI)
Ryo Kimura	(GODI)
Harumi Ohta	(GODI)
Not on-board :	
Takeshi Matsumoto	(University of the Ryukyus) : Principal Investigator

(2) 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 MR07-07 Leg.1 cruise from 28 December 2007 to 25 January 2008, except for the territorial waters of New Zealand, and the territorial waters and the EEZ of Papua New Guinea and Republic of Indonesia.

(3) Principle of ship-board geomagnetic vector measurement

The relation between a magnetic-field vector observed on-board, **H**ob, (in the ship's fixed coordinate system) and the geomagnetic field vector, **F**, (in the Earth's fixed coordinate system) is expressed as:

$$\mathbf{H}ob=\mathbf{ARPYF}+\mathbf{Hp} \qquad \text{(a)}$$

where **R**, **P** and **Y** are the matrices of rotation due to roll, pitch and heading of a ship, respectively. **A** is a 3×3 matrix which represents magnetic susceptibility of the ship, and **Hp** is a magnetic field vector produced by a permanent magnetic moment of the ship's body. Rearrangement of Eq. (a) makes

$$\mathbf{BHob}+\mathbf{Hbp}=\mathbf{RPYF} \qquad \text{(b)}$$

where $\mathbf{B}=\mathbf{A}^{-1}$, and **H**bp=-**BHp**. The magnetic field, **F**, can be obtained by measuring **R**, **P**, **Y** and **Hob**, if **B** and **Hbp** are known. Twelve constants in **B** and **Hbp** can be determined by measuring variation of **Hob** with **R**, **P** and **Y** at a place where the geomagnetic field, **F**, is known.

(4) Instruments on *R/V MIRAI*

A shipboard three-component magnetometer system (Tierra Tecnica SFG1214) is equipped on-board *R/V MIRAI*. Three-axes 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 (GPS) and speed data are taken from LAN every second.

(5) Data Archives

Magnetic force data obtained during this cruise will be submitted to the Marine-Earth Data and Information Department (MEDID) in JAMSTEC, and will be archived there.

(6) Remarks

1. Following periods, we did not collect data in the territorial waters and the EEZ.
   23:00 27 Dec. 2007 - 05:55 28 Dec. 2007 (the territorial waters of New Zealand)
   21:38 03 Jan. 2008 - 20:34 08 Jan. 2008 (the territorial waters and the EEZ of Papua New Guinea and Republic of Indonesia)
   21:38 14 Jan. 2008 - 03:00 15 Jan. 2008 (the EEZ of Republic of Indonesia)
2. For calibration of the ship’s magnetic effect, we made a “Figure eight” turn (a pair of clockwise and anti-clockwise rotation). The periods were follows;
   08:15 - 08:36 11 Jan. 2008, about at 05-30N, 137-00E
   08:49 - 09:17 24 Jan. 2008, about at 24-54N, 127-08E

6.6.3 Swath Bathymetry

(1) Personnel

Souichiro Sueyoshi	(Global Ocean Development Inc.: GODI)
Ryo Kimura	(GODI)
Harumi Ohta	(GODI)
Not on-board :	
Takeshi Matsumoto	(University of the Ryukyus) : Principal Investigator

(2) Introduction

R/V MIRAI is equipped with a Multi narrow Beam Echo Sounding system (MBES), SEABEAM 2112.004 (SeaBeam Instruments Inc.), add system Sub-Bottom Profiler (SBP). The objective of MBES is collecting continuous bathymetric data along ship's track to make a contribution to geological and geophysical investigations and global datasets.

(3) Data Acquisition

The "SEABEAM 2100" on R/V MIRAI was used for bathymetry mapping during the MR07-07 leg.1 cruise from 28 December 2007 to 25 January 2008, except for the territorial waters of New Zealand, and the territorial waters and the EEZ of Papua New Guinea and Republic of Indonesia.

To get accurate sound velocity of water column for ray-path correction of acoustic multibeam, we used Surface Sound Velocimeter (SSV) data to get the sea surface (6.2m) sound velocity, and the deeper sound velocity profiles were calculated by temperature and salinity profiles from CTD and XCTD data by the equation in Mackenzie (1981) during the cruise.

Table 6.6.3 shows system configuration and performance of SEABEAM 2112.004 system.

Table 6.6.3 System configuration and performance

SEABEAM 2112.004 (12 kHz system)	
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)

Sub-Bottom Profiler (4kHz system)	
Frequency:	4 kHz
Transmit beam width:	5 degree
Sweep:	5 to 100 msec
Depth Penetration:	As much as 75 m (varies with bottom composition)
Resolution of sediments:	Under most condition within < tens-of-centimeters range
	(dependent upon depth and sediment type)

(4) Preliminary Results

The results will be published after primary processing.

(5) Data Archives

Bathymetric data obtained during this cruise will be submitted to the Marine-Earth Data and Information Department (MEDID) in JAMSTEC, and will be archived there.

(6) Remarks

1. Following periods, we did not collect data in the territorial waters and the EEZ.
   23:00 27 Dec. 2007 - 05:55 28 Dec. 2007 (the territorial waters of New Zealand)
   21:38 03 Jan. 2008 - 20:35 08 Jan. 2008 (the territorial waters and the EEZ of Papua New Guinea and Republic of Indonesia)
   21:38 14 Jan. 2008 - 03:00 15 Jan. 2008 (the EEZ of Republic of Indonesia)

7. Special Observations

7.1 TRITON moorings

7.1.1 TRITON Mooring Operation

(1) Personnel

Yuji Kashino	(JAMSTEC): Principal Investigator
Hiroshi Matsunaga	(MWJ): Operation Leader
Masaki Furuhata	(MWJ): Technical Staff
Kenichi Katayama	(MWJ): Technical Staff
Akinori Murata	(MWJ): Technical Staff
Keisuke Matsumoto	(MWJ): Technical Staff
Takatoshi Kiyokawa	(MWJ): Technical Staff
Tomohide Noguchi	(MWJ): Technical Staff
Hiroki Ushiromura	(MWJ): Technical Staff
Yuichi Sonoyama	(MWJ): Technical Staff
Miyo Ikeda	(MWJ): Technical Staff
Tomoki Takimoto	(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).

Five TRITON buoys have been successfully recovered and six TRITON deployed during this R/V MIRAI cruise (MR07-07 Leg1).

(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

R.M.YOUNG COMPANY MODEL50202/50203

Atmospheric pressure

PAROPSCIENTIFIC.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	EQ, 138E
ID number at JAMSTEC	13009
Number of surface float	T16
ARGOS PTT number	None
ARGOS backup PTT number	24715, 24241
Deployed date	07 Jan. 2008
Exact location	00 - 01.94N, 137 - 53.32 E
Depth	4,360 m

Nominal location	2N, 138E
ID number at JAMSTEC	12009
Number of surface float	T27
ARGOS PTT number	03779
ARGOS backup PTT number	24239
Deployed date	09 Jan. 2008
Exact location	02 - 03.90N, 138 - 03.87 E
Depth	4,334m

Nominal location	5N, 137E
ID number at JAMSTEC	11007
Number of surface float	T12
ARGOS PTT number	09793
ARGOS backup PTT number	11593
Deployed date	11 Jan. 2008
Exact location	04 - 56.37N, 137 - 18.23E
Depth	4,132 m

Nominal location	8N, 137E
ID number at JAMSTEC	10007
Number of surface float	T09
ARGOS PTT number	01132
ARGOS backup PTT number	11592
Deployed date	13 Jan. 2008
Exact location	07 - 38.99N, 136 - 41.94E
Depth	3,170 m

Nominal location	2N, 130E
ID number at JAMSTEC	16007
Number of surface float	T20
ARGOS PTT number	None
ARGOS backup PTT number	24718, 29700
Deployed date	15 Jan. 2008
Exact location	02 - 00.71N, 130 - 12.60E
Depth	4,371 m

Nominal location	8N, 130E
ID number at JAMSTEC	14006
Number of surface float	T28
ARGOS PTT number	07960
ARGOS backup PTT number	24242
Deployed date	18 Jan. 2008
Exact location	07 - 55.59N, 130 - 03.58E
Depth	5,639 m

(6) TRITON recovered

Nominal location	EQ, 138E
ID number at JAMSTEC	13008
Number on surface float	T15
ARGOS PTT number	None
ARGOS backup PTT number	07871, 07881
Deployed date	03 Jan. 2007
Recovered date	07 Jan. 2008
Exact location	00 - 04.39N, 138 - 03.28E
Depth	4,206 m

Nominal location	2N, 138E
ID number at JAMSTEC	12008
Number on surface float	T06
ARGOS PTT number	11826
ARGOS backup PTT number	07864
Deployed date	05 Jan. 2007
Recovered date	09 Jan. 2008
Exact location	01 - 59.78N, 138 - 06.31E
Depth	4,321m

Nominal location	5N, 137E
ID number at JAMSTEC	11006
Number on surface float	T05
ARGOS PTT number	20374
ARGOS backup PTT number	07861
Deployed date	06 Jan. 2007
Recovered date	12 Jan. 2008
Exact location	04 - 51.42N, 137 - 16.16E
Depth	4,097 m

Nominal location	8N, 137E
ID number at JAMSTEC	10006
Number on surface float	T04
ARGOS PTT number	20451
ARGOS backup PTT number	29708
Deployed date	09 Jan. 2007
Recovered date	13 Jan. 2008
Exact location	07 - 51.73N, 136 - 29.05E
Depth	3,351 m

Nominal location	8N, 130E
ID number at JAMSTEC	14005
Number on surface float	T07
ARGOS PTT number	03594
ARGOS backup PTT number	11584
Deployed date	25 Dec. 2006
Recovered date	18 Jan. 2008
Exact location	07 - 58.77N, 130 - 00.64E
Depth	5,721 m

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

(6) Details of deployed

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

Deployed TRITON buoys

Observation No.	Location.	Details.
10007	8N-137E	Deploy with full spec.
11007	5N-137E	Deploy with full spec and one optional CT sensor.
12009	2N-138E	Deploy with full spec and one optional CT sensor.
13009	EQ-138E	Deploy with ten CT sensor, two CTD sensor, one current meter and one optional CT sensor.
14006	8N-130E	Deploy with full spec and one optional supersonic WND sensor.
16007	2N-130E	Deploy with ten CT sensor, two CTD sensor, one current meter and one optional CT sensor.

(7) 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

Yuji kashino	(JAMSTEC): Principal Investigator
Hiroshi Matsunaga	(MWJ): Operation Leader
Kenichi Katayama	(MWJ): Technical staff
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 (or XCTD) observation on R/V MIRAI for this intercomparison. We conducted 1 CTD cast at each TRITON buoy site before recovery, conducted 1 XCTD 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 about 2 nm.

TRITON buoy data was sampled every 1 hour except for transmission 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	Longitude	Condition
10007	8N	137E	After Deployment
11007	5N	137E	After Deployment
12009	2N	138E	After Deploymant
14006	8N	130E	After Deploymant
10006	8N	1370E	Before Recover
12008	2N	138E	Before Recover
14005	8N	130E	Before Recover

(5) Results

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

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

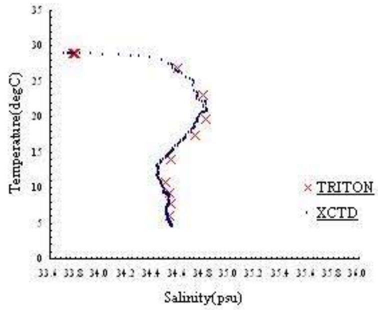
The estimations were calculated as deployed buoy data minus shipboard XCTD data. The salinity differences are from 0.037 to 1.085 for all depths. Below 300db, salinity differences are from 0.037 to 0.054 (See the Figures 7.1.2-2 (a) and Table 7.1.2-1 (a)). The absolute average of all salinity differences was 0.074 with absolute standard deviation of 0.156.

The estimations were calculated as recovered buoy data minus shipboard CTD (9Plus) data. The salinity differences are from –0.490 to 0.116 for all depths. Below 300db, salinity differences are from –0.011 to 0.010 (See the Figures 7.1.2-2(b) and Table 7.1.2-1 (b)). The absolute average of salinity differences was 0.065 with absolute standard deviation of 0.086.

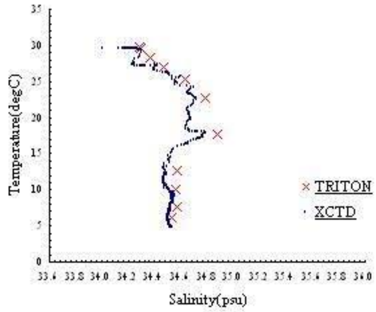
The estimations of time-drift were calculated as recovered buoy data minus deployed buoy data. The difference of salinity over 1 year had the variation ranging from 0.004 to 0.405, for all depths. Below 300db, the difference of salinity over 1 year had the variation ranging from 0.004 to 0.046 (See the figures 7.1.2-2(c)). The absolute average of salinity differences was 0.065 with absolute standard deviation of 0.074.

(6) Data archive

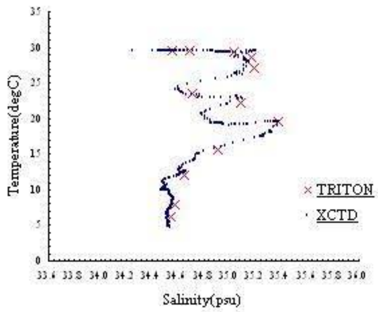
All raw and processed CTD data files were copied on 3.5 inch magnetic optical disks and submitted to JAMSTEC TOCS group of the Ocean Observation and Research Department. All original data will be stored at JAMSTEC Mutsu brunch. (See section 5)



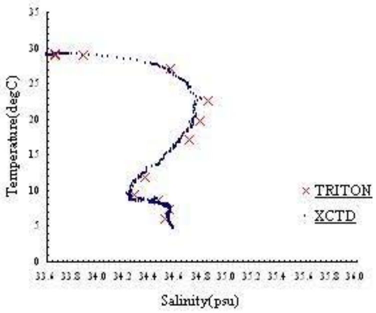
Observation No. 10007 after Deployment



Observation No. 11007 after Deployment

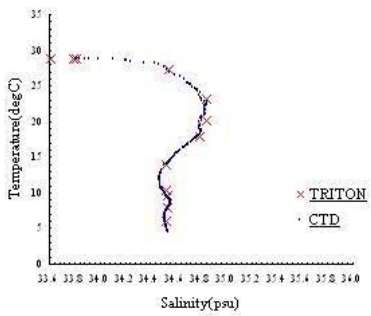


Observation No. 12009 after Deployment

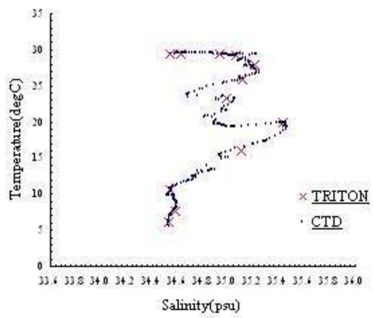


Observation No. 14006 after Deployment

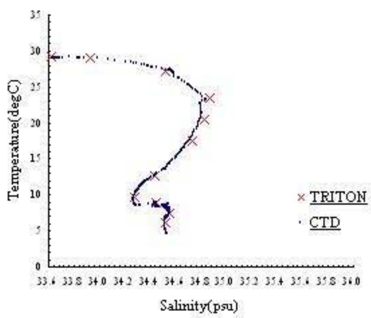
Fig.7.1.2.-1(a) T-S diagram of TRITON buoys data and shipboard XCTD data



Observation No. 10007 Before Recovery



Observation No. 12007 Before Recovery



Observation No. 14005 Before Recovery

Fig.7.1.2.-1(b) T-S diagram of TRITON buoys data and shipboard CTD data

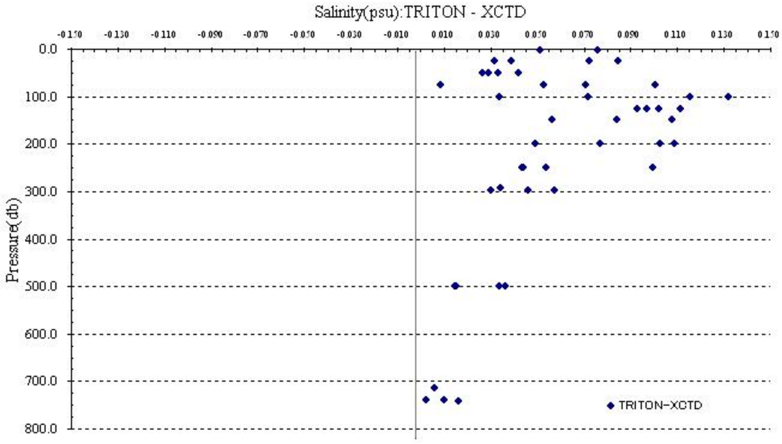


Fig.7.1.2.-2 (a) Salinity differences between TRITON buoys data and shipboard XCTD data after deployment

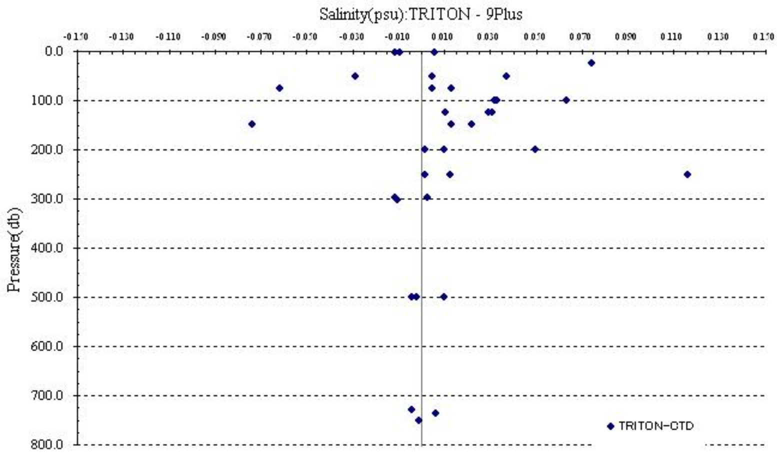


Fig.7.1.2.-2 (b) Salinity differences between TRITON buoys data and shipboard CTD data before recovery

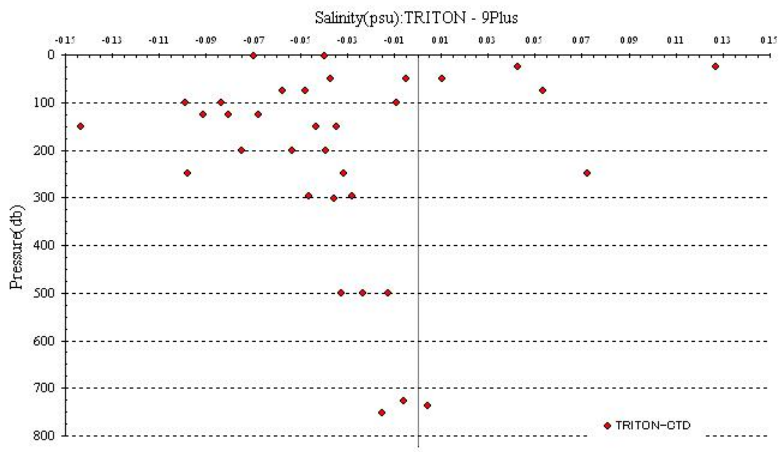


Fig.7.1.2.-2 (c) Salinity differences between deployment data and recovery data for 1year Observation No.10,12,14

Table 7.1.2.-1(a) Data differences between TRITON buoys data and XCTD data after deployment

Observation No.	Pressure (db)	Temperature (degC)	Conductivety (S/m)	Salinity (psu)
10006	1.5	-0.03	0.009	0.076
10006	25.0	-0.03	0.011	0.073
10006	50.0	-0.01	0.007	0.033
10006	75.0	-0.11	0.001	0.071
10006	100.0	-0.10	0.007	0.116
10006	125.0	0.01	0.014	0.111
10006	150.0	0.00	0.008	0.056
10006	200.0	0.00	0.006	0.049
10006	250.0	-0.01	0.005	0.044
10006	297.7	0.00	0.005	0.030
10006	500.0	-0.02	0.001	0.015
10006	740.4	0.00	0.001	0.002
11006	1.5	-0.02	0.202	1.290
11006	25.0	-0.02	0.007	0.039
11006	50.0	0.00	0.008	0.029
11006	75.0	0.01	0.016	0.101
11006	100.0	0.00	0.005	0.034
11006	125.0	0.03	0.016	0.093
11006	150.0	-0.03	0.010	0.084
11006	200.0	0.02	0.017	0.109
11006	250.0	-0.01	0.007	0.054
11006	292.1	0.00	0.005	0.034
11006	500.0	0.00	0.003	0.015
11006	714.4	0.10	0.010	0.006
12008	1.5	-0.01	0.007	0.051
12008	25.0	0.01	0.009	0.032
12008	50.0	0.00	0.009	0.042
12008	75.0	-0.17	-0.009	0.053
12008	100.0	-0.02	0.011	0.072
12008	125.0	-0.01	0.015	0.102
12008	150.0	-0.18	-0.002	0.108
12008	200.0	0.03	0.018	0.103
12008	250.0	-0.02	-0.007	0.044
12008	297.9	0.00	0.006	0.046
12008	500.0	0.01	0.005	0.034
12008	741.7	-0.03	0.000	0.016
14005	1.5	-0.04	0.031	0.242
14005	25.0	-0.04	0.011	0.085
14005	50.0	0.03	0.010	0.027
14005	75.0	-0.03	0.000	0.009
14005	100.0	-0.19	-0.004	0.132
14005	125.0	0.00	0.013	0.097
14005	150.0	0.04	0.025	0.165
14005	200.0	-0.02	0.009	0.077
14005	250.0	-0.01	0.012	0.100
14005	298.2	0.00	0.006	0.057
14005	500.0	0.00	0.005	0.036
14005	738.4	0.00	0.002	0.010

(red) bad data

Table 7.1.2.-1(b) Data differences between TRITON buoys data and ship board CTD data before recovery

Observation No.	Pressure (db)	Temperature (degC)	Conductivety (S/m)	Salinity (psu)
10006	1.5	0.00	0.001	0.006
10006	25.0	0.01	-0.028	-0.200
10006	50.0	0.00	-0.005	-0.029
10006	75.0	-0.10	-0.008	0.013
10006	100.0	-0.05	-0.001	0.032
10006	125.0	-0.10	-0.006	0.031
10006	150.0	0.01	0.002	0.013
10006	200.0	0.00	0.001	0.010
10006	250.0	-0.02	-0.001	0.012
10006	297.7	-0.01	0.000	0.002
10006	500.0	0.00	0.000	-0.002
10006	737.4	-0.01	0.000	0.007
12008	1.5	-0.02	-0.004	-0.012
12008	25.0	0.02	0.013	0.074
12008	50.0	0.03	0.004	0.005
12008	75.0	0.00	0.001	0.005
12008	100.0	0.02	0.011	0.063
12008	125.0	-0.01	0.001	0.011
12008	150.0	0.02	-0.008	-0.074
12008	200.0	0.02	0.008	0.050
12008	250.0	0.09	0.022	0.116
12008	301.8	0.02	0.001	-0.011
12008	500.0	0.00	0.000	0.010
12008	751.4	-0.01	-0.001	-0.001
14005	1.5	0.07	0.005	-0.009
14005	25.0	0.00	-0.072	-0.490
14005	50.0	0.01	0.006	0.037
14005	75.0	0.00	-0.009	-0.062
14005	100.0	0.07	0.011	0.033
14005	125.0	0.02	0.006	0.029
14005	150.0	-0.03	0.000	0.022
14005	200.0	-0.06	-0.006	0.002
14005	250.0	0.00	0.001	0.002
14005	297.2	0.00	-0.001	-0.011
14005	500.0	0.04	0.004	-0.004
14005	728.3	0.04	0.003	-0.004

(red) bad data

7.2 Lidar observations of clouds and aerosols

(1) Personnel

Nobuo Sugimoto, Ichiro Matsui, and Atsushi Shimizu (National Institute for Environmental Studies, not on board), lidar operation was supported by GODI.

(2) Objectives

Objectives of the observations in this cruise is to study distribution and optical characteristics of ice/water clouds and marine aerosols using a two-wavelength lidar.

(3) Measured parameters

- Vertical profiles of backscattering coefficient at 532 nm
- Vertical profiles of backscattering coefficient at 1064 nm
- Depolarization ratio at 532 nm

(4) Method

Vertical profiles of aerosols and clouds were measured with a two-wavelength 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 20 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 digital oscilloscope and stored on a hard disk with a computer. The lidar system was installed in the radiosonde container on the compass deck. The container has a glass window on the roof, and the lidar was operated continuously regardless of weather.

(5) Results

Data obtained in this cruise has not been analyzed.

(6) Data archive

- raw data

lidar signal at 532 nm

lidar signal at 1064 nm

depolarization ratio at 532 nm

temporal resolution 15 min.

vertical resolution 6 m.

data period (utc) : 6:00 Dec. 28, 2007 – 21:38 Jan. 3, 2008,

11:50 Jan. 5 2008 – 12:00 Jan. 24 2008

- processed data

cloud base height, apparent cloud top height

phase of clouds (ice/water)

cloud fraction

boundary layer height (aerosol layer upper boundary height)

backscatter coefficient of aerosols

particle depolarization ratio of aerosols

7.3 Rain Sampling for Stable Isotopes

(1) Personnel

Kimpei Ichiyanagi (JAMSTEC) (Not on board)

(2) Objective

To determine the spatial distribution of isotopic composition of rainfall on the Ocean

(3) Method

Rainfall samples are collected in 6cc glass bottle with plastic cap. Isotopic compositions for hydrogen and oxygen in rainfall are determined by the Isotope Ratio Mass Spectrometry (IRMS).

(4) Preliminary results

During this cruise, we collected 20 samples in total. Table 7.3-1 lists the date and location of rainfall samples. Analysis will be done after the cruise.

(5) Data archive

Original samples will be analyzed by IORGC. Inventory and analyzed digital data will be submitted to JAMSTEC Data Management Office.

Table 7.3-1 Dates and locations to show when and where rain water were sampled.

Sample No.	Date (UTC)	Location (lat/lon)	Rain (mm)
001	23:18, Dec. 29, 2007	26-43.1S / 169-07.2E	57.4
002	22:49, Dec. 31	17-33.6S / 160-54.2E	98.0
003	21:48, Jan. 1, 2008	13-16.4S / 157-18.1E	16.9
004	09:23, Jan. 2	11-08.7S / 155-32.3E	4.3
005	19:40, Jan. 2	11-08.7S / 154-02.7E	24.1
006	20:49, Jan. 3	06-34.1S / 148-51.2E	6.5
007	03:39, Jan. 7	00-13.1N / 137-55.9E	2.4
008	22:52, Jan. 7	00-04.4N / 138-03.9E	5.2
009	23:10, Jan. 8	02-01.8N / 138-07.2E	4.8
010	04:31, Jan. 11	04-58.3N / 137-17.4E	6.2
011	07:24, Jan. 12	05-41.4N / 137-02.4E	3.4
012	00:39, Jan. 13	07-38.7N / 136-41.4E	2.1
013	23:47, Jan. 13	05-16.8N / 133-38.8E	1.7
014	02:27, Jan. 15	01-59.7N / 139-12.5E	6.9
015	03:42, Jan. 17	07-46.1N / 126-38.1E	17.3
016	02:38, Jan. 18	07-55.6N / 130-02.7E	9.4
017	01:10, Jan. 19	08-00.7N / 129-59.4E	6.0
018	07:25, Jan. 19	08-56.3N / 129-59.6E	25.3
019	01:37, Jan. 20	13-00.4N / 129-59.7E	1.7
020	09:33, Jan. 21	18-20.0N / 127-55.7E	16.7

7.4 Current profile observations using a lowered acoustic Doppler current profiler

Personnel Kelvin Richards (IPRC, University of Hawaii)
Norievill España (University of the Philippines)

(1) Objective

To measure the small vertical scale velocity structure associated with lateral intrusions of salinity

(2) Overview of instrument and operation

In order to measure the velocity structure at fine vertical scales a high frequency ADCP was used in lowered mode (LADCP). The instrument was a Teledyne RDI Workhorse Sentinel 600kHz ADCP rated for 1000m depth. The instrument was attached to the frame of the CTD system using a plastic collar and two retaining bolts. A rope was tied to the top end of the instrument to minimize vertical slippage and for added safety (see Figure 7.4-1). The instrument was deployed on CTD casts 1-13 and performed well throughout its use.

Fig 7.4-1 Mounting of LADCP on CTD System

The instrument is self-contained with an internal battery pack. The health of the battery is monitored by the recorded voltage count. The relationship between the actual battery voltage and the recorded voltage count is obscure and appears to vary with the instrument and environmental conditions. Taking a direct measurement of the state of the battery requires opening up the instrument. Two direct measurements of the battery voltage were taken and compared to the recorded voltage count:

	Battery Voltage (V)	Voltage Count (VC)
Station 1	44.2	147
Station 13	41.1	136

implying an almost constant relationship of V~=0.30VC. RDI recommend the battery is changed when V gets below 30V.

(3) Setup and Parameter settings

The LADCP was controlled at deploy and recover stages by a Linux PC using the python script **ladcp600.py** (written Eric Firing, University of Hawai`i) The commands sent to the instrument at setup were contained in **ladcp600.cmd**. The instrument was setup to have a relatively small bin depth (2m) and a fast ping rate (every 0.25 sec). The full list of commands sent to the instrument were:

```
CR1               # Retrieve parameter (default)
TC2               # Ensemble per burst
WP1               # Pings per ensemble
TE 00:00:00.00    # Time per ensemble (time between data collection cycles)
TP 00:00.25       # Time between pings in mm:ss
WN25              # Number of Depth cells
WS0200            # Depth cell size (in cms)
WF0088   # Blank after transit (recommended setting for 600kHz)
WB0               # Mode 1 bandwidth control (default - wide)
WV250             # Ambiguity velocity (in cm/s)
EZ0111101         # Sensor source (speed of sound excluded)
EX00000           # Beam coordinates
CF11101           # Data flow control parameters
```

(see the RDI Workhorse "Commands and Data Output Format" document for details.)

(4) Data processing

An initial sampling of the data was made using the following scripts to check that the instrument was performing correctly

scanbb integrity check
plot_PTCV.py plot pressure, temperature, voltage and current counts
plot_vel.py plot velocity from all 4 beams

The principal onboard data processing was performed using the Lamont Doherty Earth Observatory (LDEO, Columbia University) LADCP software package version IX_4 (available at ftp://ftp/ldeo.columbia.edu/pub/ant/LADCP). The package is based on a number of matlab scripts. The package performs an inverse of the LADCP data, incorporating CTD (for depth) and GPS data, to provide a vertical profile of the horizontal components of velocity, U and V (eastward and northward, respectively), that is a best fit to specified constraints. The down- and up-casts are solved separately, as well as the full cast inverse. The package also calculates U and V from the vertical shear of velocity.

The software is run using the matlab script **process_cast.m** with the configuration file **set_cast_params.m.** Frequent CTD data are required. Files of 1 second averaged CTD data were prepared for each station. Accurate time keeping is also required, particularly between the CTD and GPS data. To ensure this the CTD data records also included the GPS position. The LDEO software allows the ship's ADCP data (SADCP) to be included in the inverse calculation. The SADCP data were not included in this case so as to provide an independent check on the functioning of the LADCP.

Because of the short range of the 600 kHz instrument (20-40m in this case) the analysis is very sensitive to the presence of the wake of the CTD system on up-casts. Beam 1 data were most severely affected by the wake. Initial processing using all 4 beams produced large errors in the large-scale vertical shear in the up-cast inverse solution and the shear solution. The 3-beam solution, produced by ignoring beam 1, produced much better results. There was little difference between the 3- and 4-beam solutions except for the occasional small scale feature.

On-station SADCP velocity profiles were produced by averaging the five minute averaged profiles (mr0707l1007_000000.LTA produced using VmDAS) over the period of the CTD/LADCP cast. Care was taken to ensure the average did not contain any spurious data from periods when the ship was maneuvering.

(5) Preliminary results

Two examples of the on-board processed data are presented. All results are from the 3-beam solution. Figure 7.4-2 compares the full cast inverse, up- and down-cast inverse, and the shear solutions with the SADCP profile for Station 1. There is a good correspondence between the general structure of all velocity profiles. It is noteworthy that the full inverse solution has a poorer large scale shear for the northward component of velocity than do the other solutions, a feature of a number of full cast inverse profiles. The reason is unclear.

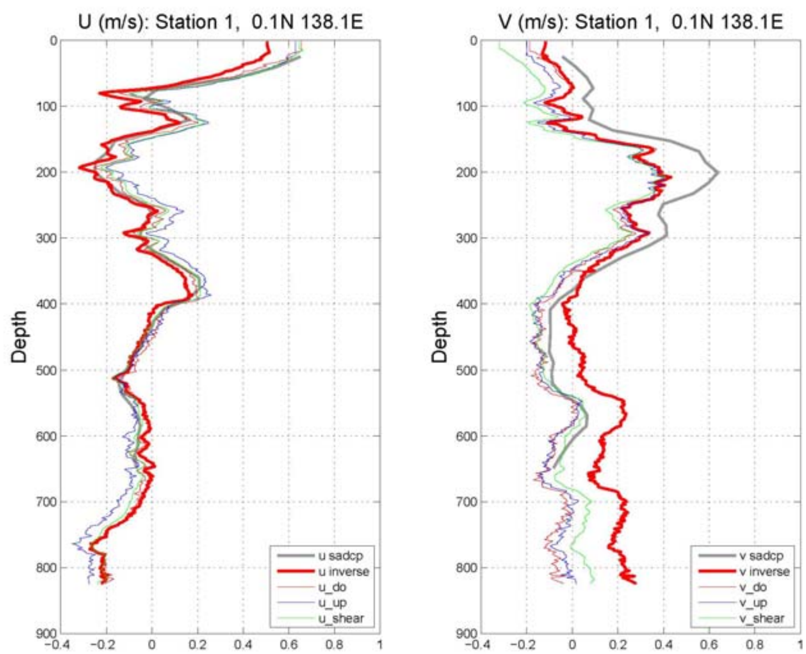


Figure 7.4-2 CTD Station 1: Vertical profiles of U and V calculated by a number of methods using LADCP data. Full cast inverse (u inverse), down-cast only inverse (u_do), up-cast only inverse (u_up) and shear solution (u_shear). Also shown are the profiles using SADCP data (u sadcp).

The down- and up-cast inverse solutions for U are compared with salinity over a portion of the CTD Station 5 profile in Figure 7.4-3. The fact that a number of the same small scale features are evident in both the down- and up- cast profiles of U, and that certain features are seen between stations (not shown), is very encouraging with regard to the ability of the instrument to measure small vertical scale features in velocity. There is some correspondence between the small scale features in U and salinity, although the exact relationship will depend on the time evolution of both fields. Because of its global nature, there is a tendency for the inverse solution to smooth small scale features. A more detailed local analysis will be conducted post-cruise.

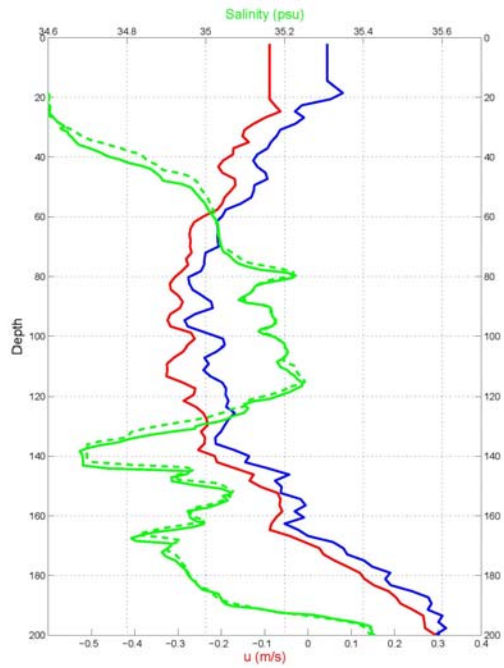
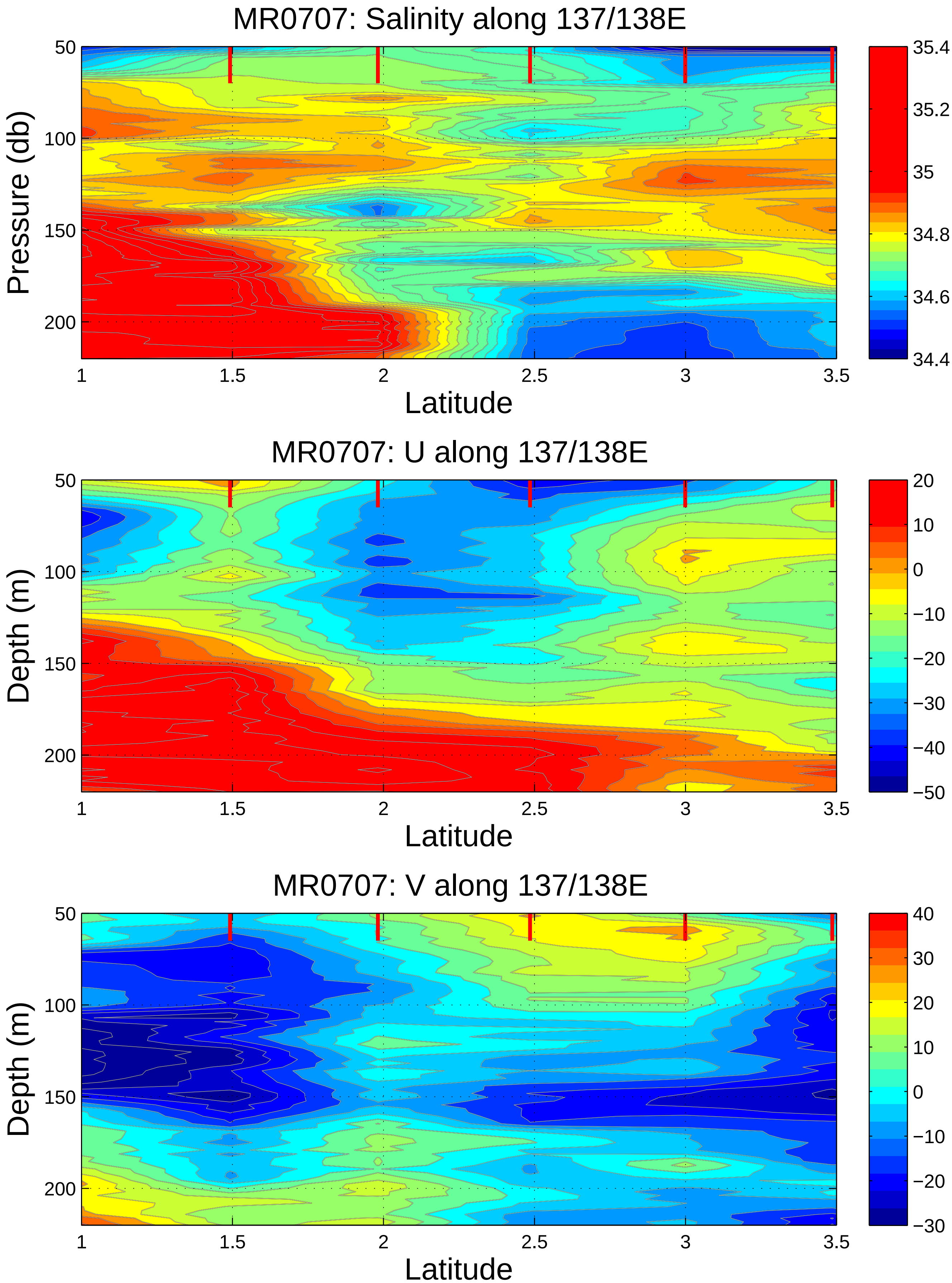


Figure 7.4-3 CTD Station 5: Vertical profiles of the down-cast (red) and up-cast (blue) inverse solutions for U, and the down-cast (solid green) and up-cast (dashed green) salinity


MR0707: Salinity along 137/138E
Pressure (db)
50
100
150
200
1
1.5
2
2.5
3
3.5
Latitude
35.4
35.2
35
34.8
34.6
34.4
MR0707: U along 137/138E
Depth (m)
50
100
150
200
1
1.5
2
2.5
3
3.5
Latitude
20
10
0
−10
−20
−30
−40
−50
MR0707: V along 137/138E
Depth (m)
50
100
150
200
1
1.5
2
2.5
3
3.5
Latitude
40
30
20
10
0
−10
−20
−30

7.5 Radiosonde Observations

(1) Personnel

Biao Geng	(JAMSTEC)	
Hisayuki Kubota	(JAMSTEC)	
Naoki Sato	(JAMSTEC)	Principal Investigator
Souichiro Sueyoshi	(GODI)	
Ryo Kimura	(GODI)	
Harumi Ota	(GODI)	
Fadli Syamsudin	(BPPT)	
Agus Setiawan	(BPPT)	
Norievill B. España	(University of Philippines)	

(2) Objective

Atmospheric soundings of temperature, humidity, and wind speed/direction.

(3) Method

Atmospheric sounding by radionsonde was carried out every 6 hours from January 6 through 20, 2008. In total, 57 soundings were carried out (Table 7.5-1). The main system consists of processor (Vaisala, DigiCORA III MW21), GPS antenna (GA20), UHF antenna (RB21), balloon launcher (ASAP), and GPS radiosonde sensor (RS92-SGP).

Prior to launch, humidity and temperature sensors were calibrated using humidity calibrator (Vaisala Ground Check set GC25) and pressure sensor was calibrated using Vaisala barmometer (PTC220). Calibrator humidity was set at 0%.

(4) Preliminary results

When the radiosonde observation was started, the atmospheric condition was active phase of Madden Julian Oscillation (MJO). Westerly wind bursts around low-level troposphere, high relative humidity profiles and high precipitable water show their features (Fig. 7.5-1, 2). The height of strong westerly wind more than 10 m/s was observed up to 6 km from Jan. 7 12 UTC, which means the latter half of mature phase of MJO. While R/V Mirai sailed northern offshore of New Guinea Island (until Jan. 11), nocturnal maximum of relative humidity were observed around 4 to 6 km. These results are associated with diurnal variation of convection affected by New Guinea Island.

During this cruise two tropical disturbances passed close of the vessel. One was in

Jan. 10 06 UTC and the other was in Jan. 18 07 UTC. Minimum surface pressure of 1005.5 hPa and 1004.2 hPa were observed during these cases respectively. Mirai sailed northward and the centers of tropical disturbances were located toward west of the vessel in both cases. Around Jan. 10 southerly wind was observed below 3 km associated with cyclonic circulation. On the other hand, around Jan. 18, southwesterly wind became stronger and their height became thicker up to 8 km. These two different structures may represent the transition from weak tropical disturbance in the easterly wave to tropical depression. Further analysis will be in future work.

(5) Data archive

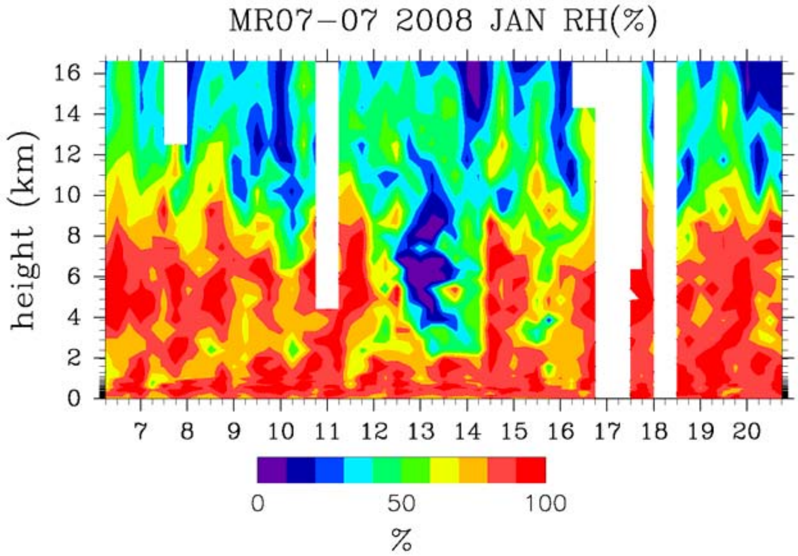
Data were sent to the world meteorological community by Global Telecommunication System through the Japan Meteorological Agency, immediately after each observation. Raw data is recorded as ASCII format every 2 seconds during ascent. These raw datasets will be submitted to JAMSTEC Data Management Office.

Table 7.5-1 Radiosonde launch log during the observation

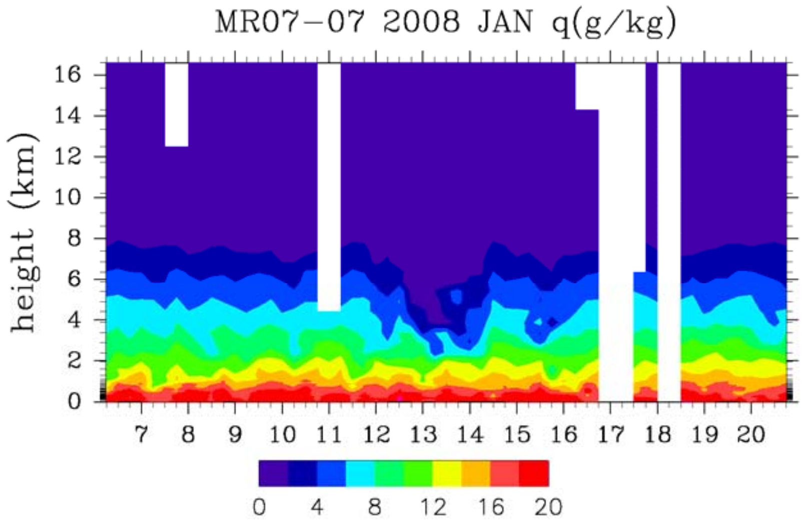
Date	Lon	Lat	Psfc	Tsfc	RH	WD	Wsp	Max height		Cloud	
YYYYMMDDHH	deg	deg	hPa	degC	%	deg	m/s	hPa	m	Amount	Type
2008010606	138.583	−0.193	1004.9	28.4	79	276	9.1	31.3	23351	10	As, Sc
2008010612	137.892	0.029	1008.0	29.0	77	293	6.0	36.8	22363	10	−
2008010618	137.853	0.035	1005.8	28.4	76	256	4.3	46.7	20917	10	−
2008010700	137.931	0.025	1009.2	27.1	84	304	8.8	28.2	24066	10	Sc, Ns, Cu
2008010706	138.004	0.498	1005.5	28.3	70	295	10.6	18.3	26832	10	As, Sc
2008010712	138.013	0.797	1007.6	28.3	71	309	9.0	23.2	25273	10	As, Sc
2008010718	138.010	0.256	1005.8	26.4	87	287	8.3	108.7	16027	10	−
2008010800	138.065	0.073	1007.5	28.2	82	292	5.8	44.0	21271	9	Cc, Cs, As, Ac, Cu
2008010806	138.123	0.629	1004.3	29.1	76	288	7.8	37.2	22277	8	Cu, Sc, As
2008010812	138.016	1.558	1006.5	29.0	71	283	4.3	30.4	23550	10	−
2008010818	138.069	1.833	1004.4	28.3	80	304	5.9	28.5	23921	9	−
2008010900	138.120	2.029	1006.1	27.3	81	278	5.6	23.2	25307	7	St, Cu, Ac, As
2008010906	138.105	1.983	1002.6	28.6	76	307	6.5	33.3	22958	6	St, Cu, Ac, As
2009010912	137.820	2.500	1005.7	28.0	82	5	3.1	47.6	20787	6	−
2008010918	137.722	2.808	1004.2	28.1	79	293	3.7	22.4	25501	2	(Cs or As)
2008011000	137.664	2.998	1006.5	27.1	85	144	4.4	35.4	22598	6	Cu, Ac, As, Cs
2008011006	137.331	3.999	1003.3	28.9	75	187	3.4	22.0	25597	6	Cu, St, As, Sc
2008011012	137.189	4.580	1005.8	28.8	77	165	2.6	27.4	24206	4	−
2008011018	137.238	4.753	1004.7	26.6	81	82	1.6	26.7	24386	10	−
2008011100	137.363	4.917	1007.7	27.1	88	139	3.3	588.2	4569	10	Ns, Cu
2008011106	137.219	5.108	1005.3	27.6	82	64	7.0	25.1	24773	10	St, Sc, Cu, As
2008011112	137.005	5.370	1006.5	27.6	75	64	4.3	24.8	24854	9	−
2008011118	137.189	5.045	1004.6	28.1	79	51	8.2	41.5	21587	10	−
2008011200	137.278	4.845	1006.8	28.0	79	86	1.1	20.6	26081	10	Cu, As, Ac
2008011206	137.157	5.249	1003.9	27.9	80	95	3.7	26.9	24288	9	Cu, As, Cb, Ac
2008011212	137.012	6.260	1006.4	28.2	82	57	5.7	25.4	24678	10	Cu, Ns
2008011218	136.813	7.329	1004.8	28.2	80	66	11.3	26.1	24485	0	
2008011300	136.658	7.627	1007.0	28.4	76	70	8.2	21.2	25877	10	As, Cu
2008011306	136.470	7.858	1003.4	28.7	74	66	7.2	25.4	24648	6	Cu, As
2008011312	135.819	7.770	1005.8	28.5	76	60	7.3	24.8	24846	6	As, Sc, Cu
2008011318	134.724	6.308	1004.7	28.2	76	48	6.9	30.7	23439	0	
2008011400	133.754	5.400	1006.2	28.6	76	41	6.5	22.4	25519	5	Cu, As

2008011406	132.702	4.425	1002.9	28.7	77	51	3.8	28.8	23865	3	Sc, As, Cu
2008011412	131.543	3.401	1006.9	25.5	92	14	7.3	97.5	16680	10	Ns
2008011418	130.705	2.789	1004.7	27.6	81	32	3.4	22.4	25522	10	−
2008011500	130.219	1.948	1007.5	28.2	77	342	3.2	23.2	25306	10	Cu, As, Ac
2008011506	130.129	2.422	1005.1	28.3	79	289	2.1	35.1	22631	9	Sc, Cu, As, Ns
2008011512	130.002	3.659	1007.4	28.3	78	355	1.6	28.5	23958	9	Cu, Ns
2008011518	130.000	4.959	1005.1	27.7	78	27	5.7	25.7	24600	2	Cu
2008011600	130.001	6.196	1007.3	27.8	81	44	9.6	23.3	25286	8	Cu, As, Cs, Cc
2008011606	129.925	7.001	1004.7	28.2	81	36	8.0	34.6	22757	4	Cu, Ci, As
2008011612	128.727	6.997	1007.1	25.8	82	2	2.3	39.0	22033	8	Ns, As, Cu
2008011618	127.537	6.999	1006.3	26.9	80	15	6.3	70.2	18499	10	−
2008011712	127.739	8.003	1007.3	24.6	93	38	7.2	570.5	4801	10	Ns
2008011718	129.077	7.996	1004.3	25.1	92	11	10.7	54.9	19954	10	−
2008011800	130.002	7.939	1005.5	26.5	84	119	6.0	34.1	22867	10	Cu, Ns, As, Ac
2008011806	129.991	7.986	1002.8	27.8	80	123	5.5			6	Cu, Ac, Cs, As
2008011812	129.992	8.127	1004.5	27.0	83	150	7.7	41.0	21702	7	Cu, As
2008011818	129.873	8.041	1003.3	27.8	81	162	5.9	70.1	18498	10	−
2008011900	129.999	7.993	1005.4	26.3	87	184	4.1	31.1	23432	9	Ac, As, Cu, Sc
2008011906	129.984	8.623	1003.7	25.7	94	120	7.7	96.0	16748	10	Ns, Cu, As
2008011912	129.996	9.808	1005.8	26.6	86	131	7.5	36.8	22317	10	Cu, Ac, As
2008011918	130.001	11.205	1004.5	25.8	88	120	6.5	38.0	22181	10	As, Cu
2008012000	130.003	12.643	1007.6	25.9	83	97	10.2	35.6	22628	10	As, Cu, Sc
2008012006	130.020	13.801	1005.5	27.5	86	91	8.0	24.6	24863	9	Sc, Cu, As, Ns
2008012012	129.998	15.084	1008.3	26.5	84	79	6.9	71.7	18401	10	Cu, As
2008012018	130.003	16.485	1007.9	27.3	83	99	8.4	27.4	24197	5	Cu, As, Ac

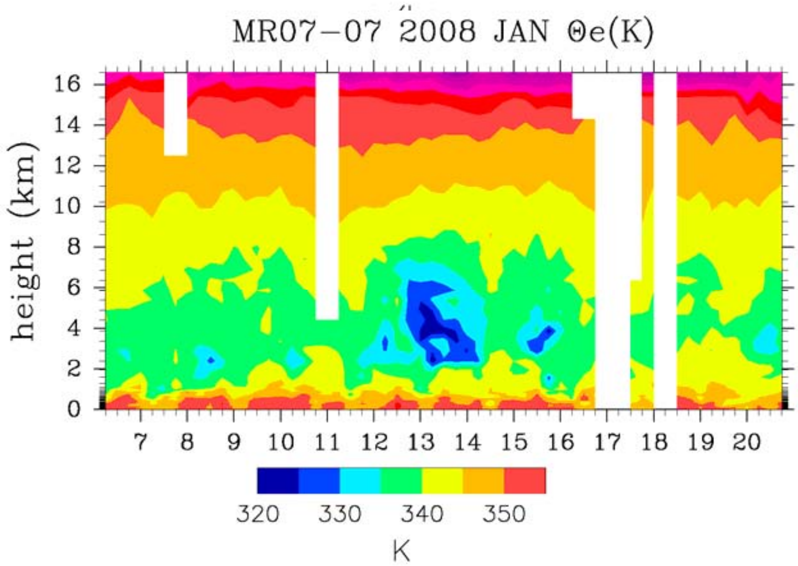
(a)


MR07-07 2008 JAN RH(%)
height (km)
0 2 4 6 8 10 12 14 16
7 8 9 10 11 12 13 14 15 16 17 18 19 20
0 50 100
%

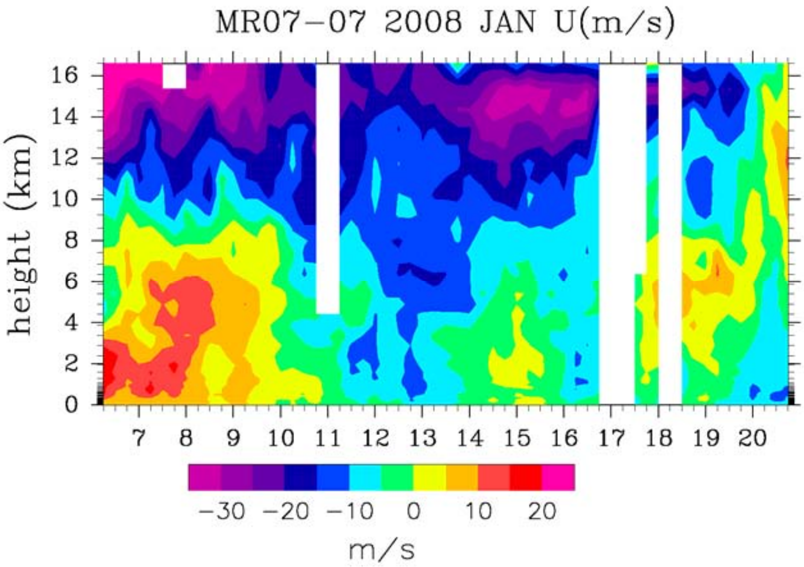
(b)


MR07-07 2008 JAN q(g/kg)
height (km)
0 2 4 6 8 10 12 14 16
7 8 9 10 11 12 13 14 15 16 17 18 19 20
0 4 8 12 16 20

(c)


MR07-07 2008 JAN Θe(K)
height (km)
0 2 4 6 8 10 12 14 16
7 8 9 10 11 12 13 14 15 16 17 18 19 20
320 330 340 350
K

(d)



(e)

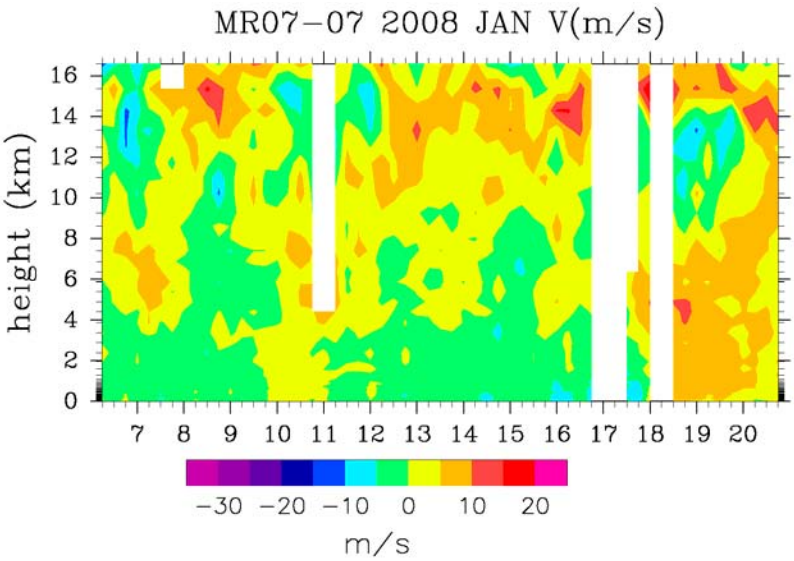


Fig. 7.5-1 Time height cross section of (a) relative humidity, (b) mixing ratio, (c) equivalent potential temperature, (d) zonal wind, (e) meridional wind.

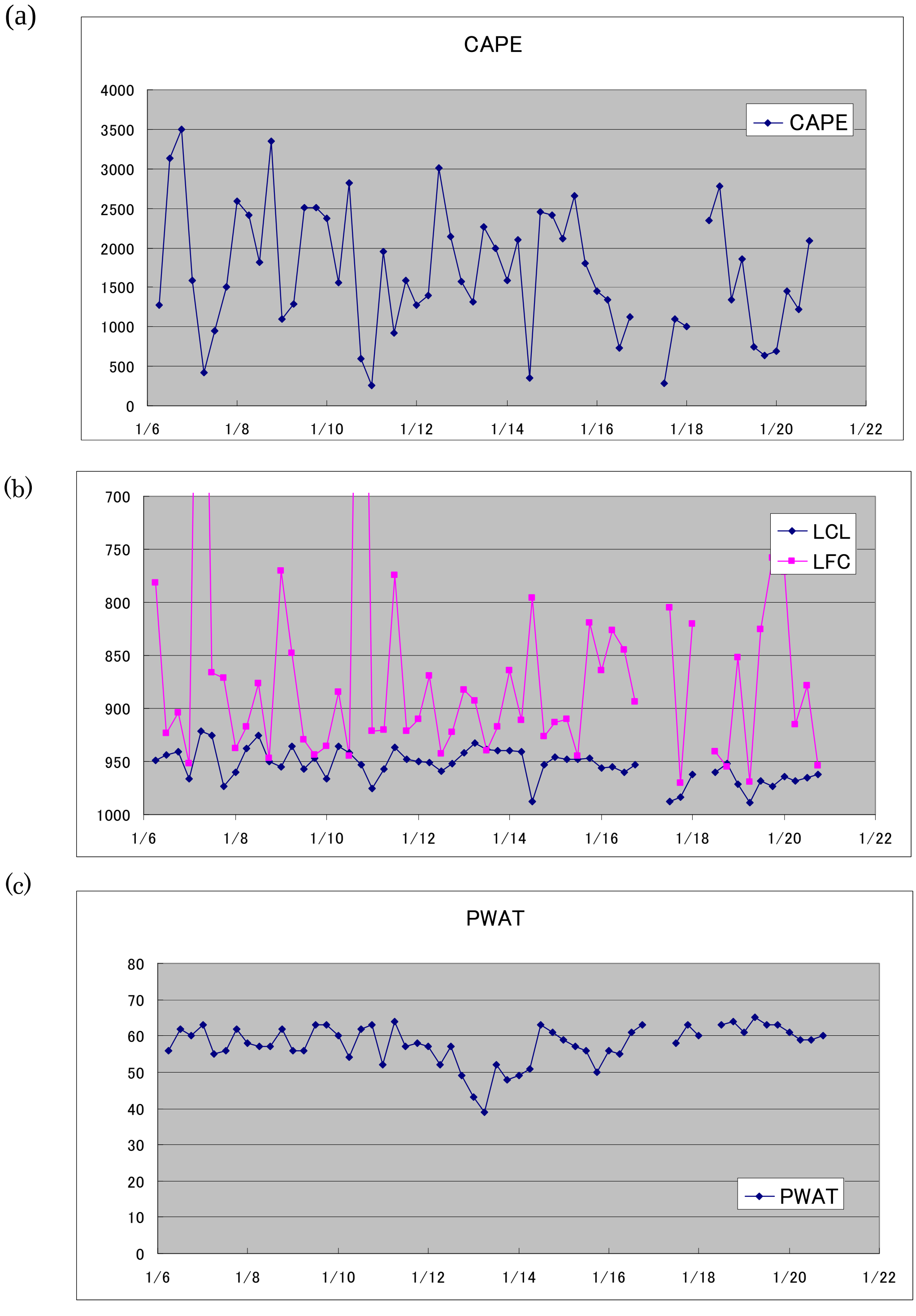


Fig. 7.5-2 Time series of (a) convective available potential energy (J/kg), (b) lifted condensation level (hPa) and level of free convection (hPa), (c) precipitable water (mm).

7.6 Doppler radar observations

(1) Personnel

Naoki Sato	(JAMSTEC); Principal Investigator	
Hisayuki Kubota	(JAMSTEC)	
Biao Geng	(JAMSTEC)	
Souichiro Sueyoshi	(GODI);	Operation Leader
Ryo Kimura	(GODI)	
Harumi Ota	(GODI)	

(2) Objective

The objective of the Doppler radar observation in this cruise is to investigate three dimensional rainfall and kinematic structures of precipitation systems and their temporal and special variations around Mindanao Islands and ITCZ during the winter.

(3) Method

The Doppler radar on board of MIRAI is used. The specification of the radar is:

Frequency:	5290 MHz
Beam Width:	less than 1.5 degrees
Output Power:	250 kW (Peak Power)
Signal Processor:	RVP-7 (Sigment Inc., USA)
Inertial Navigation Unit:	PHINS (Ixsea S.A.S., France)
Application Software:	IRIS/Open (Sigment Inc., USA)

Parameters of the radar are checked and calibrated at the beginning and the end of the intensive observation. Meanwhile, daily checking is performed for (1) frequency, (2) mean output power, (3) pulse width, and (4) PRF (pulse repetition frequency).

During the intensive observation period, the volume scan consisting of 21 PPIs (Plan Position Indicator) is conducted every 10 minutes. A dual PRF mode with the maximum range of 160 km is used for the volume scan. Meanwhile, a surveillance PPI scan is performed every 30 minutes in a single PRF mode with the maximum range of 300 km. At the same time, RHI (Range Height Indicator) scans of the dual PRF mode are also operated whenever detailed vertical structures are necessary in certain azimuth directions. Detailed information for each observational mode is listed in Table 7.6-1.

The Doppler radar observation is from Jan. 02 to Jan. 23, 2008, except for the period when MIRAI was passing through the EEZ of the Papua New Guinea.

(4) Preliminary results

Shown in Fig. 7.6-1 is the variation of radar echo areas obtained from surveillance PPI scans during the cruise. The Doppler radar has observed precipitation systems from the equatorial area to the low-latitude area in the northern hemisphere. Distinct meridional variation of precipitation systems has been detected. Larger echo areas, which indicate the appearance of strong precipitation systems, are observed around latitudes of 0.03N (Jan. 7), 4.93N (Jan. 11), 7.13N (Jan. 17), and 12.35N (Jan. 20), respectively. At the same time, diurnal variation of precipitation systems is also evident, with a peak usually being found in the early morning. Around Mindanao Islands, a tropical disturbance has been observed. As shown in Fig. 7.6-2, the tropical disturbance consists of several stronger precipitation areas with intensive radar reflectivities. Fine structures within intensive precipitation areas have been well captured by the Doppler radar. It seems that the Doppler radar observation has provided useful data for studying the meridionally variational structure and development of precipitation systems.

(5) Data archive

All data of the Doppler radar observation during this cruise will be submitted to the Data Management Office of JAMSTEC.

Table 7.6-1 Parameters for each observational mode

	Surveillance PPI	Volume Scan	RHI
Pulse Width	2 (microsec)	0.5 (microsec)	0.5 (microsec)
Pulse Width	18 (deg/sec)	18 (deg/sec)	Automatically determined
PRF	260 (Hz)	900/720 (Hz)	900/720 (Hz)
Sweep Integration	32 samples	40 samples	32 samples
Ray Spacing	1.0 (deg)	1.0 (deg)	0.2 (deg)
Bin Spacing	250 (m)	250 (m)	150 (m)
Elevation Angle	0.5	0.5, 1.0, 1.8, 2.6, 3.4, 4.2, 5.0, 5.8, 6.7, 7.7, 8.9, 10.3, 12.3, 14.5, 17.1, 20.0, 23.3, 27.0, 31.0, 35.4, 40.0	0.0 to 65.0
Azimuth	Full Circle	Full Circle	Optional
Range	300 (km)	160 (km)	160 (km)

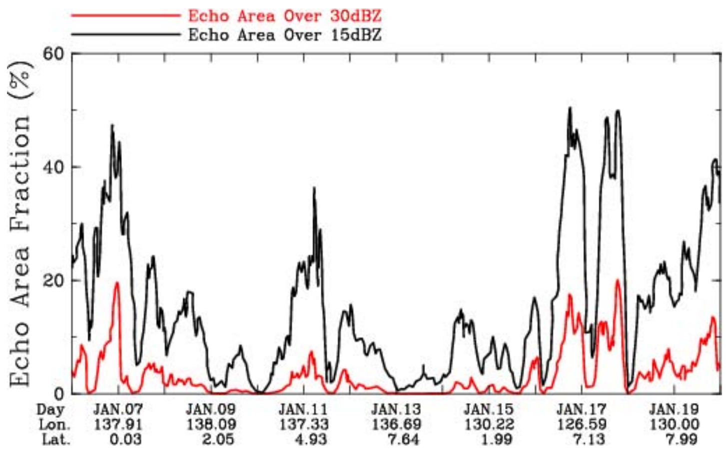


Figure 7.6-1: Variation of radar echo areas obtained from surveillance PPI scans. The indicated value is the ratio of the echo area to the radar coverage area with a radius of 200 km.

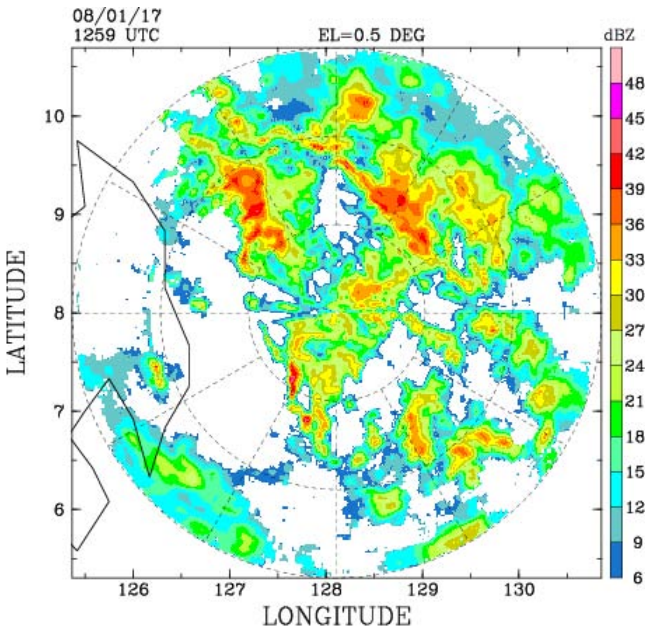


Figure 7.6-2: Horizontal distribution of radar echoes obtained from the surveillance PPI scan at 1259 UTC, Jan. 17, 2008.