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R/V Mirai Cruise Report MR00-K07 Leg-3/4

November 22 - December 20, 2000

Japan Marine Science and Technology Center
(JAMSTEC)

Cruise Report for MR00-K07 Leg-3/4

[Contents]

1. Introduction

As well known, the atmosphere and the ocean influence each other and it is called air-sea interaction. Especially, such an interaction is most active over the tropical western Pacific Ocean due to the existence of the warmest sea surface temperature region. El Nino / Southern Oscillation (ENSO) is one of the well-known phenomena of results of air-sea interaction. As a result of active air-sea interaction, deep atmospheric convections often develop over this area and produce much precipitation. In turn, this precipitation also affects the ocean surface structure by providing fresh water onto the ocean surface and accompanying wind. The main target of this cruise is to observe these convections and environmental conditions.

When clouds develop, water vapor, that are supplied from ocean surface, condense into cloud droplet and release huge heat to the outside. Such a transfer of heat energy from the ocean to the atmosphere is very important because this release of heat by cumulus drives the entire global climate and is often called heat engine of the earth. Each cloud has a scale of order about a couple of kilometers up to several 10 kilometers. However, in this area, they are often organized into larger scale cloud mass, we call them as “cloud cluster” or “mesoscale convective system”. And sometimes, it organized into over 1000 km. In the past studies, it is reported that 90% of the precipitation amount in this area are produced by these organized cloud systems. So, more exactly to say, our target is these organized cloud systems.

Besides, there is an another very important factor to study the convection. Usually, easterly trade winds prevail over the equatorial region and are balanced by zonal gradient of ocean surface pressure. This creates the warmest sea surface temperature region in the tropical western Pacific and then produce much organized cloud systems over this region. However, once this balance is broken, warm water shifts eastward and then cloud area also moves to the east. Namely, this is El Nino event. At present, it is thought that the strong westerly wind burst that seems to relate to cloud clusters can break this balance, but we don’t know why this burst occurs and their real influence onto the phenomena.

For these purposes, the latter part of MR00-K07 cruise as leg-3 was dedicated to conduct a stationary observation at (2N, 138E), where TRITON buoy has been deployed during the former leg of this MR00-K07 cruise. Various observation including C-band Doppler radar, radiosonde, ceilometer, surface meteorological station, CTD, ADCP, and so on were carried out to survey atmospheric and oceanic conditions for achieving more knowledge about air-sea interaction and the mechanism of convections. In addition to this main mission, other continuous observations such as LIDAR observation by National Institute for Environmental Studies and Sky radiometer observation by Hokkaido University were conducted and they provide useful aerosol information.

This cruise report summarizes these observation items and preliminary results are also included. Brief cruise summary can be found in section 2. Some basic information of measurement systems, cruise track, and onboard personnel are stated in sections 3-5, respectively. Details of each observation are described in section 6. Some other useful information is also attached in the Appendix.

2. Cruise Summary

2.1 Ship

Name	R/V MIRAI
L×B×D	128.6 m × 19.0 m × 13.2 m
Gross Tonnage	8,672 tons
Call sign	JNSR
Mother Port	Mutsu, Aomori Pref.

2.2 Cruise Code

MR00-K07 (Leg-3 and 4)

2.3 Project Name

The Study of Air-Sea Interaction in the Tropics

2.4 Undertaking Institute

Japan Marine Science and Technology Center (JAMSTEC)
2-15, Natsushima, Yokosuka 237-0061, JAPAN

2.5 Chief Scientist

Kunio Yoneyama (Ocean Observation and Research Department / JAMSTEC)

2.6 Periods and Ports of call

November 22, 2000	Jakarta, Indonesia
December 13-14, 2000	Koror, Republic of Palau
December 20, 2000	Yokosuka, Kanagawa, Japan

2.7 Observation Summary

C-band Doppler radar	continuously (10minutes interval volume scan)
Radiosonde	115 times (every 3 hours during Nov. 28 - Dec.11)
Ceilometer	continuously (every 1 minutes)
Total Sky Imager	continuously (every 5 minutes)
Surface Meteorology	continuously (every 6 seconds for Mirai Weather Station) (every 10 seconds for SOAR system)
CTD	96 times (down to 500m, except 1000m at 0000Z) (every 3 hours during Nov. 29 - Dec. 11)
ADCP	continuously (every 5 minutes)
Sea Surface Water Monitoring	continuously (every 1 minute)
LIDAR	continuously (every 10 seconds)
Turbulent Measurement	continuously
Sky Radiometer	continuously
Optical Particle Counter	continuously
Gravity and magnetic force	continuously
Sea bottom depth	continuously

* Every continuous observation was conducted from 27(or 28) November to 19 December, 2000 except during port at Koror, Palau.

2.8 Overview

The most outstanding feature during the stationary observation at (2N, 138E) was the fact that the westerly wind burst (WWB) whose speed at surface over 15m/sec was observed over one week. The two-week period that we conducted a stationary observation(or we call it IOP for Intensive Observation Period) can be classified into two regimes ; during the WWB(first week) and after the WWB (second week).

From the cloud images from Geostationary Meteorological Satellite of Japan Meteorological Agency, it is evident that convectively active phase of MJO(Madden-Julian Oscillation or equatorial intraseasonal oscillation), where many deep clouds develop, passed over the observational area before and around the day when we arrived at site. WWB blow into this convective region existed in the east.

In the first week of IOP (during WWB), well-organized clouds were often observed (see Figs.6.3-2 and 6.3-3 of Doppler radar observation) and thermocline became shallow (Fig.6.8.1-1 of CTD results), while diurnal variation became dominant in the second week of IOP (Fig.6.10-2, result of Sea surface monitoring) due to probably few clouds area (Fig.6.3-1).

As we could get various data during/just after WWB, the response of atmosphere and ocean to the WWB will be studied and revealed by our future active research and analysis.

2.9 Acknowledgment

We’d like to express our special thanks to Captain T. Hashimoto and his crew for the skillful ship operation and support to the observation. In spite of the fact that monotonous task was imposed to them, they were patient and understood the purpose of research. Able technical staff of Global Ocean Development Inc. and Marine Works Japan Ltd. provided highly assured data.

3. List of Instruments

3.1 Surface Meteorological Parameters

(a) JAMSTEC / Mirai Met System
Anemometer: KE-500, Koshin Denki
Thermometer: FT, Koshin Denki
Dewpoint Meter DW-1, Koshin Denki
Barometer: F-451, Yokogawa Co.
Rain Gauge: 50202, R.M. Young
Optical Rain Gauge: ORG-115DR, SCTI
Shortwave Radiometer: MS-801, Eiko Seiki
Longwave Radiometer: MS-200, Eiko Seiki
Wave Height Meter: MW-2, Tsurumi-seiki

(b) JAMSTEC / SOAR system
Anemometer: 05106, R. M. Young
Thermometer / Hygrometer: HMP45A, Vaisala
(with 43408 Gill aspirated radiation shield, R.M.Young)
Barometer: 61201, R. M. Young
Rain Gauge: 50202, R. M. Young
Optical Rain Gauge: ORG-115DA, ScTi
Sea Surface Skin Tempreature Sensor: SST-100, Brookhaven National Lab.
Shortwave Radiometer: PSP, Eppley Labs.
Longwave Radiometer: PIR, Eppley Labs.
Fast Rotating Shadowband Radiometer: Yankee Engineering Systems
Shortwave Radiometer (upwelling radiation): MS-801, Eiko Seiki
Longwave Radiometer (upwelling radiation): MS-202, Eiko Seiki

(c) JAMSTEC / Total Sky Imager System
Total Sky Imager: Yankee Engineering System

3.2 Radiosonde Observation

(a) JAMSTEC
GPS radiosonde: RS-80-G, Vaisala
Receiver: DigiCORA MW11, Vaisala

3.3 Doppler Radar Observation

(a) JAMSTEC
C-band Doppler Radar: RC-52B, Mitsubishi Electric Co.
Signal Processor: RVP-6, Sigmet
Antenna Controller: RCP-02, Sigmet
Control and Processing Software: IRIS/Open, Sigmet
Inertial Navigation Unit: DRUH, Honeywell

3.4 Lidar Observation

(a) NIES and Tohoku Institute of Technology
Compact Mie Scattering Lidar

3.5 Ceilometer Observation

(b) JAMSTEC

Ceilometer: CT-25K, Vaisala

3.6 Aerosol and Radiation Measurement

(a) ILTS, Hokkaido Univ.

Sky Radiometer: POM-01MKII, PREDE
Particle Soot / Absorption Photometer: Radiance Research
Integrating Nephelometer: M903, Radiance Research
Optical Particle Counter: KC-01C, RION

3.7 Surface Turbulent Flux Measurement system

(a) FORSGC

Supersonic Thermoanemometer: DA-600, Kaijo Co.
Infrared Hygrometer: AH-300, Kaijo Co.
Inclinometer: MD-900-T, Appied Geomechanics
Accelerometer: OA700-020, Applied Signal Inc.
Rate Gyros: QRS11-0050-100, Sytron Donner
Data Logging System: Labview, National Intsruments Co.
Infrared Radiation Thermometer: THI-700, TASCO
Data Logging System: CR-23X, Campbell Scientific Co.

3.8 CTD

(a) JAMSTEC

CTD 9plus, Sea-Bird
Temperature Sensor. SBE3-04F, Sea-Bird Electronics, Inc.
Conductivity Sensor. SBE4-04/0, Sea-Bird Electronics, Inc.
Oxygen Sensor. SBE13-04-B, Sea-Bird Electronics, Inc.
Deck Unit:SBE 11plus, Sea-Bird Electronics, Inc.
Altimeter sensor: PSA-9000, Datasonics Inc.
Carousel water sampler: SBE32, Sea-Bird Electronics, Inc.
Guildline Autosal salinometer:model 8400B
Software: SEASOFT ver. 4.232, Sea-Bird Electronics, Inc.

3.9 Current Profiling

(a) JAMSTEC

Broad-Band ADCP: VM-75, RD Instrument.

3.10 Sea Surface Water Monitoring

(a) JAMSTEC

Thermosalinograph: SBE-21, Sea-Bird Electronics, Inc.
Dissolved Oxygen Sensor: 2127,Oubisufair Laboratories
Fluorometer: 10-AU-005, Turner Designs
Particle Size Sensor: P-05, Nippon Kaiyo Ltd.
Guildline Autosal Salinometer: model 8400B
Titrator: Metrohm Model 716 DMS Titrino / 10 ml of titration vessel
Pt Electrode/ 6.0403.100, Metrohm
Software: Data acquisition and endpoint evaluation / METRODATA / 606113 .000, Metrohm

3.11 Underway geophysics

(a) JAMSTEC

Onboard Gravity Meter: S-116, LaCoste-Romberg
Three-Axes Fluxgate Magnetometer: Tierra Tecnica
Multi-Narrow beam echo sounding system: SeaBeam 2100, SeaBeam Inc.

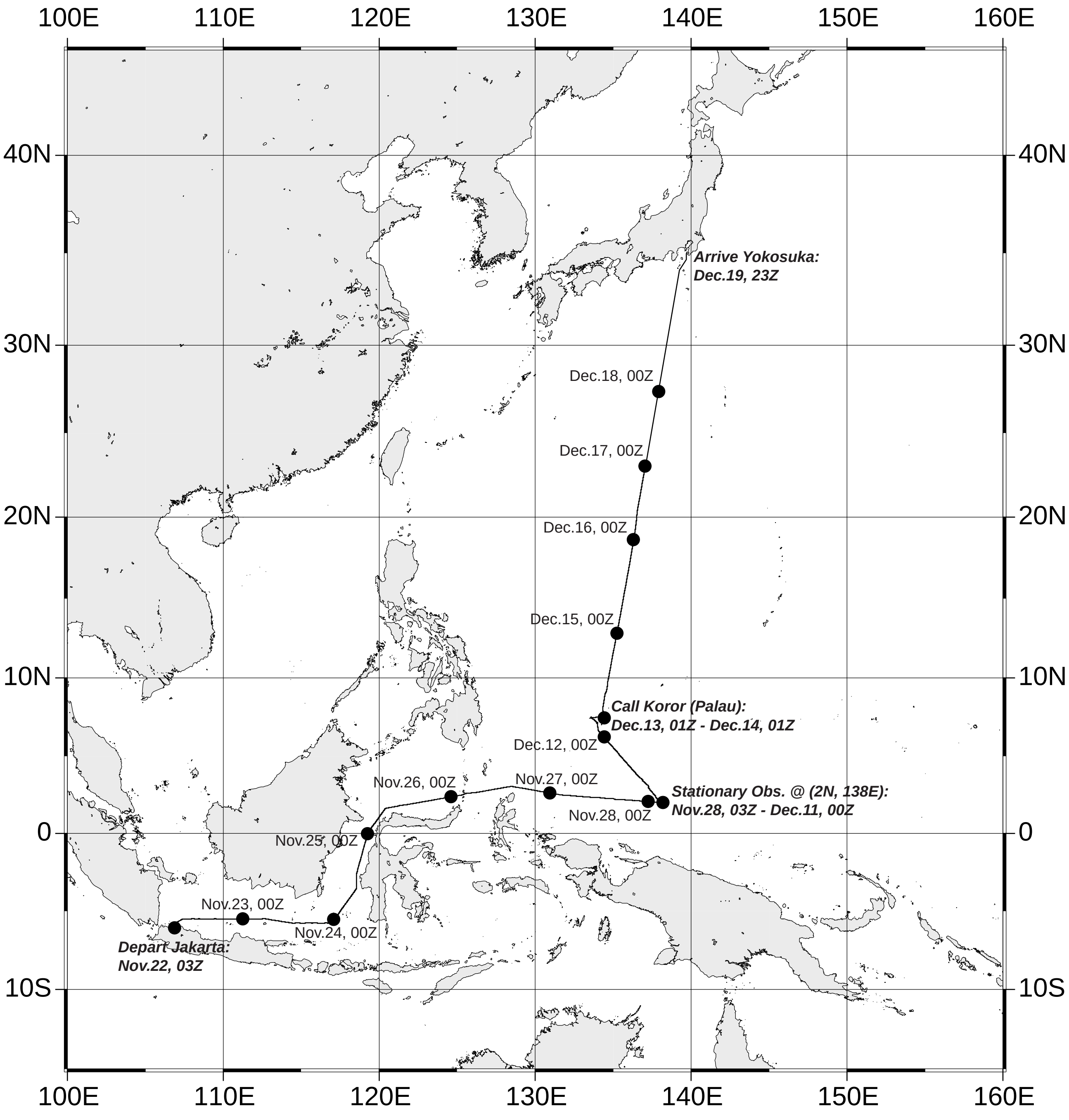
3.13 Miscellaneous

(a) JAMSTEC

Navigation System: SAINS19, Sena Co.
GMS Receiving System: Nippon Hakuyo
HRPT Receiving System: Terascan
Observation Data Acquisition System: SCS (Scientific Computer System), NOAA

4. Cruise track and log

4.1 Cruise track



4.2 Cruise Log

Date	LST	UTC	Event	Lat.(deg.)	Lon. (deg.)
22-Nov			Cloudy / Rainy		
	12:00	05:00	Depart Jakarta		
23-Nov			Cloudy		
24-Nov			Cloudy		
25-Nov			Cloudy		
26-Nov			Fine		
27-Nov			Fine		
	09:00	00:00	Start data logging of continuous observation instruments		
	14:40	05:40	Test launch of radiosonde (tethered)		
	20:30	11:30	RS(radiosonde observation) - 001	2.33 N	133.99 E
	23:31	14:31	RS-002	2.26 N	134.78 E
28-Nov			Fine		
	02:29	17:29	RS-003	2.19 N	135.58 E
	05:29	20:29	RS-004	2.14 N	136.36 E
	08:40	23:40	RS-005	2.07 N	137.17 E
	11:29	02:29	RS-006	2.02 N	137.88 E
	12:30	03:30	Arrive observation point (2N, 138E)		
	13:08	04:08	Deployment of albedo boom		
			(start of "SeaSnake" SSST monitoring and shortwave/longwav		
	13:40	04:40	start circular movement around (2N, 138E)		
	14:30	05:30	RS-007	1.92 N	138.19 E
	17:29	08:29	RS-008	2.07 N	138.04 E
	20:29	11:29	RS-009	1.92 N	138.13 E
	20:32	11:32	CTD (CTD casting) - 001 (500m)	1.92 N	138.13 E
	20:36	11:36	Surface sea water sampling (bucket)		
	23:30	14:30	RS-010	2.08 N	138.03 E
	23:34	14:34	CTD-002 (500m)	2.08 N	138.03 E
	23:38	14:38	Surface sea water sampling (bucket)		
29-Nov			Cloudy / Rainy		
	02:30	17:30	RS-011	1.92 N	138.18 E
	02:33	17:33	CTD-003 (500m)	1.92 N	138.19 E
	02:37	17:37	Surface sea water sampling (bucket)		
	05:30	20:30	RS-012	2.00 N	138.03 E
	05:34	20:34	CTD-004 (500m)	2.00 N	138.03 E
	05:37	20:37	Surface sea water sampling (bucket)		
	08:29	23:29	RS-013	1.99 N	138.19 E
	08:34	23:34	CTD-005 (1000m with water sampling)	1.99 N	138.19 E
	08:38	23:38	Surface sea water sampling (bucket)		
	11:29	02:29	RS-014	1.92 N	138.02 E
	11:32	02:32	CTD-006 (500m)	1.92 N	138.02 E
	11:35	02:35	Surface sea water sampling (bucket)		
	14:29	05:29	RS-015	2.08 N	138.15 E
	14:32	05:32	CTD-007 (500m)	2.08 N	138.15 E
	14:37	05:37	Surface sea water sampling (bucket)		
	17:29	08:29	CTD-008 (500m)	1.92 N	138.08 E
	17:35	08:35	Surface sea water sampling (bucket)		
	17:55	08:55	RS-016	1.92 N	138.08 E
	20:30	11:30	RS-017	2.08 N	138.10 E

	20:32	11:32	CTD-009 (500m)	2.08	N	138.10	E
	20:35	11:35	Surface sea water sampling (bucket)				
	23:29	14:29	RS-018	1.91	N	138.09	E
	23:33	14:33	CTD-010 (500m)	1.91	N	138.09	E
	23:37	14:37	Surface sea water sampling (bucket)				
30-Nov			Cloudy / Rainy				
	02:29	17:29	RS-019	2.09	N	138.07	E
	02:33	17:33	CTD-011 (500m)	2.09	N	138.07	E
	02:36	17:36	Surface sea water sampling (bucket)				
	05:29	20:29	RS-020	1.98	N	138.14	E
	05:33	20:33	CTD-012 (500m)	1.92	N	138.14	E
	05:37	20:37	Surface sea water sampling (bucket)				
	08:29	23:29	RS-021	2.07	N	138.03	E
	08:34	23:34	CTD-013 (1000m with water sampling)	2.06	N	138.03	E
	08:37	23:37	Surface sea water sampling (bucket)				
	11:32	02:32	CTD-014 (500m)	2.00	N	138.20	E
	11:38	02:38	Surface sea water sampling (bucket)				
	12:00	03:00	RS-022	2.00	N	138.20	E
	14:29	05:29	RS-023	1.94	N	138.03	E
	14:32	05:32	CTD-015 (500m)	1.94	N	138.03	E
	14:35	05:35	Surface sea water sampling (bucket)				
	17:29	08:29	RS-024	2.08	N	138.19	E
	17:33	08:33	CTD-016 (500m)	2.08	N	138.19	E
	17:36	08:36	Surface sea water sampling (bucket)				
	20:29	11:29	RS-025	1.91	N	138.03	E
	20:33	11:33	CTD-017 (500m)	1.91	N	138.03	E
	20:36	11:36	Surface sea water sampling (bucket)				
	23:38	14:38	CTD-018 (500m)	2.08	N	138.12	E
	23:44	14:44	Surface sea water sampling (bucket)				
1-Dec			Fine / Cloudy				
	00:09	15:09	RS-026	2.06	N	138.13	E
	02:29	17:29	RS-027	1.91	N	138.10	E
	02:33	17:33	CTD-019 (500m)	1.91	N	138.10	E
	02:37	17:37	Surface sea water sampling (bucket)				
	05:36	20:36	RS-028	2.09	N	138.03	E
	05:39	20:39	CTD-020 (500m)	2.08	N	138.02	E
	05:45	20:45	Surface sea water sampling (bucket)				
	08:29	23:29	RS-029	1.95	N	138.19	E
	08:32	23:32	CTD-021 (1000m with water sampling)	1.95	N	138.19	E
	08:37	23:37	Surface sea water sampling (bucket)				
	11:29	02:29	RS-030	1.98	N	138.02	E
	11:33	02:33	CTD-022 (500m)	1.98	N	138.02	E
	11:36	02:36	Surface sea water sampling (bucket)				
	14:29	05:29	RS-031	1.96	N	138.19	E
	14:32	05:32	CTD-023 (500m)	1.95	N	138.19	E
	14:36	05:36	Surface sea water sampling (bucket)				
	17:29	08:29	RS-032	2.01	N	138.02	E
	17:33	08:33	CTD-024 (500m)	2.00	N	138.02	E
	17:37	08:37	Surface sea water sampling (bucket)				
	20:30	11:30	RS-033	2.02	N	138.19	E
	20:33	11:33	CTD-025 (500m)	2.02	N	138.19	E
	20:36	11:36	Surface sea water sampling (bucket)				
	23:30	14:30	RS-034	1.95	N	138.02	E
	23:33	14:33	CTD-026 (500m)	1.94	N	138.02	E
	23:38	14:38	Surface sea water sampling (bucket)				
2-Dec			Fine / Cloudy				

	02:29	17:29	RS-035	2.08	N	138.19	E
	02:32	17:32	CTD-027 (500m)	2.08	N	138.18	E
	02:36	17:36	Surface sea water sampling (bucket)				
	05:29	20:29	RS-036	1.92	N	138.02	E
	05:32	20:32	CTD-028 (500m)	1.92	N	138.02	E
	05:37	20:37	Surface sea water sampling (bucket)				
	08:29	23:29	RS-037	2.08	N	138.13	E
	08:33	23:33	CTD-029 (1000m with water sampling)	2.08	N	138.13	E
	08:37	23:37	Surface sea water sampling (bucket)				
	11:32	02:32	CTD-030 (500m)	2.00	N	138.02	E
	11:35	02:35	Surface sea water sampling (bucket)				
	11:59	02:59	RS-038	2.01	N	138.02	E
	14:29	05:29	RS-039	2.03	N	138.20	E
	14:32	05:32	CTD-031 (500m)	2.03	N	138.20	E
	14:36	05:36	Surface sea water sampling (bucket)				
	17:29	08:29	RS-040	1.94	N	138.02	E
	17:32	08:32	CTD-032 (500m)	1.93	N	138.02	E
	17:36	08:36	Surface sea water sampling (bucket)				
	20:29	11:29	RS-041	2.09	N	138.17	E
	20:32	11:32	CTD-033 (500m)	2.08	N	138.17	E
	20:37	11:37	Surface sea water sampling (bucket)				
	23:29	14:29	RS-042	1.93	N	138.02	E
	23:32	14:32	CTD-034 (500m)	1.93	N	138.02	E
	23:36	14:36	Surface sea water sampling (bucket)				
3-Dec			Cloudy				
	02:31	17:31	CTD-035 (500m)	2.08	N	138.16	E
	02:35	17:35	Surface sea water sampling (bucket)				
	02:54	17:54	RS-043	2.08	N	138.16	E
	05:29	20:29	RS-044	1.91	N	138.01	E
	05:32	20:32	CTD-036 (500m)	1.91	N	138.01	E
	05:35	20:35	Surface sea water sampling (bucket)				
	08:29	23:29	RS-045	2.08	N	138.13	E
	08:32	23:32	CTD-037 (1000m with water sampling)	2.08	N	138.13	E
	08:36	23:36	Surface sea water sampling (bucket)				
	11:19	02:19	RS-046	2.00	N	138.02	E
	11:22	02:22	CTD-038 (500m)	2.00	N	138.02	E
	11:26	02:26	Surface sea water sampling (bucket)				
	14:30	05:30	RS-047	2.00	N	138.18	E
	14:32	05:32	CTD-039 (500m)	2.00	N	138.18	E
	14:36	05:36	Surface sea water sampling (bucket)				
	17:29	08:29	RS-048	1.99	N	138.02	E
	17:32	08:32	CTD-040 (500m)	1.99	N	138.02	E
	17:36	08:36	Surface sea water sampling (bucket)				
	20:29	11:29	RS-049	2.01	N	138.18	E
	20:31	11:31	CTD-041 (500m)	2.01	N	138.18	E
	20:36	11:36	Surface sea water sampling (bucket)				
	23:30	14:30	RS-050	1.99	N	138.02	E
	23:32	14:32	Surface sea water sampling (bucket)				
4-Dec			Cloudy / Rainy				
	02:22	17:22	Surface sea water sampling (bucket)				
	02:29	17:29	RS-051	1.97	N	138.19	E
	05:20	20:20	Surface sea water sampling (bucket)				
	05:39	20:39	RS-052	2.04	N	138.02	E
	08:19	23:19	RS-053	1.92	N	138.20	E
	08:24	23:24	CTD-042 (1000m with water sampling)	1.92	N	138.20	E
	08:28	23:28	Surface sea water sampling (bucket)				
	11:11	02:11	Surface sea water sampling (bucket)				

	11:19	02:19	RS-054	1.97	N	138.03	E
	14:29	05:29	RS-055	1.91	N	138.20	E
	14:36	05:36	CTD-043 (500m)	1.91	N	138.21	E
	14:39	05:39	Surface sea water sampling (bucket)				
	17:21	08:21	Surface sea water sampling (bucket)				
	17:29	08:29	RS-056	1.98	N	138.03	E
	20:29	11:29	RS-057	1.96	N	138.19	E
	20:32	11:32	CTD-044 (500m)	1.96	N	138.19	E
	20:36	11:36	Surface sea water sampling (bucket)				
	23:29	14:29	RS-058	2.00	N	138.02	E
	23:34	14:34	CTD-045 (500m)	2.00	N	138.03	E
	23:38	14:38	Surface sea water sampling (bucket)				
5-Dec			Cloudy				
	02:32	17:32	CTD-046 (500m)	2.00	N	138.19	E
	02:35	17:35	Surface sea water sampling (bucket)				
	02:59	17:59	RS-059	2.00	N	138.19	E
	05:29	20:29	RS-060	1.93	N	138.02	E
	05:32	20:32	CTD-047 (500m)	1.93	N	138.03	E
	05:36	20:36	Surface sea water sampling (bucket)				
	08:19	23:19	RS-061	2.09	N	138.18	E
	08:22	23:22	CTD-048 (1000m with water sampling)	2.09	N	138.18	E
	08:26	23:26	Surface sea water sampling (bucket)				
	11:21	02:21	CTD-049 (500m)	1.91	N	138.07	E
	11:25	02:25	Surface sea water sampling (bucket)				
	12:10	03:10	RS-062	1.94	N	138.04	E
	14:29	05:29	RS-063	2.09	N	138.15	E
	14:31	05:31	CTD-050 (500m)	2.09	N	138.16	E
	14:35	05:35	Surface sea water sampling (bucket)				
	17:29	08:29	RS-064	1.92	N	138.03	E
	17:32	08:32	CTD-051 (500m)	1.91	N	138.04	E
	17:35	08:35	Surface sea water sampling (bucket)				
	20:29	11:29	RS-065	2.08	N	138.19	E
	20:32	11:32	CTD-052 (500m)	2.07	N	138.19	E
	20:36	11:36	Surface sea water sampling (bucket)				
	23:32	14:32	CTD-053 (500m)	1.92	N	138.02	E
	23:35	14:35	Surface sea water sampling (bucket)				
	23:50	14:50	RS-066	1.92	N	138.02	E
6-Dec			Cloudy / Fine				
	02:29	17:29	RS-067	2.09	N	138.11	E
	02:32	17:32	CTD-054 (500m)	2.08	N	138.11	E
	02:35	17:35	Surface sea water sampling (bucket)				
	05:29	20:29	RS-068	1.92	N	138.08	E
	05:33	20:33	CTD-055 (500m)	1.92	N	138.10	E
	05:36	20:36	Surface sea water sampling (bucket)				
	08:19	23:19	RS-069	1.98	N	138.13	E
	08:22	23:22	CTD-056 (1000m with water sampling)	1.98	N	138.13	E
	08:26	23:26	Surface sea water sampling (bucket)				
	08:36	23:36	Checking out TRITON buoy	1.99	N	138.12	E
	11:20	02:20	CTD-057 (500m)	2.06	N	138.02	E
	11:23	02:23	Surface sea water sampling (bucket)				
	11:49	02:49	RS-070	2.06	N	138.02	E
	14:29	05:29	RS-071	1.96	N	138.19	E
	14:31	05:31	CTD-058 (500m)	1.96	N	138.19	E
	14:36	05:36	Surface sea water sampling (bucket)				
	17:29	08:29	RS-072	2.01	N	138.02	E
	17:31	08:31	CTD-059 (500m)	2.00	N	138.02	E
	17:35	08:35	Surface sea water sampling (bucket)				

	20:29	11:29	RS-073	2.00	N	138.19	E
	20:30	11:30	CTD-060 (500m)	1.99	N	138.19	E
	20:33	11:33	Surface sea water sampling (bucket)				
	23:29	14:29	RS-074	2.01	N	138.02	E
	23:32	14:32	CTD-061 (500m)	2.00	N	138.02	E
	23:37	14:37	Surface sea water sampling (bucket)				
7-Dec			Fine				
	02:29	17:29	RS-075	1.99	N	138.18	E
	02:33	17:33	CTD-062 (500m)	1.99	N	138.18	E
	02:36	17:36	Surface sea water sampling (bucket)				
	05:30	20:30	RS-076	1.99	N	138.03	E
	05:33	20:33	CTD-063 (500m)	1.99	N	138.03	E
	05:37	20:37	Surface sea water sampling (bucket)				
	08:19	23:19	RS-077	2.01	N	138.19	E
	08:22	23:22	CTD-064 (1000m with water sampling)	2.01	N	138.19	E
	08:26	23:26	Surface sea water sampling (bucket)				
	11:19	02:19	RS-078	2.04	N	138.03	E
	11:22	02:22	CTD-065 (500m)	2.03	N	138.04	E
	11:26	02:26	Surface sea water sampling (bucket)				
	14:29	05:29	RS-079	1.93	N	138.09	E
	14:33	05:33	CTD-066 (500m)	1.93	N	138.09	E
	14:36	05:36	Surface sea water sampling (bucket)				
	17:29	08:29	RS-080	2.04	N	138.02	E
	17:33	08:33	CTD-067 (500m)	2.08	N	138.15	E
	17:36	08:36	Surface sea water sampling (bucket)				
	20:29	11:29	RS-081	1.94	N	138.03	E
	20:33	11:33	CTD-068 (500m)	1.94	N	138.03	E
	20:37	11:37	Surface sea water sampling (bucket)				
	23:29	14:29	RS-082	2.04	N	138.19	E
	23:33	14:33	CTD-069 (500m)	2.04	N	138.19	E
	23:36	14:36	Surface sea water sampling (bucket)				
8-Dec			Fine				
	02:29	17:29	RS-083	1.97	N	138.02	E
	02:32	17:32	CTD-070 (500m)	1.97	N	138.02	E
	02:35	17:35	Surface sea water sampling (bucket)				
	05:29	20:29	RS-084	2.05	N	138.19	E
	05:32	20:32	CTD-071 (500m)	2.05	N	138.19	E
	05:36	20:36	Surface sea water sampling (bucket)				
	08:19	23:19	RS-085	1.95	N	138.02	E
	08:19	23:19	CTD-072 (1000m with water sampling)	1.95	N	138.02	E
	08:23	23:23	Surface sea water sampling (bucket)				
	11:19	02:19	RS-086	2.08	N	138.18	E
	11:19	02:19	CTD-073 (500m)	2.08	N	138.18	E
	11:23	02:23	Surface sea water sampling (bucket)				
	14:31	05:31	CTD-074 (500m)	1.99	N	138.02	E
	14:36	05:36	Surface sea water sampling (bucket)				
	14:47	05:47	RS-087	1.99	N	138.02	E
	17:33	08:33	CTD-075 (500m)	2.04	N	138.19	E
	17:37	08:37	Surface sea water sampling (bucket)				
	17:49	08:49	RS-088	2.04	N	138.19	E
	20:29	11:29	RS-089	1.95	N	138.03	E
	20:33	11:33	CTD-076 (500m)	1.95	N	138.03	E
	20:36	11:36	Surface sea water sampling (bucket)				
	23:29	14:29	RS-090	2.06	N	138.19	E
	23:32	14:32	CTD-077 (500m)	2.06	N	138.19	E
	23:36	14:36	Surface sea water sampling (bucket)				

9-Dec			Fine				
	02:29	17:29	RS-091	1.95	N	138.02	E
	02:32	17:32	CTD-078 (500m)	1.95	N	138.02	E
	02:36	17:36	Surface sea water sampling (bucket)				
	05:29	20:29	RS-092	2.08	N	138.18	E
	05:30	20:30	CTD-079 (500m)	2.08	N	138.18	E
	05:33	20:33	Surface sea water sampling (bucket)				
	08:19	23:19	RS-093	1.92	N	138.02	E
	08:19	23:19	CTD-080 (1000m with water sampling)	1.92	N	138.02	E
	08:23	23:23	Surface sea water sampling (bucket)				
	11:19	02:19	RS-094	2.08	N	138.15	E
	11:23	02:23	CTD-081 (500m)	2.08	N	138.15	E
	11:27	02:27	Surface sea water sampling (bucket)				
	14:29	05:29	RS-095	1.92	N	138.04	E
	14:30	05:30	CTD-082 (500m)	1.92	N	138.04	E
	14:33	05:33	Surface sea water sampling (bucket)				
	17:29	08:29	RS-096	2.09	N	138.19	E
	17:32	08:32	CTD-083 (500m)	2.09	N	138.19	E
	17:35	08:35	Surface sea water sampling (bucket)				
	20:29	11:29	RS-097	1.92	N	138.03	E
	20:30	11:30	CTD-084 (500m)	2.91	N	138.03	E
	20:34	11:34	Surface sea water sampling (bucket)				
	23:29	14:29	RS-098	2.09	N	138.20	E
	23:30	14:30	CTD-085 (500m)	2.09	N	138.20	E
	23:34	14:34	Surface sea water sampling (bucket)				
10-Dec			Fine				
	02:29	17:29	RS-099	1.92	N	138.02	E
	02:31	17:31	CTD-086 (500m)	1.92	N	138.02	E
	02:35	17:35	Surface sea water sampling (bucket)				
	05:29	20:29	RS-100	2.09	N	138.17	E
	05:29	20:29	CTD-087 (500m)	2.09	N	138.17	E
	05:34	20:34	Surface sea water sampling (bucket)				
	08:19	23:19	RS-101	1.92	N	138.02	E
	08:19	23:19	CTD-088 (1000m with water sampling)	1.92	N	138.02	E
	08:23	23:23	Surface sea water sampling (bucket)				
	11:19	02:19	RS-102	2.09	N	138.02	E
	11:19	02:19	CTD-089 (500m)	2.09	N	138.15	E
	11:23	02:23	Surface sea water sampling (bucket)				
	14:29	05:29	RS-103	1.97	N	138.02	E
	14:29	05:29	CTD-090 (500m)	1.88	N	138.02	E
	14:33	05:33	Surface sea water sampling (bucket)				
	17:29	08:29	RS-104	2.04	N	138.20	E
	17:31	08:31	CTD-091 (500m)	2.04	N	138.20	E
	17:35	08:35	Surface sea water sampling (bucket)				
	20:29	11:29	RS-105	1.96	N	138.02	E
	20:31	11:31	CTD-092 (500m)	1.96	N	138.02	E
	20:36	11:36	Surface sea water sampling (bucket)				
	23:29	14:29	RS-106	2.04	N	138.19	E
	23:32	14:32	CTD-093 (500m)	2.04	N	138.19	E
	23:35	14:35	Surface sea water sampling (bucket)				
11-Dec			Fine				
	02:29	17:29	RS-107	1.98	N	138.03	E
	02:31	17:31	CTD-094 (500m)	1.98	N	138.02	E
	02:35	17:35	Surface sea water sampling (bucket)				
	05:29	20:29	RS-108	2.02	N	138.19	E
	05:32	20:32	CTD-095 (500m)	2.02	N	138.19	E
	05:36	20:36	Surface sea water sampling (bucket)				

	08:19	23:19	RS-109	1.97	N	138.02	E
	08:21	23:21	CTD-096 (1000m with water sampling)	1.97	N	138.02	E
	08:24	23:24	Surface sea water sampling (bucket)				
	11:19	02:19	RS-110	2.39	N	137.72	E
	14:29	05:29	RS-111	2.97	N	137.27	E
	17:29	08:29	RS-112	3.42	N	136.92	E
	20:29	11:29	RS-113	3.89	N	136.47	E
12-Dec			Fine / Cloudy				
	08:20	23:20	RS-114	6.09	N	134.52	E
	18:00	09:00	Pause surface sea water monitoring				
	20:29	11:29	RS-115	7.49	N	133.61	E
13-Dec			Cloudy / Rainy				
	06:00	21:00	Stop Doppler radar observation				
	10:00	01:00	Arrive Koror				
14-Dec			Cloudy / Rainy				
	09:45	00:45	Depart Koror				
	13:00	04:00	Resume surface sea water monitoring				
15-Dec			Cloudy				
16-Dec			Cloudy				
17-Dec			Cloudy				
18-Dec			Cloudy				
19-Dec			Cloudy				
	09:00	00:00	Finish all observations				
20-Dec			Fine				
	08:00	23:00	Arive Yokosuka				

5. Participants List

5.1 On Board Scientists / Engineer / Technical Staff / Observer

Name	Affiliation	On board	e-mail
Yoneyama, Kunio	JAMSTEC	Jakarta -Yokosuka	
Katsumata, Masaki	JAMSTEC	Singapore - Yokosuka	
Moriwaki, Kaichi	JAMSTEC	Jakarta - Yokosuka	
Shibayama, Ken-ichi	JAMSTEC	Jakarta - Yokosuka	
Kubota, Hisayuki	FORSGC	Jakarta - Koror	
Matsui, Ichiro	NIES	Jakarta - Yokosuka	
Hanyu, Masaki	GODI	Jakarta - Yokosuka	
Kouzuma, Kiyotake	GODI	Jakarta - Koror	
Sueyoshi, Soichiro	GODI	Jakarta - Yokosuka	
Uno, Hirokatsu	MWJ	Jakarta - Koror	
Inoue, Asako	MWJ	Jakarta - Koror	
Kitada, Mikio	MWJ	Jakarta - Koror	
Seike, Takayoshi	MWJ	Jakarta - Yokosuka	
Akizawa, Kaori	MWJ	Jakarta - Yokosuka	
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5.2 Ship Crew

Master	Hashimoto, Takaaki
Chief Officer	Dowaki, Yukio
1st Officer	Shibata, Yuji
2nd Officer	Inoue, Haruhiko
3rd Officer	Isohi, Takeshi
Chief Engineer	Watanabe, Yoichiro
1st Engineer	Ikeda, Minoru
2nd Engineer	Narumi, Hiroaki
3rd Engineer	Kajiyama, Katsunori
Chief Radio Officer	Shishido, Kaiichirou
2nd Radio Officer	Morioka, Naoto
Boatswain	Suzuki, Tadao
Able Seaman	Naruo, Hisashi
Able Seaman	Kinoshita, Hirokazu
Able Seaman	Kawata, Seiichiro
Able Seaman	Horita, Kazunori
Able Seaman	Oguni, Hisao
Able Seaman	Inoue, Yuji
Able Seaman	Suzuki, Masaru
Able Seaman	Sato, Tsuyoshi
Able Seaman	Monzaka, Tsuyoshi
Able Seaman	Okada, Masashige
Able Seaman	Komata, Shuji
No.1 Oiler	Honda, Sadanori
Oiler	Yoshikawa, Toshimi
Oiler	Horiuchi, Yukitoshi
Oiler	Inoue, Fumio
Oiler	Miyazaki, Takashi
Oiler	Taniguchi, Daisuke
Chief Steward	Koga, Yasuaki
Steward	Kurita, Yasutaka
Steward	Akita, Takayuki
Steward	Ota, Hitoshi
Steward	Hamabe, Tatsuya

6. Summary of Observations

6.1 Surface meteorological parameters

(1) Personnel

Kunio Yoneyama (JAMSTEC): Principal Investigator
Masaki Katsumata (JAMSTEC)
Masaki Hanyu (GODI): Operation Leader
Kiyotake Kouzuma (GODI)
Souichiro Sueyoshi (GODI)

(2) Objective

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

(3) Methods

The surface meteorological parameters were observed throughout MR00-K07 cruise from the departure of Jakarta on 22 November 2000 to the arrival of Yokosuka on 20 December 2000.

This cruise, we used 3 systems for the surface meteorological observation.

1. Mirai meteorological observation system
2. Shipboard Oceanographic and Atmospheric Radiation (SOAR) system
3. Total Sky Imager (TSI)

(3-1) Mirai meteorological observation system

Instruments of Mirai met system are listed in Table 6.1-1 and measured parameters are listed in Table 6.1-2. Data was collected and processed by KOAC-7800 weather data processor made by Koshin Denki, Japan. The data set has 6-second averaged every 6-second record and 10-minute averaged every 10-minute record.

Table 6.1-1: Instruments and their installation locations of Mirai met system

Sensors	Type	manufacturer	location (altitude from surface)
Anemometer	KE-500	Koshin Denki, Japan	foremast (24m)
Thermometer	FT	Koshin Denki, Japan	compass deck (21m)
dewpoint meter	DW-1	Koshin Denki, Japan	compass deck (21m)
Barometer	F451	Yokogawa, Japan	weather observation room captain deck (13m)
rain gauge	50202	R. M. Young, USA	compass deck (19m)
optical rain gauge	ORG-115DR	SCTI, USA	compass deck (19m)
radiometer (short wave)	MS-801	Eiko Seiki, Japan	radar mast (28m)
radiometer (long wave)	MS-200	Eiko Seiki, Japan	radar mast (28m)
wave height meter	MW-2	Tsurumi-seiki, Japan	Bow

Table 6.1-2: Parameters of Mirai meteorological observation system

	Parameters	units	remarks
1	Latitude	degree	
2	Longitude	degree	
3	Ship's speed	knot	Mirai log
4	Ship's heading	degree	Mirai gyro
5	relative wind speed	m/s	6 sec. / 10 min. averaged
6	relative wind direction	degree	6 sec. / 10 min. averaged
7	True wind speed	m/s	6 sec. / 10 min. averaged
8	True wind direction	degree	6 sec. / 10 min. averaged
9	barometric pressure	hPa	adjusted to the sea surface level 6 sec. / 10 min. averaged
10	air temperature (starboard side)	degC	6 sec. / 10 min. averaged
11	air temperature (port side)	degC	6 sec. / 10 min. averaged
12	dewpoint temperature (stbd side)	degC	6 sec. / 10 min. averaged
13	dewpoint temperature (port side)	degC	6 sec. / 10 min. averaged
14	relative humidity (starboard side)	%	6 sec. / 10 min. averaged
15	relative humidity (port side)	%	6 sec. / 10 min. averaged
16	Rain rate (optical rain gauge)	mm/hr	6 sec. / 10 min. averaged
17	Rain rate (capacitive rain gauge)	mm/hr	6 sec. / 10 min. averaged
18	down welling shortwave radiometer	W/m^2	6 sec. / 10 min. averaged
19	down welling infra-red radiometer	W/m^2	6 sec. / 10 min. averaged
20	sea surface temperature	degC	-5m
21	significant wave height (fore)	m	3 hourly
22	significant wave height (aft)	m	3 hourly
23	significant wave period (fore)	second	3 hourly
24	significant wave period (aft)	second	3 hourly

(3-2) Shipboard Oceanographic and Atmospheric Radiation (SOAR) system

SOAR system, designed by BNL (Brookhaven National Laboratory, USA), is consisted of 3 parts.

1. Portable Radiation Package (PRP) designed by BNL – short and long wave down welling radiation
2. Zeno meteorological system designed by BNL – wind, Tair/RH, pressure and rainfall measurement
3. Scientific Computer System (SCS) designed by NOAA (National Oceanographic and Atmospheric Administration, USA) – centralized data acquisition and logging of all data sets

In adding to the original components, the short wave and long wave upwelling radiation were measured.

SCS recorded PRP data every 6.5 seconds, Zeno met data every 10 seconds and upwelling radiation data every 6 seconds.

Instruments and their locations are listed in Table 6.1-3 and measured parameters are listed in Table 6.1-4

Table 6.1-3: Instrument installation locations of SOAR system

Sensors	type	manufacturer	location (altitude from surface)
Zeno/Met			
anemometer	05106	R. M. Young, USA	foremast (24m)
T/RH	HMP45A	Vaisala, USA	foremast (23m)
	with 43408 Gill aspirated radiation shield (R. M. Young)		
Barometer	61201	R. M. Young, USA	foremast (23m)
	with 61002 Gill pressure port (R. M. Young)		
rain gauge	50202	R. M. Young, USA	foremast (24m)
optical rain gauge	ORG-115DA	ScTi, USA	foremast (24m)
sea surface temperature	SST-100	BNL, USA	bow, 5m extention (-1cm)
PRP			
radiometer (short wave)	PSP	Eppley labs, USA	foremast (24m)
radiometer (long wave)	PIR	Eppley labs, USA	foremast (24m)
fast ratating shadowband radiometer		Yankee, USA	foremast (24m)
Upwelling radiation			
radiometer (short wave)	MS-801	Eiko Seiki, Japan	bow, 8m extention (6m), 7.01mV/kW^2
radiometer (long wave)	MS-202	Eiko Seiki, Japan	bow, 8m extention (6m), 3.39mV/kW^2

Table 6.1-4: Parameters of SOAR System

	parameters	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	sea surface temperature	degC	-1cm, Seasnake
11	Rain rate (optical rain gauge)	mm/hr	
12	precipitation (capacitive rain gauge)	mm	reset at 50mm
13	down welling shortwave radiation	W/m^2	
14	down welling infra-red radiation	W/m^2	
15	defuse irradiation	W/m^2	
16	upwelling short wave radiation	W/m^2	
17	upwelling infra-red radiation	W/m^2	

(3-3) Total Sky Imager (TSI)

The Total Sky Imager (TSI) was installed at the top deck midship, altitude of 17m from sea level. TSI was developed jointly by Penn State University, BNL and Yankee Environmental Systems, Inc. and manufactured by YES Inc. TSI recorded every 5 minutes from dawn to sunset. Measured parameters are listed in Table 6.1-5.

Table 6.1-5: Parameters of TSI system

	parameters	units
1	opaque cloud cover	%
2	Thin cloud cover	%

(4) Preliminary results

The daytime cloud cover ratio obtained from TSI during the Intensive Observation Period (IOP), from 28th November to 11th December is shown in Figure 6.1-1. Wind (converted to U, V component), Tair/SSST, RH/precipitation, solar radiation and pressure observed during from SOAR system during IOP are shown in Figure 6.1-2. In the figures, accumulated precipitation data from SOAR capacitive rain gauge was converted to the precipitation amount in every minute and obvious noises were eliminated but not calibrated. Other figures are showing uncorrected data.

(5) Data archives

These raw data will be submitted to the Data Management Office (DMO) in JAMSTEC just after the cruise.

Remarks concerning about data quality are as follows;

1. SSST sensor of SOAR system was deployed from 0405UTC November 28th and recovered at 0001UTC December 11th.
2. Upwelling radiation measurement was conducted from 0405UTC November 28th to 0001UTC December 11th.
3. The timestamp of Mirai Navigation system was unchanged from 063559UTC to 073457UTC December 3rd due to the bad receiving condition of No.2 GPS satellite receiver.

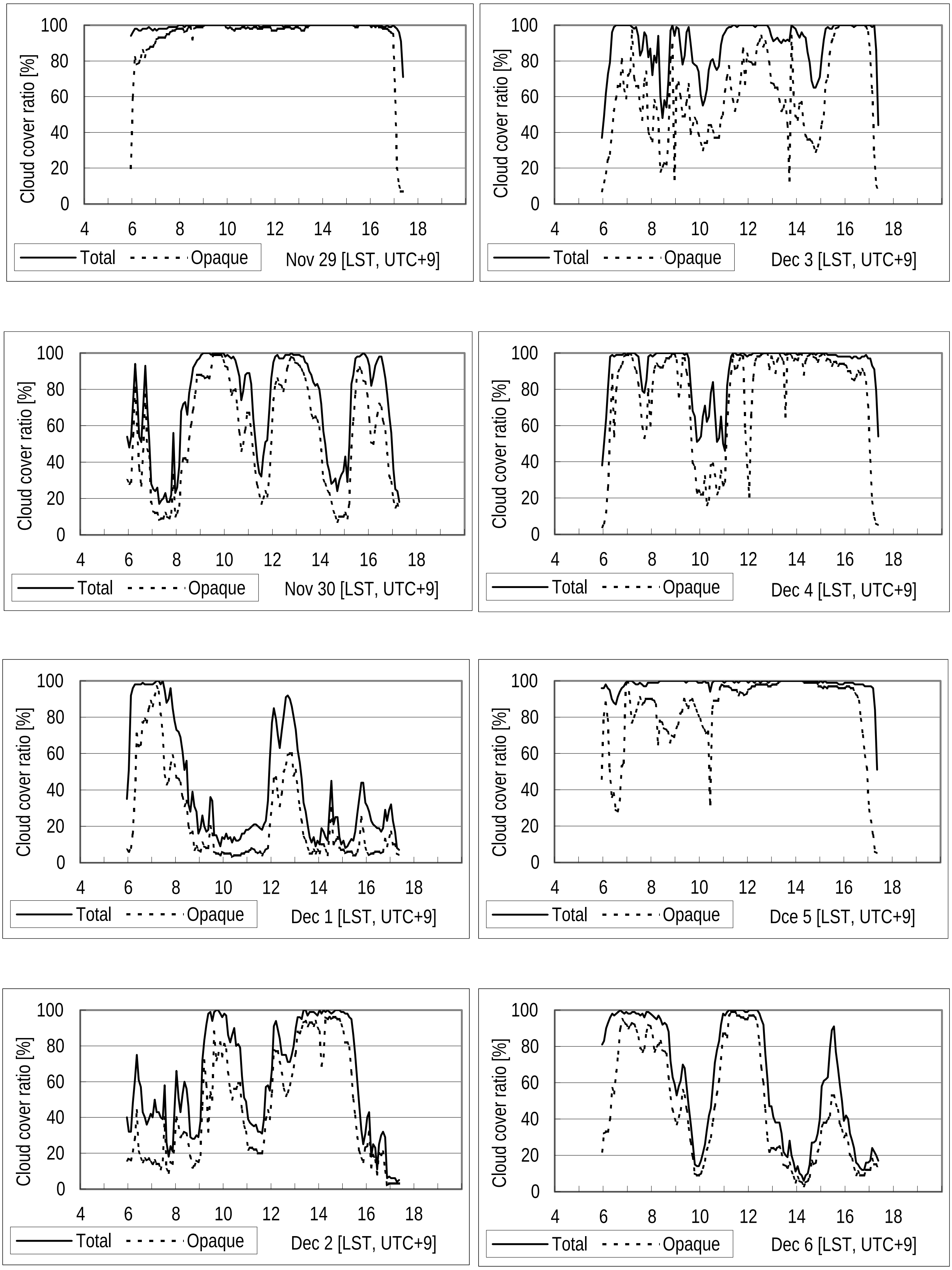

Fig 6.1-1: Daytime cloud cover ratio from TSI.

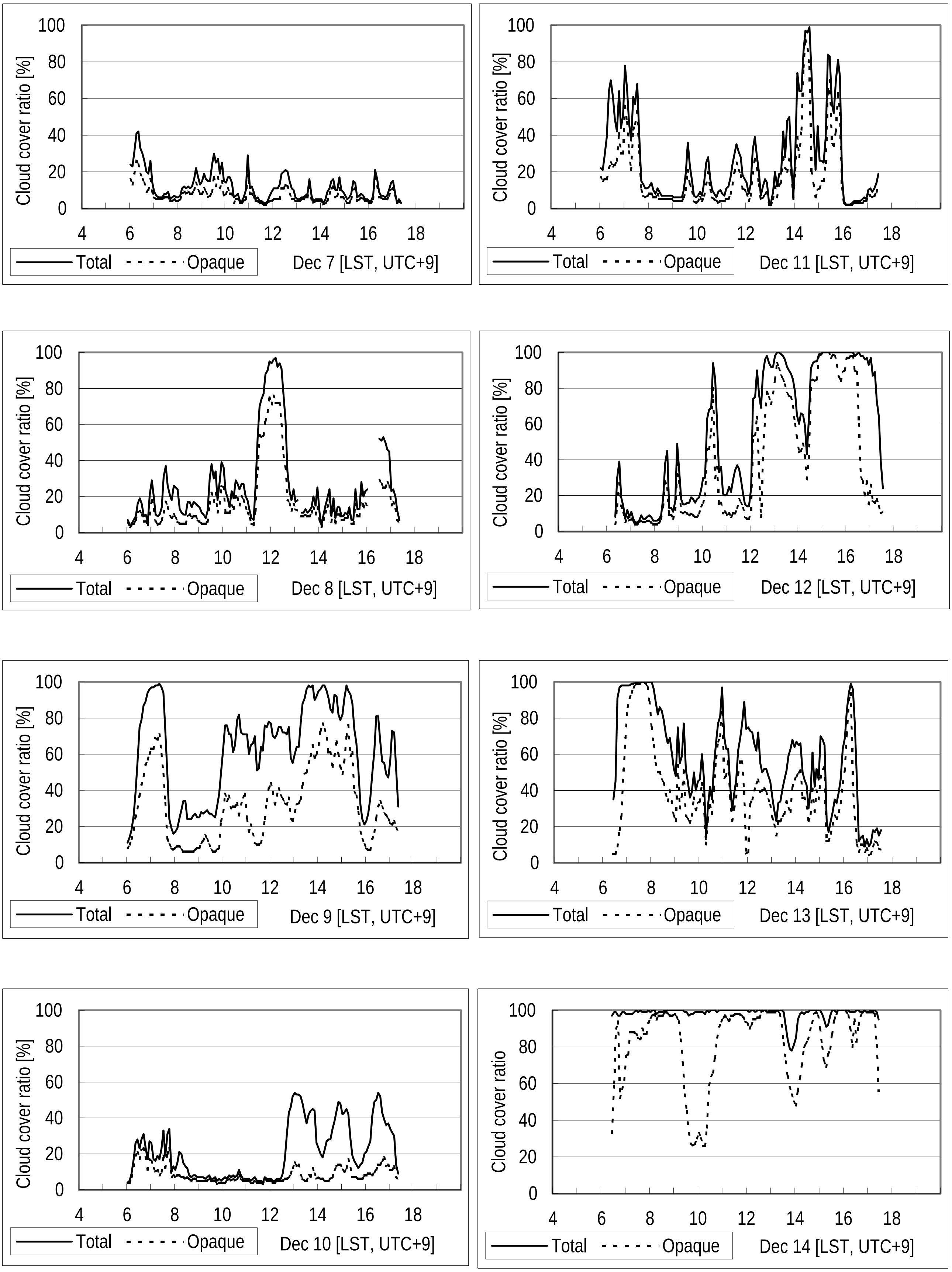

Fig 6.1-1: (Continued)

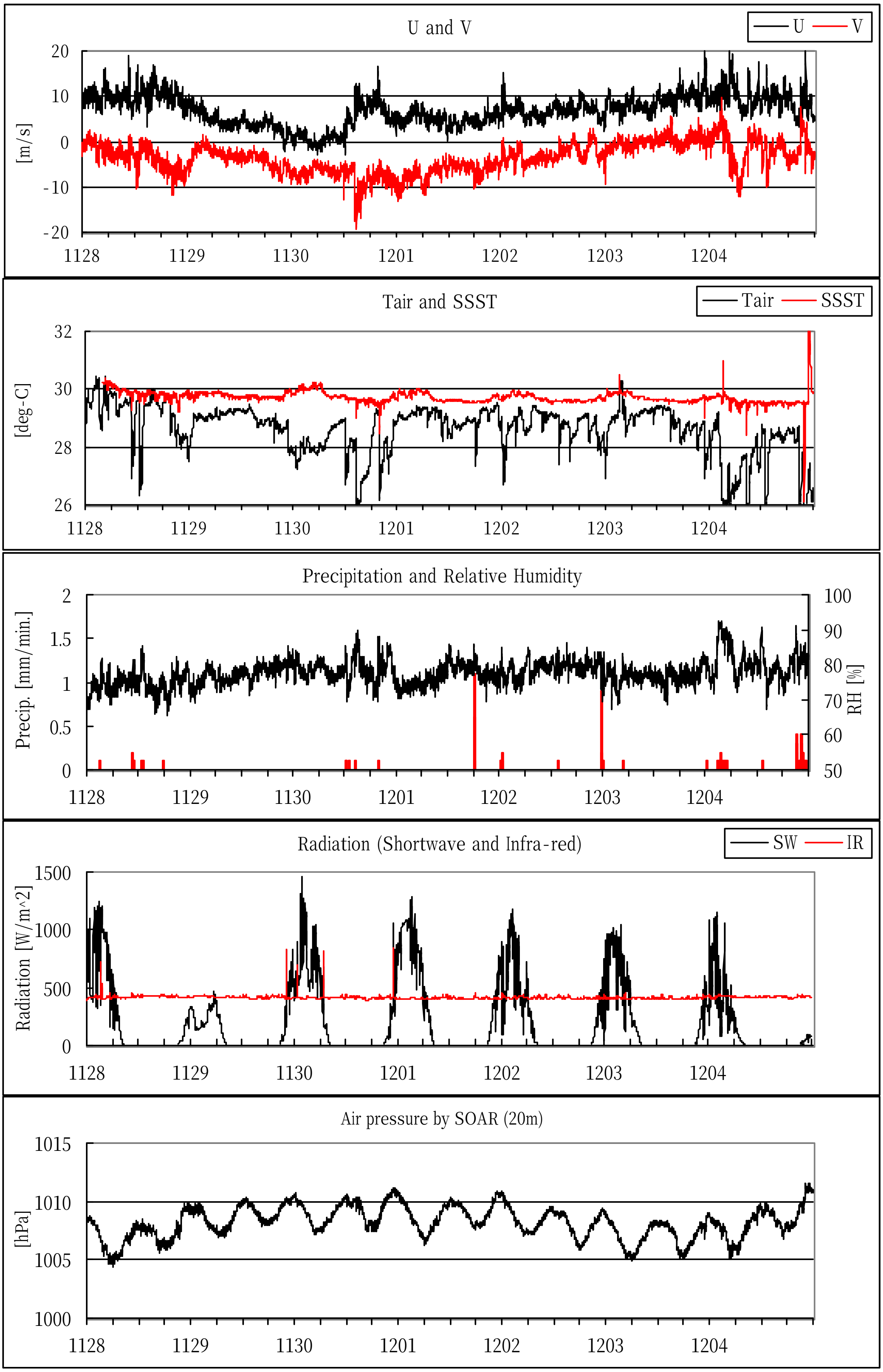

Figure 6.1-2: Time series of measured parameter by SOAR system.

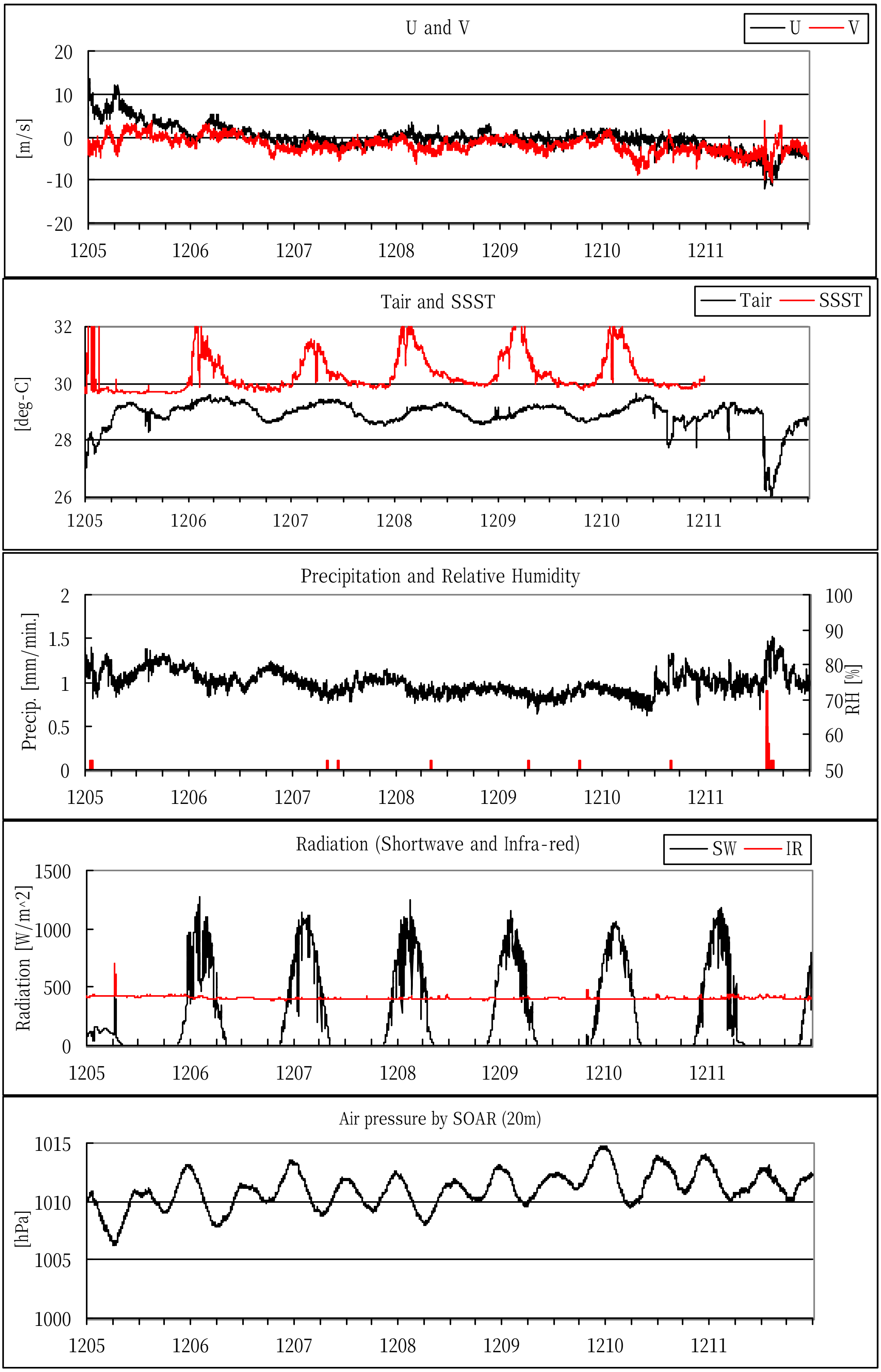

Figure 6.1-2 (continued)

6.2 Radiosonde observation

(1) Personnel

Kunio Yoneyama	(JAMSTEC)	Principal Investigator
Kiyotake Kouzuma	(GODI)	
Souichiro Sueyoshi	(GODI)	
Hisayuki Kubota	(FORSGC)	
Masaki Katsumata	(JAMSTEC)	
Kenichi Shibayama	(JAMSTEC)	
Kaichi Moriwaki	(JAMSTEC)	

(2) Objective

Atmospheric soundings (vertical profile of temperature, humidity, and wind speed/direction)

(3) Method

Atmospheric sounding by radiosonde was carried out around 2N,138E every three hours (00, 03, 06, 09, 12, 15, 18, 21 UTC) during 1200UTC, November 28 and 1200 UTC, December 11. In total, 115 radiosondes were launched during the whole cruise. The system consists of Main processor (Vaisala DigiCORA MW11), Balloon Launcher (Vaisala ASAP), GPS antenna (GA20), UHF telemetry antenna (RB21), PC (Toshiba Dynabook 430CDT), and GPS radiosonde (RS80-15GH).

Before launching, temperature and humidity were calibrated using Humidity calibrator (Digilog Instruments VAPORPAK H-31) whose humidity was set at 70% constant.

(4) Preliminary results

The log file of radiosonde launching is listed in Table 6.2-1.

Time-height cross section of potential temperature, mixing ratio, zonal, and meridional wind components are shown in Fig.6.2-1, respectively. Profiles of temperature and dew point temperature are plotted on the thermodynamic chart (EMAGRAM) with wind profiles and attached in the Appendix. It is apparent that westerly wind burst prevailed over this area during the first half of observation period (until December 5). Moist conditions slightly weakened after the burst quit.

(5) Data Archive

All data were sent to the world meteorological community by GTS through Japan Meteorological Agency, immediately after the each observation. Raw data is stored as ASCII format every 2 seconds during ascent. Data near the surface, where temperature and humidity are affected by ship body warming/cooling, are corrected and all data are converted onto every 5hPa from 1000hPa through 100hPa. Both (raw 2 seconds interval and corrected 5 hPa interval data) are archived and available from K.Yoneyama of JAMSTEC.

Table 6.2.1 Radiosonde launch log,

				Surface	States							
No	Time (UTC)	lat	lon	Pres	Temp	RH	WD	WS	Max	Altitude	Cloud	Cloud
	YYMMDDHH	(degE)	(degN)	(hPa)	(degC)	(%)	(deg)	(m/s)	(hPa)	(m)	Amount	Type
1	00112712	133.86	2.32	1003.7	29.1	75	260	10.5	47.1	20849	0	-
2	00112715	134.69	2.26	1003.6	29.2	78	265	11.5	46.5	20937	3	Sc,Cu
3	00112718	135.51	2.19	1002.0	29.2	78	259	10.7	29.0	23784	4	-
4	00112721	136.28	2.14	1001.7	29.5	75	262	11.9	25.8	24502	4	Cu,Cb,Sc
5	00112800	137.12	2.08	1003.4	29.1	80	274	12.0	23.4	25162	4	Cu,St,As,Cb
6	00112803	137.83	2.02	1002.6	30.4	73	267	9.5	25.7	24558	4	Cb,Cu,Sc,As
7	00112806	138.19	1.94	1000.2	30.0	74	269	13.8	27.9	24012	6	Cb,Cu,Sc,As
8	00112809	138.02	2.03	1001.3	29.5	77	280	9.9	44.1	21208	3	Ci,Cu,Cb
9	00112812	138.13	1.92	1003.1	28.9	77	267	8.2	42.3	21484	-	-
10	00112815	138.02	2.06	1002.8	29.5	79	273	10.5	47.9	20758	9	-
11	00112818	138.18	1.92	1001.5	29.0	77	277	10.7	55.5	19857	9	-
12	00112821	138.02	2.00	1002.3	29.2	75	294	14.7	28.1	24024	10	As,Cu,Sc
13	00112900	138.19	1.99	1004.4	28.5	79	307	10.7	30.3	23562	10	Cb,Sc,St,Ac,Cs
14	00112903	138.02	1.91	1004.4	29.1	74	273	8.0	31.3	23363	10	St,Cu
15	00112906	138.14	2.08	1002.4	29.4	77	289	5.4	29.4	23710	9	St,Cu,Ac,Sc
16	00112909	138.08	1.92	1002.8	29.3	76	301	6.3	46.0	20978	7	Cb,Cu,As
17	00112912	138.10	2.08	1004.7	29.4	78	304	5.3	33.3	22974	-	-
18	00112915	138.08	1.91	1004.5	29.3	75	297	5.4	41.2	21667	4	-
19	00112918	138.07	2.08	1003.1	28.8	81	296	4.5	31.7	23282	4	-
20	00112921	138.14	1.91	1003.9	28.9	80	327	6.1	28.3	23971	8	Cu,Sc,As,Ci
21	00113000	138.02	2.04	1005.3	28.3	79	327	5.8	28.7	23888	8	As,St,Cs,Cu,Cb
22	00113003	138.20	2.00	1003.8	28.4	76	343	7.9	35.3	22603	6	Ac.As,Sc,Cu
23	00113006	138.02	1.94	1002.5	28.1	79	352	6.2	28.8	23809	5	Ac,Cu,As
24	00113009	138.19	2.08	1003.3	28.7	76	335	6.6	31.8	23214	3	As,Ci
25	00113012	138.03	1.91	1005.0	28.9	79	350	5.9	36.8	22366	-	-
26	00113015	138.10	2.08	1005.2	26.1	92	319	15.2	88.2	17291	10	-
27	00113018	138.10	1.91	1003.1	27.4	79	299	11.5	33.2	22976	3	-
28	00113021	138.02	2.08	1004.5	27.2	84	301	11.3	27.7	24079	8	Ac,As,Sc
29	00120100	138.19	1.97	1005.3	29.0	79	317	11.1	27.9	24092	6	As,St,As
30	00120103	138.02	1.96	1004.1	29.3	74	318	11.0	28.2	23980	3	Cu,As,Sc
31	00120106	138.19	1.95	1002.1	29.4	77	321	10.0	40.7	21761	2	Cu,As,St
32	00120109	138.02	2.00	1002.9	29.3	76	311	8.4	56.0	19859	2	Cu,Cb,Ci
33	00120112	138.19	2.04	1004.5	29.1	79	303	6.9	38.6	22096	-	-
34	00120115	138.02	1.92	1004.7	28.7	82	322	6.9	45.3	21107	6	-
35	00120118	138.18	2.08	1002.8	28.8	80	309	7.5	44.0	21276	1	-
36	00120121	138.03	1.91	1003.6	29.4	78	302	8.0	47.0	20891	8	Cc,Cu,Cb,Ci
37	00120200	138.11	2.08	1005.4	29.5	78	308	9.2	26.6	24338	4	Cb,St,As,Cu,Cs
38	00120203	138.02	2.00	1003.5	29.4	80	292	8.0	27.7	24064	6	Cu,As,Ac
39	00120206	138.20	2.03	1002.3	28.8	74	308	7.8	43.0	21404	8	Cb,Ci,As,Ac
40	00120209	138.02	1.94	1002.8	29.4	78	299	8.5	55.9	19861	3	Cu,Cb
41	00120212	138.16	2.08	1004.1	29.5	77	283	8.1	39.0	22001	-	-

42	00120215	138.02	1.93	1003.7	29.0	78	278	8.5	49.2	20614	8	Sc
43	00120218	138.16	2.08	1001.2	28.9	81	278	9.3	65.8	18909	3	-
44	00120221	138.03	1.91	1002.6	28.0	84	254	7.3	45.2	21102	10	Cb,Sc,Cc
45	00120300	138.11	2.08	1004.6	28.6	81	280	7.5	32.7	23099	6	Cb,As,Cu,Cs,St
46	00120303	138.02	1.98	1002.5	29.2	72	275	8.4	37.7	22208	8	Cb,As,Cu
47	00120306	138.18	2.00	1000.3	29.1	80	272	8.0	32.0	23171	7	Cb,Cu,Ac,As
48	00120309	138.02	1.99	1001.5	29.2	78	267	8.8	53.6	20112	4	Cu,Cb,Ci,As
49	00120312	138.18	2.01	1003.1	29.4	77	255	8.2	55.5	19918	-	-
50	00120315	138.02	1.96	1003.0	29.3	73	251	8.0	45.6	21083	4	-
51	00120318	138.19	1.98	1000.6	28.3	73	270	11.7	47.1	20860	3	-
52	00120321	138.02	2.04	1001.8	28.7	77	260	10.7	46.3	20970	9	Cu,As,Sc
53	00120400	138.19	1.95	1003.6	28.0	83	265	10.8	29.6	23721	10	Cs,St,As
54	00120403	138.02	1.96	1003.0	29.3	79	239	12.2	28.6	23973	8	Cb,As,Cu,Sc
55	00120406	138.19	1.92	1001.0	26.8	86	281	12.0	3276.8	3805	10	Ns,Cu,Sc
56	00120409	138.02	1.98	1002.9	27.8	81	273	9.8	68.3	18727	9	Cu,Cb,As
57	00120412	138.19	1.96	1004.3	27.5	81	254	9.6	64.9	19017	-	-
58	00120415	138.02	1.98	1004.0	28.9	75	265	11.1	35.5	22591	8	As,Sc,Cu
59	00120418	138.19	2.01	1002.8	28.9	76	289	10.6	60.6	19383	10	-
60	00120421	138.02	1.92	1003.6	28.4	82	293	5.7	35.5	22602	9	Sc,Cu,As,Ac
61	00120500	138.16	2.08	1006.0	26.9	87	292	12.5	39.8	21955	10	As,Ns,Cs,Cu
62	00120503	138.05	1.92	1003.7	28.2	76	289	6.6	526.9	5441	10	Ns
63	00120506	138.16	2.08	1001.8	28.7	77	273	8.4	41.4	21691	10	Ns,As,Cu
64	00120509	138.03	1.91	1002.9	29.3	76	253	7.4	46.1	21011	8	St,As,Cc
65	00120512	138.17	2.08	1005.6	29.5	76	260	4.5	51.1	20408	-	-
66	00120515	138.02	1.92	1005.5	28.5	80	228	4.2	59.7	19463	-	-
67	00120518	138.12	2.09	1004.0	29.0	81	263	2.8	43.9	21277	10	-
68	00120521	138.10	1.92	1005.5	28.6	77	262	4.0	37.4	22247	10	As,Sc,Cu
69	00120600	138.13	1.98	1007.8	29.6	80	251	0.1	28.7	23898	9	Cu,St,Cs,Cb
70	00120603	138.02	2.06	1005.4	30.2	74	213	3.2	26.9	24278	7	Cu,Ac,As
71	00120606	138.19	1.96	1002.8	30.1	74	252	3.8	28.7	23845	5	As,Ac
72	00120609	138.02	2.01	1003.3	29.7	75	252	1.5	43.2	21376	3	Ac,As,St
73	00120612	138.19	2.01	1006.1	30.0	73	208	1.1	726.8	2835	-	-
74	00120615	138.02	1.98	1005.9	29.8	70	339	0.9	35.5	22591	5	As,Ac,Sc
75	00120618	138.18	1.99	1004.7	28.9	71	332	1.0	41.1	21685	2	-
76	00120621	138.02	1.99	1005.8	29.0	76	351	2.4	47.4	20857	5	Ac,As,Sc,Cu
77	00120700	138.19	2.03	1008.1	29.6	74	20	3.5	39.8	21874	2	Ci,Cu,St
78	00120703	138.02	2.02	1006.6	29.8	72	23	2.7	32.4	23100	3	Sc,Ac,As,Cu
79	00120706	138.10	1.92	1003.9	30.0	71	344	2.1	30.0	23582	2	Cu,As
80	00120709	138.15	2.08	1004.5	29.7	69	35	2.6	208.3	12195	1	Cu,Ci
81	00120712	138.02	1.94	1006.7	29.5	73	27	4.0	39.1	21986	-	-
82	00120715	138.19	2.07	1005.6	29.3	75	33	2.5	40.5	21773	2	Cu,Sc
83	00120718	138.02	1.97	1004.3	29.3	74	19	1.9	52.5	20223	3	-
84	00120721	138.19	2.05	1005.2	28.8	72	332	1.7	33.8	22846	3	Cs,Sc,Cu
85	00120800	138.02	1.92	1007.1	29.5	73	320	0.9	31.1	23387	1	Cu,St,Cs
86	00120803	138.15	2.08	1005.8	29.7	72	297	1.5	25.5	24596	4	As,Cu,Ac
87	00120806	138.02	1.99	1002.9	31.9	62	348	3.6	36.2	22437	2	As,Cu

88	00120809	138.20	2.04	1004.3	29.4	71	343	3.5	56.3	19800	2	Cu,As
89	00120812	138.02	1.95	1006.2	29.5	72	66	0.4	39.1	21969	-	-
90	00120815	138.19	2.07	1006.1	29.5	68	350	1.5	39.3	21949	4	Sc,Cu
91	00120818	138.02	1.94	1005.0	29.1	72	18	1.8	40.5	21728	2	Sc,As
92	00120821	138.18	2.08	1005.4	28.6	70	277	1.8	33.7	22857	3	Sc,Ac,Cs
93	00120900	138.03	1.91	1007.6	29.3	73	150	0.1	45.8	21043	7	Ac,St,As
94	00120903	138.10	2.08	1006.5	29.8	69	40	1.3	31.4	23290	7	As,Cu
95	00120906	138.06	1.92	1004.2	29.7	70	344	1.6	28.7	23831	6	As,Cu
96	00120909	138.18	2.09	1005.8	29.5	68	353	4.4	49.0	20623	4	Cu,Cb,Ci
97	00120912	138.03	1.91	1007.0	29.9	69	336	2.7	49.0	20619	-	-
98	00120915	138.19	2.08	1006.7	29.5	68	4	2.3	41.3	21626	5	Ac,Sc
99	00120918	138.02	1.92	1005.7	29.3	70	343	2.1	50.1	20475	3	Ac,St
100	00120921	138.17	2.08	1007.6	28.8	71	183	0.2	37.2	22282	5	Cu,Cc,Cs,Cb
101	00121000	138.03	1.91	1009.1	29.8	72	303	1.1	39.5	21889	2	Cs,Cu,St,As
102	00121003	138.13	2.08	1007.5	29.8	69	298	0.8	24.2	24897	2	Cu,Sc,As
103	00121006	138.02	1.94	1004.5	29.7	69	341	4.0	30.5	23435	2	Cu,As
104	00121009	138.19	2.04	1005.0	29.7	68	0	7.8	41.9	21522	2	St,Ci
105	00121012	138.02	1.94	1008.1	29.8	68	5	2.6	52.7	20191	1	Cu,As
106	00121015	138.19	2.05	1007.9	29.3	73	10	1.9	58.1	19619	7	Cu,Ac,As
107	00121018	138.03	1.97	1005.8	29.1	74	9	3.2	41.4	21594	2	Ac,As
108	00121021	138.19	2.02	1006.4	28.7	77	13	2.6	34.5	22689	6	Cu,Ci
109	00121100	138.02	1.96	1008.5	29.0	71	29	1.9	29.6	23681	4	As,Cu,St,Cs
110	00121103	137.72	2.38	1006.5	29.7	71	30	4.5	46.8	20869	5	Cb,Cu,Sc,As,Ac
111	00121106	137.30	2.92	1004.8	28.6	81	33	6.5	26.2	24367	7	Cb,Cu
112	00121109	136.89	3.41	1005.7	29.3	73	22	4.9	52.8	20152	5	As,Ci,Cu,Cb
113	00121112	136.47	3.85	1007.2	29.1	76	33	5.9	45.2	21077	5	Ac,Cu
114	00121200	134.54	6.04	1007.1	29.3	74	36	4.0	31.2	23321	6	Cu,Cb,Cs,As
115	00121212	133.61	7.47	1005.3	27.9	82	65	8.7	51.6	20305	-	-

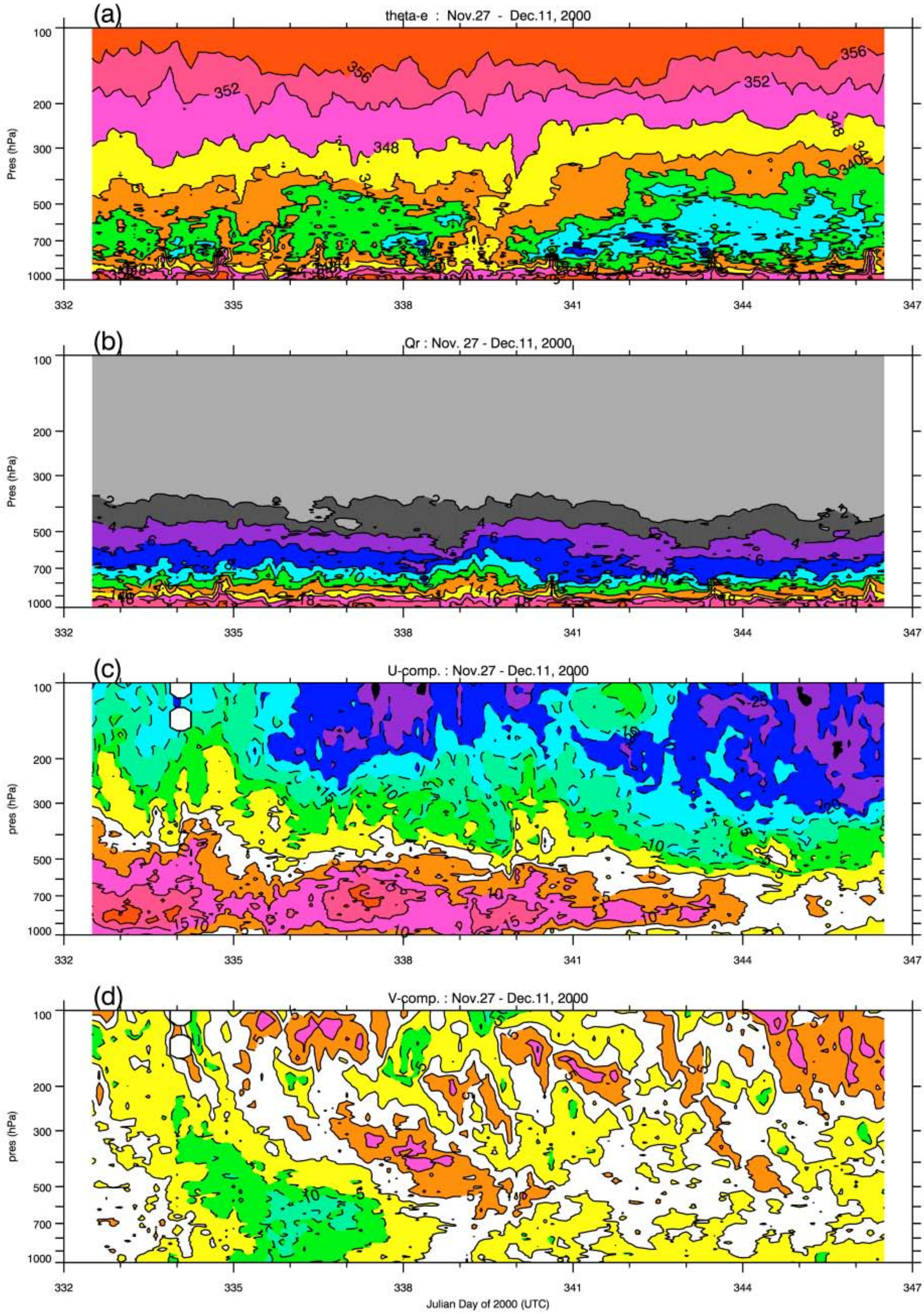

Fig. 6.2-1: Time-height cross sections of (a) equivalent potential temperature (K), (b) mixing ratio (g/kg), (c) zonal wind component (m/s), and (d) meridional wind component (m/s), respectively. Contour intervals are (a) 4 K, (b) 2 g/kg, (c) 5 m/s, and (d) 5 m/s.

6.3 Doppler radar observation

(1) Personnel

Masaki Katsumata (JAMSTEC): Principal Investigator
Masaki Hanyu (GODI): Operation Leader
Kunio Yoneyama (JAMSTEC)
Hisayuki Kubota (FORSGC)
Kaichi Moriwaki (JAMSTEC)
Ken-ichi Shibayama (JAMSTEC)
Souichiro Sueyoshi (GODI)
Kiyotake Kouzuma (GODI)

(2) Objective

The Doppler radar is operated to obtain spatial and temporal distribution of rainfall amount, and structure of precipitating cloud systems. The objective of this observation is to investigate the life cycle of precipitating systems associated with the interseasonal oscillation.

(3) Methods

The hardware specification of this shipboard Doppler radar (RC-52B, manufactured by Mitsubishi Electric Co. Ltd., Japan) are;

Frequency:	5290 MHz
Beam Width:	better than 1.5 degrees
Output Power:	250 kW (Peak Power)
Signal Processor:	RVP-6 (Sigmet Inc., U.S.A.)
Inertial Navigation Unit:	DRUH (Honeywell Inc., U.S.A.)
Application Software:	IRIS/Open (Sigmet Inc., U.S.A.)

The hardware is calibrated by checking (1) frequency, (2) mean power output, (3) pulse repetition frequency (PRF) for once a day, and (4) transmitting pulse width and (5) receiver linearity at the beginning and the end of the intensive (stationary) observation period.

The observation is performed continuously from 27 November 12 December 2000. During the observation, the programmed “tasks” are repeated every 10 minutes. One cycle consists of one “volume scan” (consists of PPIs for 21 elevations) with Doppler-mode (160-km range for reflectivity and Doppler velocity), one-elevation “Surveillance” PPI with Intensity-mode (300-km range for reflectivity). In the interval of the cycles, RHI (Range Height Indicator) scans were operated to obtain detailed vertical cross sections with Doppler-mode. The parameters for the above three tasks are listed in Table 6.3-1.

Table 6.3-1: Parameters for each task.

	Surveillance PPI	Volume Scan	RHI
Pulse Width	2 [us]	0.5 [us]	
Scan Speed	18 [deg./sec.]		Automatically determined
PRF	260 [Hz]	900 / 720 [Hz]	
Sweep Integration	32 samples		
Ray Spacing	about 1.0 [deg.]		0.2 [deg.]
Bin Spacing	250 [m]	125 [m]	
Elevations	0.5	0.5, 1.2, 2.0, 3.0, 4.0, 5.0, 6.0, 7.0, 8.0, 9.0, 10.1, 11.3, 12.8, 14.6, 16.6, 18.9, 21.6, 25.0, 29.0, 34.0, 40.0	0.0 to 85.0
Azimuths	Full Circle		Optional
Range	340 [km]	160 [km]	
Software Filters	No filter	Dual-PRF velocity unfolding	
Gain Control	Fixed		

(4) Preliminary Results

As in other data, the radar data also shows drastic change of the atmospheric state on December 6: Fig. 6.3-1 shows the time series of radar echo area and estimated averaged rainfall within the domain of surveillance PPI. Before Decemter 6, several organized mesoscale convective systems, could be seen, as shown in Figs. 6.3-2 and 6.3-3. After December 6, in contrast, the radar echo was “vanished” with the change of surface wind from strong westerly to calm easterly. The detailed analyses are the future work.

(5) Data Archive

The inventory information of the Doppler radar data obtained during this cruise will be submitted to JAMSTEC DMO (Data Management Office). The original data will be archived at Ocean Research Department of JAMSTEC.

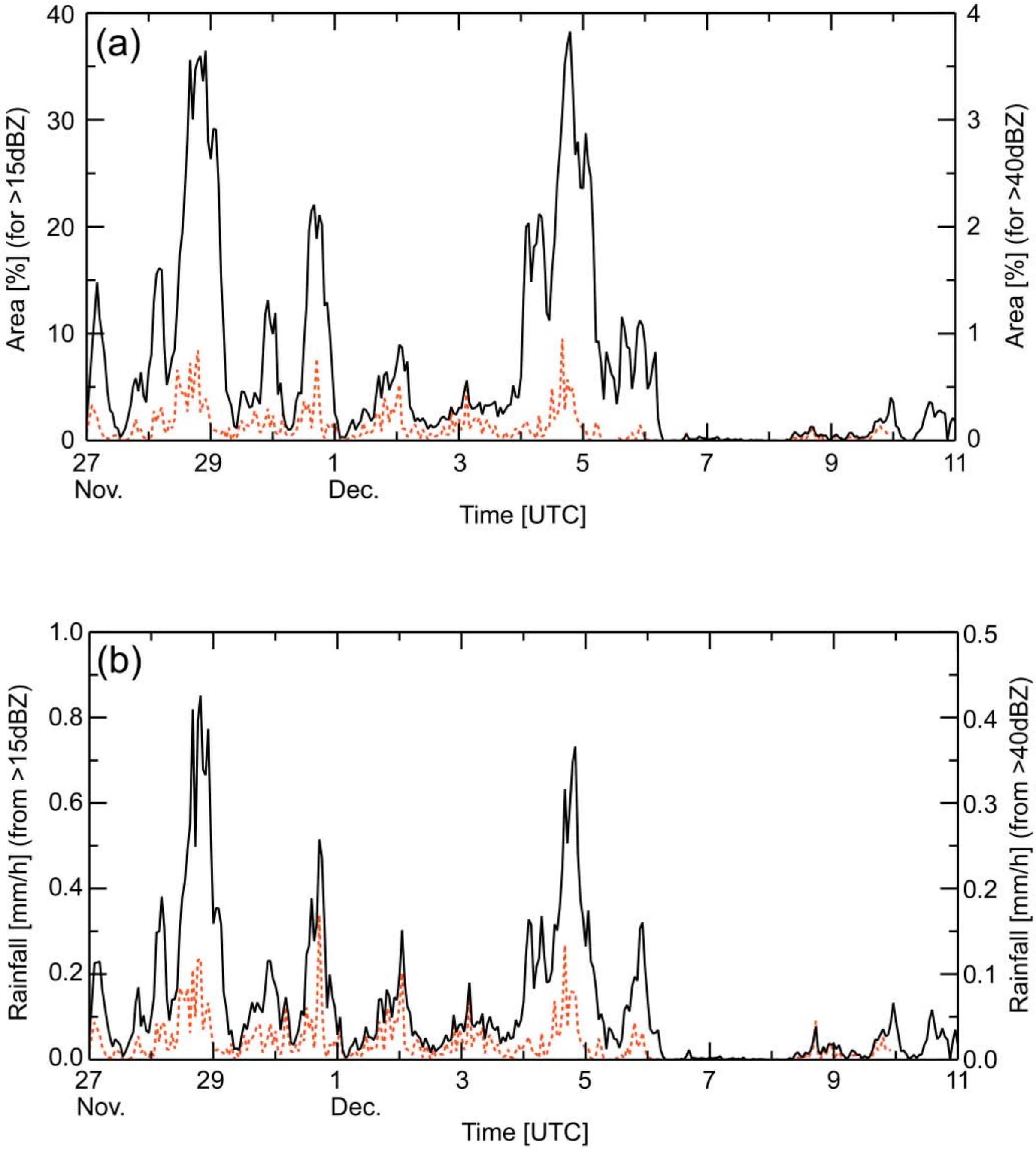

Fig. 6.3-1: Time series of the (a) ratio of the radar echo area within 200-km range and (b) averaged rainfall rate for 200-km range, derived from surveillance PPI, for the IOP. The solid and dashed line indicates the value for over 15dBZ area and over 40dBZ area, respectively.

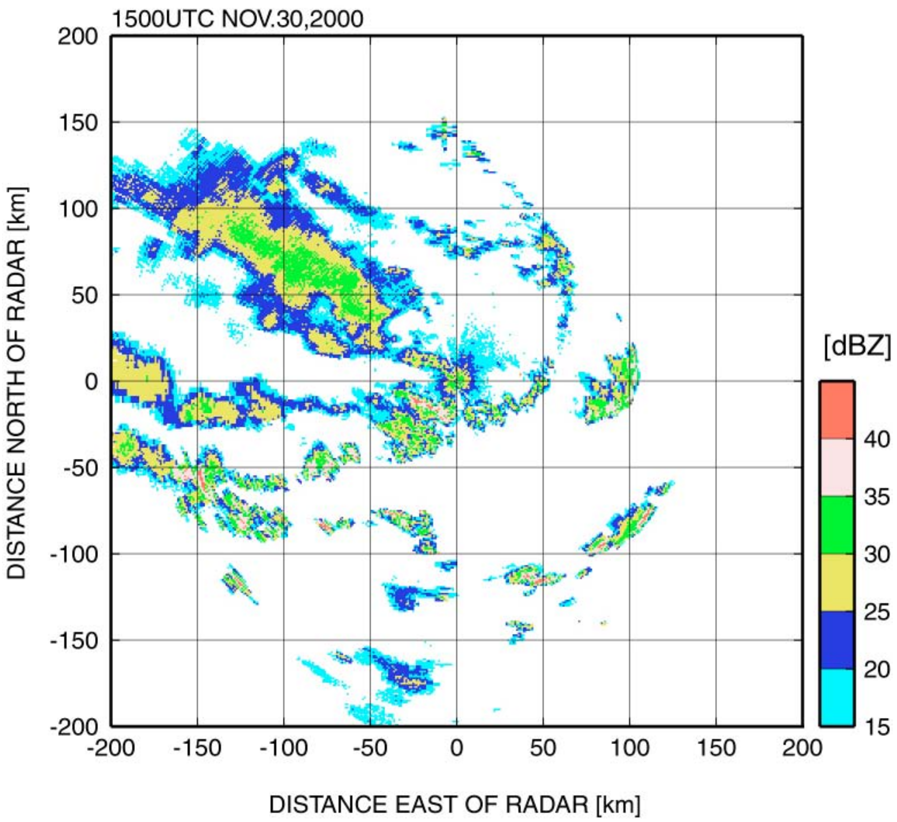

Fig. 6.3-2: Radar reflectivity field which obtained by surveillance (intensity-mode) PPI at 15UTC on Nov.30, 2000.

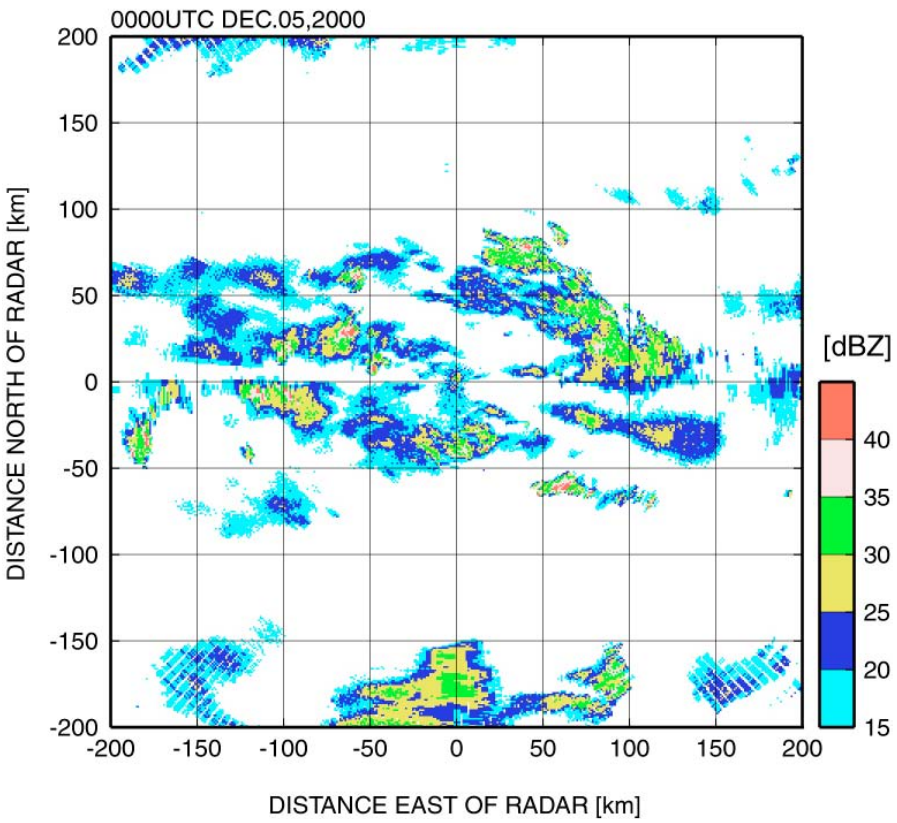

Fig. 6.3-3: Radar reflectivity field which obtained by surveillance (intensity-mode) PPI at 00UTC on Dec.5, 2000.

6.4 Mie scattering lidar observation

(1) Personnel (* indicates on board personnel)
Ichiro Matsui (NIES)*
Atsushi Shimizu (NIES)
Nobuo Sugimoto (NIES)
Osamu Takahashi (TIT)
Kazuhiro Asai (TIT)

(2) Objectives

Shipborne Mie scattering lidar observation of aerosols and clouds have been started using R/V Mirai. The purposes of the observation are to obtain global distribution and optical characteristics of aerosols and clouds which are used in the climatological study and in the study on the data reduction algorithms and data methods for space borne lidars.

(3) Method

The lidar employs a compact flashlamp pumped second-harmonics Nd:YAG laser. Mie scattering at 1064 nm and 532 nm, and depolarization ratio at 532 nm were recorded. System parameters are as follows;

Laser: Big Sky Laser CFR-200
Output power: 532 nm 50 mJ/Pulse, 1064 nm 100 mJ/pulse
Repetition rate: 10 Hz
Beam div.: 0.5 mrad
Receiver: Schmidt cassegrainian
Diameter: 280 mm
Field of view: 1 mrad
Detector: PMT (532 nm) , APD (1064 nm)
Data collection: LeCroy LC574AL
Measurement range: 0-24 km
Range resolution: 6 m
Sampling rate: 10 sec

(5) Preliminary results

Figure 6.4-1 shows a temporal variation of vertical profile. The range-corrected lidar signal at 532 nm is indicated with a color scale. Diurnal variation of boundary layer is not significant as seen in Fig.6.4-1. Low clouds are frequently observed at the top of the planetary boundary layer. Cirrus clouds are also frequently observed in an altitude range of 12 to 17 km.

(6) Data archive

All data will be archived at NIES and TIT, and submitted to JAMSTEC DMO.

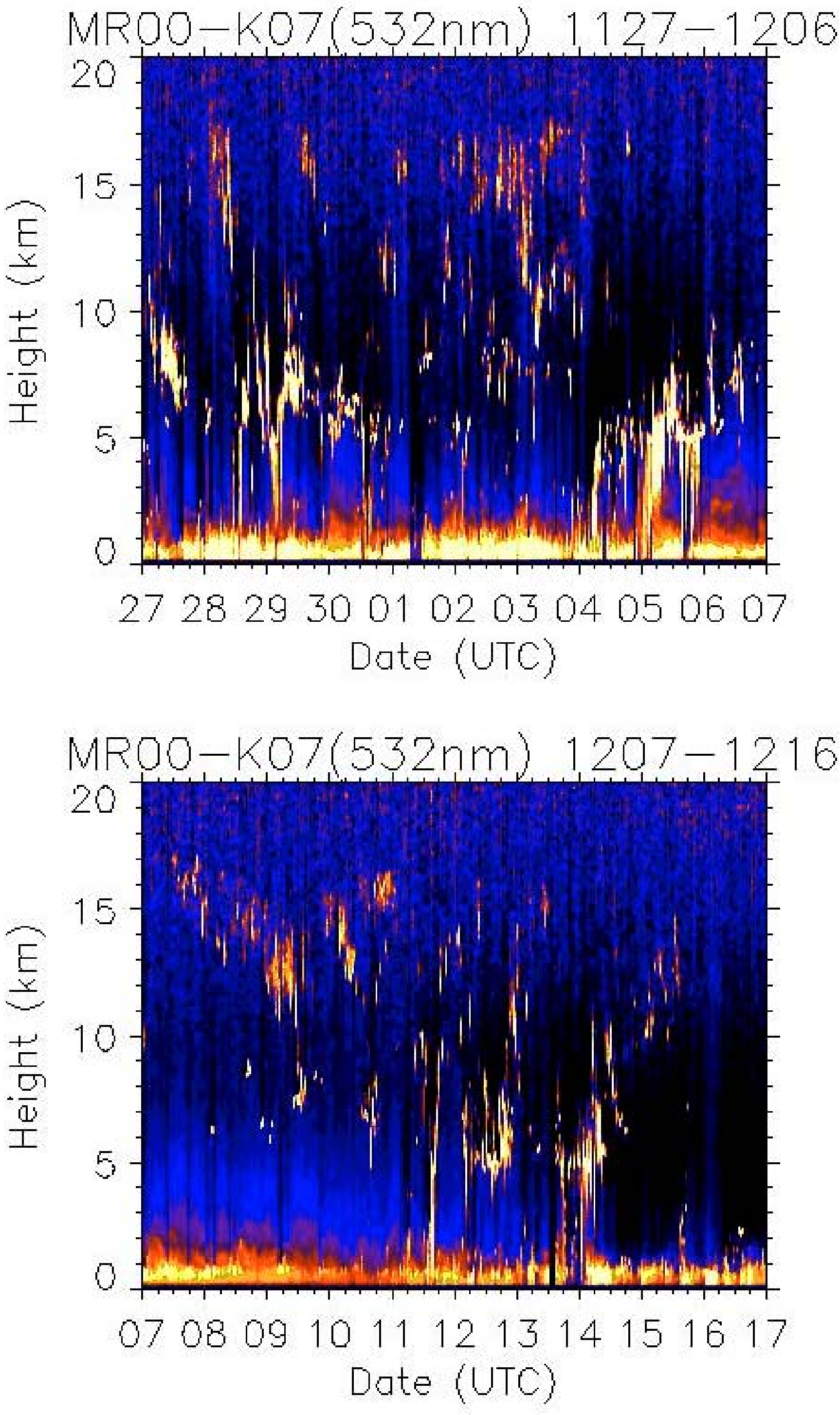

Fig.6.4-1 Temporal variation of range-corrected lidar signal at 532 nm.

6.5 Ceilometrer observation

(1) Personnel

Masaki Katsumata (JAMSTEC): Principal Investigator
Masaki Hanyu (GODI): Operation Leader
Kunio Yoneyama (JAMSTEC)
Hisayuki Kubota (FORSGC)
Ichiro Matsui (NIES)
Souichiro Sueyoshi (GODI)
Kiyotake Kouzuma (GODI)

(2) Objectives

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

(3) Methods

We measured cloud base height and backscatter profiles using CT-25K ceilometer (Vaisala, Finland) from November 27 to the end of the cruise, December 19.

Major parameters for the measurement configuration are as follows;

Laser source:	Indium Gallium Arsenide (InGaAs) Diode
Transmitting wave length:	905 +-5 nm at 25 deg-C
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.

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

(4) Preliminary results

The time series of the detected cloud base height during IOP is shown in Fig.6.5-1. In the upper panel, for Nov. 28 to Dec. 05, the height varies so widely, and we can see the continuous change of the cloud base from lower one to higher one. This continuous change reflects the passage of the well-developed (with high cloud top height) and inclined cloud. The lower panel, on the other hand, for Dec.05 to Dec.11, most of the detected cloud base are at lower than 1000 m. This indicates that the most of the detected clouds were low cumulus or stratus, with low cloud top. This drastic change corresponds to the end of the "westerly burst", observed in surface meteorological parameters (see Section 6.1) or radiosonde observations (see Section 6.2). The more detailed analyses are in future work.

(5) Data archive

Ceilometer data obtained during this cruise will be submitted to the DMO (Data Management Office) of JAMSTEC, and will be under their control.

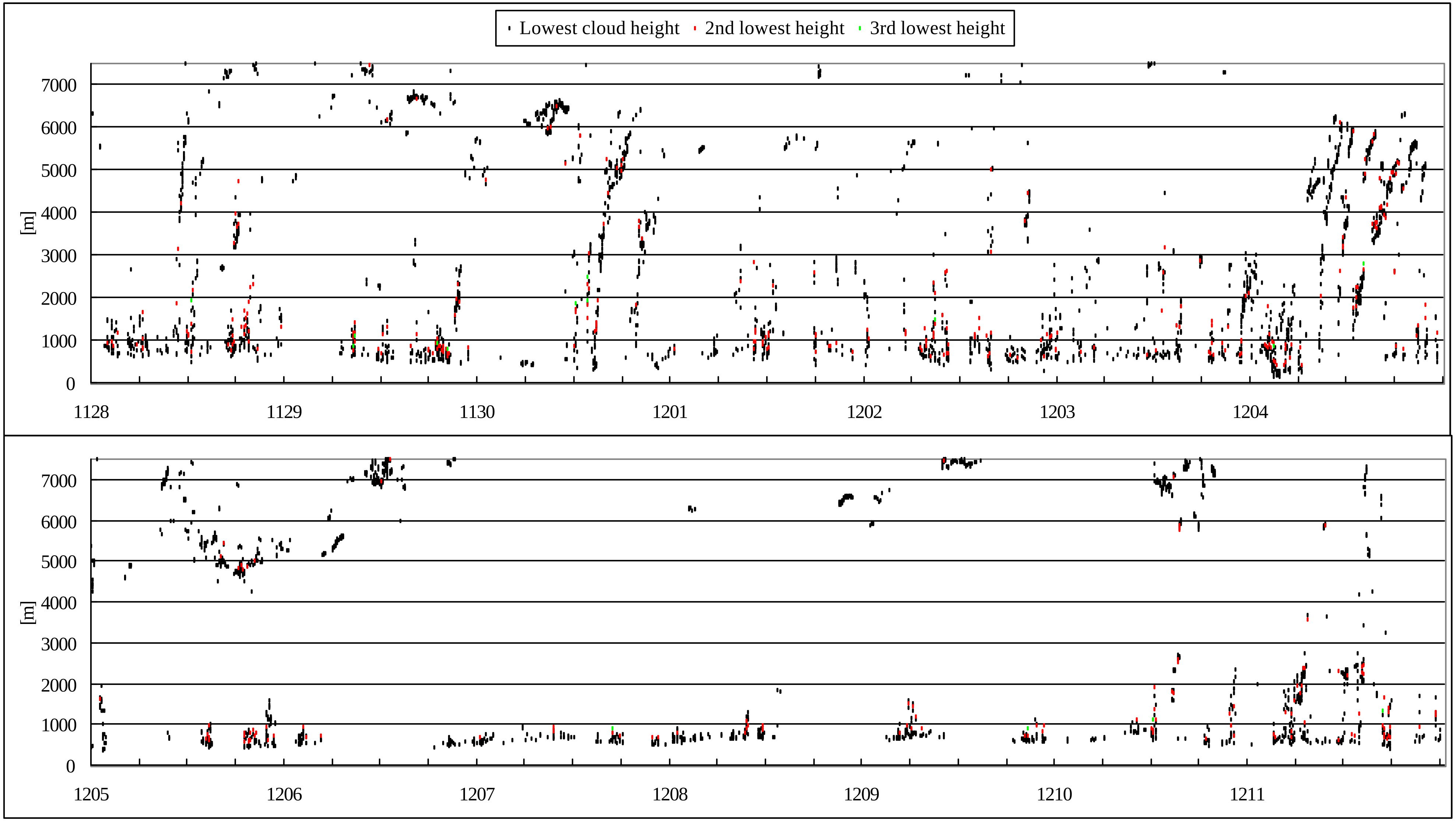

Figure 6.5-1: Cloud base height during IOP

6.6 Aerosol and radiation measurement

(1) Personnel

On board scientist:

Ichiro Matsui (NIES)

Kunio Yoneyama (JAMSTEC)

Co-workers not on board

Tatsuo Endoh (ILTS, Hokkaido University): Principle Investigator

Tamio Takamura (CEReS, Chiba University)

Sachio Ohta (Engineering environmental resource laboratory,
Graduate school of engineering, Hokkaido University)

Teruyuki Nakajima (CCSR, University of Tokyo)

(2) Objectives

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

(3) Methods

The instruments used in this work are shown as following in Table 6.6-1.

Sky Radiometer was measuring irradiating intensities of solar radiation through seven different filters with the scanning angle of 2-140 degree. These data will provide finally optical thickness, angstrom exponent and size distribution of atmospheric aerosols with a kind of retrieval method.

Optical Particle Counter was measuring the size of large aerosol particle and counting the number concentration with laser light scattering method and providing the size distribution in 0.3,0.5,1.0,2.0 and 5.0 micron of diameter with real time series display graphically.

(4) Preliminary Results

Information of data and sample obtained are summarized in Table 6.6-2. The sky radiometer has been going well owing to more calm and silent condition and circumstances about shivering problems provided by the R/V Mirai whose engines are supported by well defined cushions. Therefore, measured values will be expected to be considerably stable and provide good calculated parameters in higher quality. However, some noise waves were found to interfere the 16,13 and 12channel marine bands of VHF from sky radiometer. Fortunately the origin and source were identified by using a VHF wide band receiver and the interference waves were kept by fairly separating from two VHF antennae and decreased to recovery of 100%.

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

(5) Data Archive

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

(6) References

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

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

Table 6.6-1 Information of obtained data inventory (Method)

Item	Instrument	Position
Optical thickness Angstrom Expt.	Sky Radiometer (Prede, POM-01MK2)	Deck above Anti-rolling system
Aerosol size distribution	Particle Counter (Rion, KC-01C)	Compass deck

Table 6.6-2 Data and Sample inventory

Data / Sample	Rate	Site	Object	Period
Sun & Sky Light	1/5 min.	Deck above Anti-rolling system	optical thickness Angstrom expt.	Nov.28 – Dec.19
Size distribution of aerosols	1/2.5 min.	Compass deck	concentration of aerosols	Nov.28 – Dec.19

6.7 Surface Turbulent Flux Measurement

(1) Personnel

Hisayuki Kubota (Frontier Observational Research System for Global Change):
Principal Investigator
Hiroshi Ishida (Maritime University of Kobe /
Frontier Observational Research System for Global Change)
Osamu Tsukamoto (Okayama University)
Kunio Yoneyama (JAMSTEC)
Masaki Katsumata (JAMSTEC)

(2) Objectives

For the understanding of air-sea interaction, accurate measurements of surface heat and fresh water budgets are necessary as well as the momentum exchange through the sea surface. The surface turbulent fluxes of momentum, sensible heat and latent heat (water vapor) were measured with the eddy correlation method. These flux measurement data are combined with radiation and CTD measurements to lead the surface energy budget.

(3) Methods

A new flux measurement system was supplied by Frontier Observational Research System for Global Change. It consists of a turbulence measurement system (Kaijo Co.,Ltd) and a ship motion measurement system(Kanto Aircraft Instrument Co.,Ltd). A three dimensional sonic anemometer-thermometer (Kaijo, DA-600) and an infrared hygrometer (Kaijo, AH-300) were mounted on the top of the foremast. These turbulence instruments output signals of turbulent fluctuations of three components of wind velocity, air temperature and specific humidity. The anemometer measures relative wind velocities effected by the ship motion. The motions were measured with the motion sensors, such as an inclinometer (Applied Geomechanics, MD-900-T), accelerometers (Applied Signal Inc.,QA700-020) and rate gyros (Systron Donner, QRS11-0050-100). Fig. 6.7-1 shows the installation.

During the cruise in 1999 (MR00-K03), the international field experiment Nauru99, high frequency noise was found out in the motion signals when the R/V Mirai stayed at the point or cruised at speed of dead slow ahead. It was also found that bow and/or astern thrusters induced mechanical vibrations on the ship including the foremast. Therefore, in this cruise the lowpass filter was set in the flux measuring system to cutoff this high frequency noise.

These signals were sampled at 10 Hz with a PC based data logging system (Labview, National Instruments Co., Ltd). The turbulent fluxes of momentum, sensible heat and latent heat (water vapor) are calculated with the eddy correlation method including the ship motion correction. These complicated data will be processed after the cruise.

Sea surface temperature was continuously measured with a infrared radiation thermometer (TASCO THI-700) at the bow of the ship during the period of IOP. 1 minute mean values were recorded with a data logging system (CR-23X, Campbell Scientific Co.,Ltd).

(4) Results

The continuous measurements of turbulent fluctuations were carried out from November 27 to December 19. Favorable wind conditions are selected and analyzed later.

(5) Data archives

The raw data of turbulent fluctuation time series were archived in MO disks. All raw data are submitted to JAMSTEC DMO. The processed data of turbulent fluxes will be archived in Okayama University and open to public after the data processing and quality check.

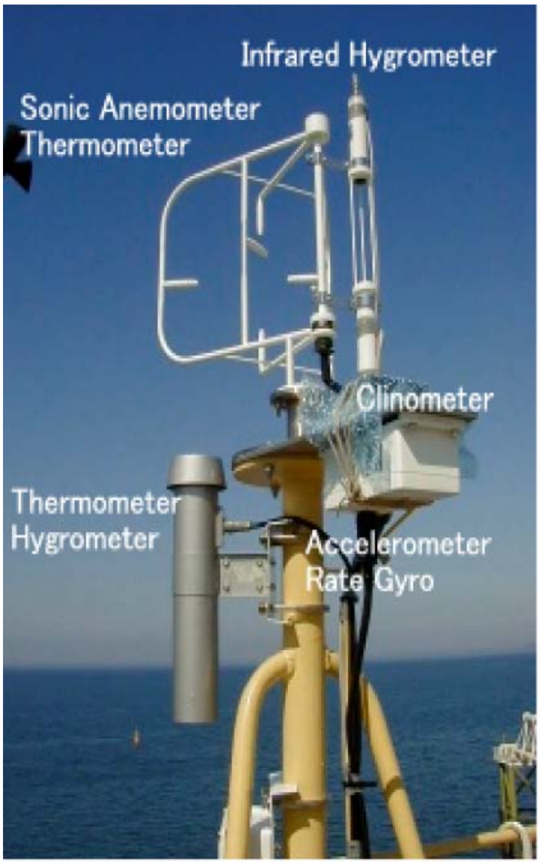

Fig.6.7-1: Installation at the top of the foremast

6.8 CTD Measurements

6.8.1 CTD Observation

(1) Personnel

Kunio Yoneyama (JAMSTEC): Principal Investigator
Hirokatsu Uno (MWJ): Operation Leader
Asako Inoue (MWJ)
Mikio Kitada (MWJ)
Kaori Akizawa (MWJ)
Takayoshi Seike (MWJ)
Endro Soeaynto (BPPT)
Eko Triarso (BPPT)

(2) Objectives

Investigation of the oceanic structure and its time variation by measuring vertical profiles of temperature and salinity.

(3) Methods

We observed vertical profile of temperature and salinity by CTD / Carousel (Conductivity Temperature Depth profiler / Carousel Multi Water Sampler). The sensors attached on CTD were temperature sensor, conductivity sensor, pressure sensor, and altimeter. Salinity was calculated by measurement values of pressure, conductivity and temperature. The CTD / Carousel was deployed from starboard on working deck. Descending rate and ascending rate were kept 1.2 m/sec respectively. Sea surface temperature (SST) measurement was done in each time, too.

The CTD raw data was acquired by SBE and stored on the hard disk of an IBM personal computer. Water samplings were made acquired in real time by using the SEASAVE utility from SEASOFT software (ver.4.232) provided during up-cast by sending a fire command from the computer. Every day we sampled water on 00:00 (UTC) at 1000 m to calibrate salinity data.

CTD measurements at stationary station (2N, 138E) have been carried out. CTD casting was conducted every 3hours (02:30, 05:30, 08:30, 11:30, 14:30, 17:30, 20:30, 23:30, UTC). Measurement depth was 1,000 m at 23:30, other cast measurement depth was 500 m. In total, 96 castings were carried out (see Table 6.8.1-1).

The CTD raw data was processed using SEASOFT (ver.4.232). Data processing procedures and used utilities of SEASOFT were as follows:

DATCNV: Converts the binary raw data to output on physical units.
Output parameters are scan number, depth, pressure, temperature, salinity, sigma-theta, potential-temperature, descent rate, conductivity. Simultaneously, this utility selects the CTD data when bottles closed to output on another file.

SECTION: Remove the unnecessary data.

WILDEDIT: Obtain an accurate estimate of the true standard deviation of the data.
Std deviations for Pass 1: 2
Std deviations for Pass 2: 10
Points per block: 100

BINAVG: Calculates the averaged data in every 1 db.

ROSSUM: Edits the data of water sampled to output a summary file.
SPLIT: Splits the data made in .CNV files into up-cast and down-cast files.

Specifications of the sensors are listed below.

Under water unit: SBE 9*plus* (S/N 09P9833-0575, Sea-Bird Electronics, Inc.)
Calibrated Date: 27.Oct.1999
Temperature Sensor: SBE3-04/F (S/N 031359, Sea-Bird Electronics, Inc)
Calibrated Date: 22.Aug.2000
Conductivity Sensor: SBE4-04/0 (S/N 041088, Sea-Bird Electronics, Inc)
Calibrated Date: 22.Aug.2000
Altimeter sensor: PSA-9000 (S/N 396, Datasonics, Inc)
Deck unit: SBE11*plus* (S/N 11P8010-0308, Sea-Bird Electronics, Inc.)
Carousel water sampler: SBE32 (S/N 329833-0026, Sea-Bird Electronics, Inc.)

(4) Preliminary Results

Vertical profiles at each CTD cast are attached in the following APPENDEX. Time variations of the vertical profile of temperature, salinity, and density (sigma-theta) are shown in Figs. 6.8.1-1 to 6.8.1-3. The state of a change in time of the SST is shown in Fig 6.8.1-4,5.

Note that in these figures, the correction of salinity data by sampled water is not applied.

(5) Data Archive

All raw and processed CTD data files were copied onto magnetic optical disks (MO) and submitted to JASTEC Data Management Office (DMO) and will be under their control.

Table 6.8.1-1 CTD cast table

Cast No.	File Name	Lat. [N]	Lon.[E]	Date	Start Time	End Time	Max. Press. [db]	Max. Wire Out [m]	SST [deg-C]	Depth [m]	Water Sampling
001	K7S001	01-55.40	138-07.82	2000/11/28	11:35	11:50	501.084	511	29.8	4241	
002	K7S002	02-04.57	138-01.76	2000/11/28	14:36	14:57	500.67	513	29.8	4334	
003	K7S003	01-55.14	138-11.07	2000/11/28	17:32	17:54	500.534	504	29.8	4349	
004	K7S004	02-00.10	138-01.70	2000/11/28	20:34	20:54	501.674	504	29.7	4261	
005	K7S005	01-59.15	138-11.51	2000/11/28	23:38	00:16	1002.769	1012	29.7	4259	○
006	K7S006	01-54.86	138-01.39	2000/11/29	02:35	02:54	502.235	511	29.7	4688	
007	K7S007	02-04.94	138-08.95	2000/11/29	05:32	05:57	500.711	506	29.7	4250	
008	K7S008	01-55.04	138-04.59	2000/11/29	08:29	08:52	501.249	496	29.7	4575	
009	K7S009	02-04.69	138-06.29	2000/11/29	11:34	11:51	502.734	509	29.6	4219	
010	K7S010	01-54.75	138-05.17	2000/11/29	14:36	14:52	501.973	504	29.7	4563	
011	K7S011	02-05.31	138-04.38	2000/11/29	17:32	17:56	501.615	504	29.6	4278	
012	K7S012	01-54.98	138-08.67	2000/11/29	20:33	20:55	501.040	499	29.6	4252	
013	K7S013	02-03.89	138-01.62	2000/11/29	23:36	00:14	1002.325	1023	29.6	4332	○
014	K7S014	01-59.90	138-11.73	2000/11/30	02:35	02:53	501.250	501	29.7	4209	
015	K7S015	01-56.33	138-01.64	2000/11/30	05:32	05:51	501.520	497	29.7	4586	
016	K7S016	02-04.93	138-11.52	2000/11/30	08:32	08:52	501.572	504	29.6	4496	
017	K7S017	01-54.79	138-01.68	2000/11/30	11:35	11:53	500.686	505	29.6	4692	
018	K7S018	02-04.62	138-07.19	2000/11/30	14:40	14:58	502.505	514	29.4	4212	
019	K7S019	01-54.68	138-05.98	2000/11/30	17:32	17:55	503.367	507	29.4	4562	
020	K7S020	02-04.87	138-01.37	2000/11/30	20:39	21:00	502.420	505	29.5	4322	
021	K7S021	01-57.12	138-11.26	2000/11/30	23:35	00:11	1003.773	1003	29.5	4350	○
022	K7S022	01-58.80	138-01.46	2000/12/01	02:36	02:52	500.765	506	29.6	4410	
023	K7S023	01-57.31	138-11.52	2000/12/01	05:32	05:55	500.971	498	29.6	4349	
024	K7S024	02-00.33	138-01.32	2000/12/01	08:32	08:52	501.114	505	29.5	4265	
025	K7S025	02-01.25	138-11.18	2000/12/01	11:35	11:52	501.797	506	29.5	4153	
026	K7S026	01-56.65	138-01.40	2000/12/01	14:36	14:52	501.277	506	29.4	4555	
027	K7S027	02-04.99	138-11.15	2000/12/01	17:32	17:52	501.098	507	29.4	4416	
028	K7S028	01-55.09	138-01.11	2000/12/01	20:32	20:53	500.371	514	29.5	4681	
029	K7S029	02-04.92	138-07.75	2000/12/01	23:36	00:09	100.986	1016	29.5	4173	○
030	K7S030	02-00.39	138-01.39	2000/12/02	02:34	02:50	501.527	503	29.6	4271	
031	K7S031	02-01.89	138-12.12	2000/12/02	05:31	05:52	501.369	498	29.6	4316	
032	K7S032	01-56.24	138-01.31	2000/12/02	08:32	08:51	502.039	510	29.6	4594	
033	K7S033	02-05.05	138-10.09	2000/12/02	11:35	11:52	500.774	508	29.4	4299	
034	K7S034	01-55.64	138-01.24	2000/12/02	14:35	14:51	505.766	507	29.5	4632	
035	K7S035	02-04.79	138-09.65	2000/12/02	17:30	17:52	502.155	513	29.5	4281	
036	K7S036	01-54.47	138-00.88	2000/12/02	20:31	20:51	500.724	503	29.5	4698	
037	K7S037	02-05.98	138-07.89	2000/12/02	23:35	00:08	1001.174	1005	29.5	4157	○
038	K7S038	02-00.03	138-00.98	2000/12/03	02:24	02:42	500.987	507	29.6	4301	
039	K7S039	01-59.89	138-10.64	2000/12/03	05:32	05:52	501.415	503	29.6	4088	
040	K7S040	01-59.58	138-01.30	2000/12/03	08:32	08:52	500.707	512	29.6	4334	

041	K7S041	02-00.78	138-10.95	2000/12/03	11:34	11:51	500.969	507	29.5	4136	
042	K7S042	01-55.02	138-11.92	2000/12/03	23:24	00:05	1000.906	1020	29.4	4369	○
043	K7S043	01-54.72	138-12.31	2000/12/04	05:36	05:55	502.146	499	29.4	4383	
044	K7S044	01-57.76	138-11.55	2000/12/04	11:32	11:55	501.588	507	29.4	4350	
045	K7S045	02-00.04	138-01.57	2000/12/04	14:36	14:55	501.219	504	29.4	4256	
046	K7S046	02-00.40	138-11.29	2000/12/04	17:34	17:50	500.285	505	29.4	4147	
047	K7S047	01-55.75	138-01.50	2000/12/04	20:35	20:51	501.234	507	29.4	4617	
048	K7S048	02-05.11	138-11.12	2000/12/04	23:24	23:59	1004.573	1008	29.4	4419	○
049	K7S049	01-54.97	138-04.40	2000/12/05	02:24	02:40	501.421	504	29.4	4587	
050	K7S050	02-05.29	138-09.74	2000/12/05	05:31	05:53	502.203	504	29.5	4299	
051	K7S051	01-54.93	138-02.01	2000/12/05	08:31	08:52	501.661	517	29.5	4658	
052	K7S052	02-04.49	138-11.22	2000/12/05	11:32	11:53	501.295	506	29.5	4348	
053	K7S053	01-55.56	138-00.96	2000/12/05	14:31	14:53	501.278	504	29.5	4642	
054	K7S054	02-05.15	138-06.57	2000/12/05	17:34	17:50	500.926	512	29.5	4166	
055	K7S055	01-55.06	138-05.67	2000/12/05	20:35	20:51	501.198	507	29.4	4541	
056	K7S056	01-59.97	138-07.56	2000/12/05	23:25	23:59	1000.973	1012	29.5	4326	○
057	K7S057	02-03.72	138-01.01	2000/12/06	02:22	02:39	501.975	507	29.6	4324	
058	K7S058	01-57.66	138-11.11	2000/12/06	05:31	05:52	501.416	505	29.7	4325	
059	K7S059	02-00.31	138-01.13	2000/12/06	08:31	08:54	500.098	508	30.0	4259	
060	K7S060	01-59.80	138-11.19	2000/12/06	11:30	11:52	501.77	507	29.7	4130	
061	K7S061	02-00.34	138-01.22	2000/12/06	14:32	14:53	501.88	501	29.7	4268	
062	K7S062	01-59.45	138-10.93	2000/12/06	17:35	17:52	501.727	502	29.6	4212	
063	K7S063	01-59.59	138-01.66	2000/12/06	20:36	20:53	501.918	498	29.6	4327	
064	K7S064	02-00.61	138-11.70	2000/12/6	23:25	23:59	1005.746	1007	29.7	4188	○
065	K7S065	02-02.05	138-02.13	2000/12/07	02:25	02:44	500.763	498	29.9	4229	
066	K7S066	01-55.69	138-05.69	2000/12/07	05:33	05:51	502.371	498	29.7	4510	
067	K7S067	02-05.07	138-09.32	2000/12/07	08:32	08:52	501.987	500	30.2	4265	
068	K7S068	01-56.66	138-01.76	2000/12/07	11:32	11:54	501.49	499	30.1	4533	
069	K7S069	02-02.53	138-11.52	2000/12/07	14:33	14:54	502	502	29.9	4298	
070	K7S070	01-58.27	138-01.48	2000/12/07	17:34	17:53	501.214	499	29.8	4415	
071	K7S071	02-02.77	138-11.44	2000/12/07	20:34	20:51	501.105	501	29.8	4279	
072	K7S072	01-56.84	138-01.02	2000/12/7	23:22	23:54	1001.737	1009	29.8	4568	○
073	K7S073	02-04.97	138-10.99	2000/12/08	02:22	02:37	501.341	499	29.9	4386	
074	K7S074	01-59.39	138-01.33	2000/12/08	05:32	05:52	502.02	499	30.5	4340	
075	K7S075	02-02.21	138-11.72	2000/12/08	08:33	08:55	502	499	30.1	4318	
076	K7S076	01-56.74	138-01.64	2000/12/08	11:33	11:55	501.466	499	30.2	4520	
077	K7S077	02-03.63	138-11.43	2000/12/08	14:32	14:54	501.118	504	29.9	4266	
078	K7S078	01-56.84	138-01.43	2000/12/08	17:35	17:51	500.485	506	29.9	4512	
079	K7S079	02-04.87	138-11.07	2000/12/08	20:32	20:47	501.613	500	29.8	4396	
080	K7S080	01-54.99	138-00.91	2000/12/8	23:22	23:55	1003.246	1010	29.9	4687	○
081	K7S081	02-04.91	138-08.72	2000/12/09	02:25	02:41	501.324	498	29.9	4213	
082	K7S082	01-54.94	138-02.30	2000/12/09	05:30	05:52	501.221	499	30.3	4651	
083	K7S083	02-05.33	138-11.30	2000/12/09	08:32	08:54	501.638	498	30.0	4510	
084	K7S084	01-54.90	138-01.66	2000/12/09	11:30	11:49	501.462	501	30.0	4678	
085	K7S085	02-05.18	138-11.79	2000/12/09	14:30	14:50	501.397	500	29.8	4544	

086	K7S086	01-55.36	138-01.16	2000/12/09	17:34	17:51	501.122	500	29.8	4654	
087	K7S087	02-05.22	138-10.09	2000/12/09	20:33	20:50	501.162	498	29.8	4308	
088	K7S088	01-55.28	138-01.01	2000/12/09	22:22	22:56	1001.662	997	29.9	4654	○
089	K7S089	02-05.25	138-09.30	2000/12/10	02:22	02:41	501.183	498	29.7	4264	
090	K7S090	01-57.95	138-01.10	2000/12/10	05:29	05:48	501.756	498	30.0	4391	
091	K7S091	02-02.19	138-11.78	2000/12/10	08:32	08:50	502.27	501	30.0	4330	
092	K7S092	01-57.59	138-01.47	2000/12/10	11:31	11:52	501.529	498	29.9	4420	
093	K7S093	02-02.31	138-11.36	2000/12/10	14:31	14:53	502.233	499	29.8	4288	
094	K7S094	01-58.61	138-01.48	2000/12/10	17:34	17:50	501.244	509	29.8	4417	
095	K7S095	02-01.28	138-11.55	2000/12/10	20:35	20:50	501.374	502	29.7	4186	
096	K7S096	01-58.10	138-01.24	2000/12/10	23:24	23:57	1000.664	1001	29.8	4415	○

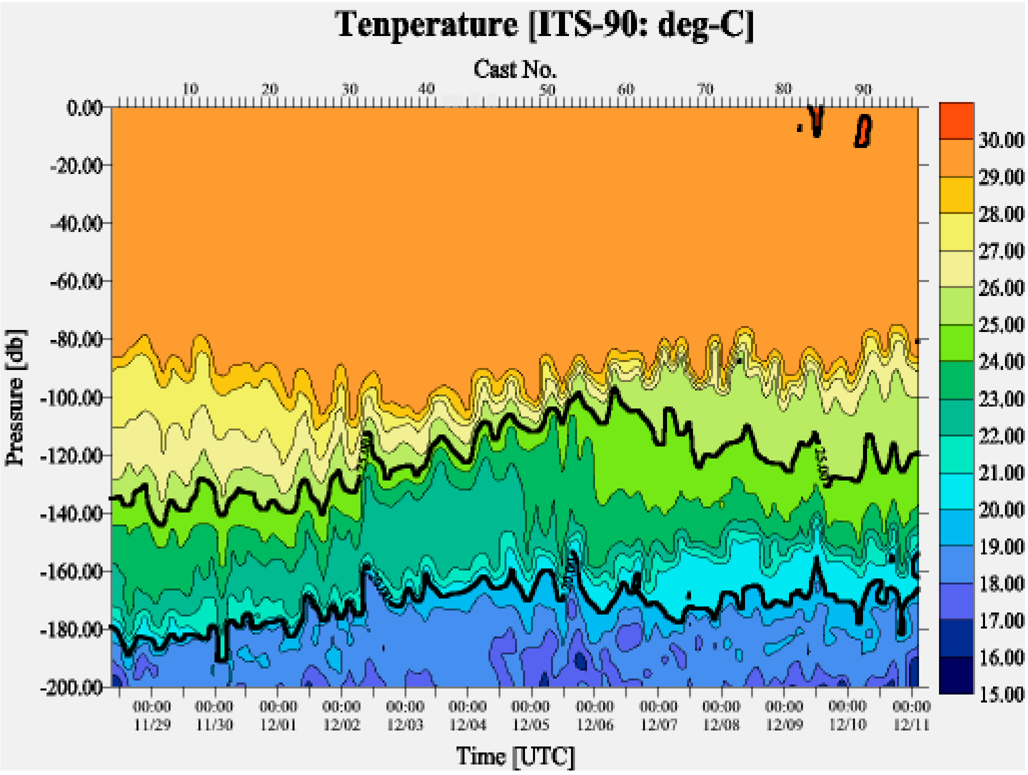

Fig 6.8.1-1: Temporal variations of the vertical profile of temperature

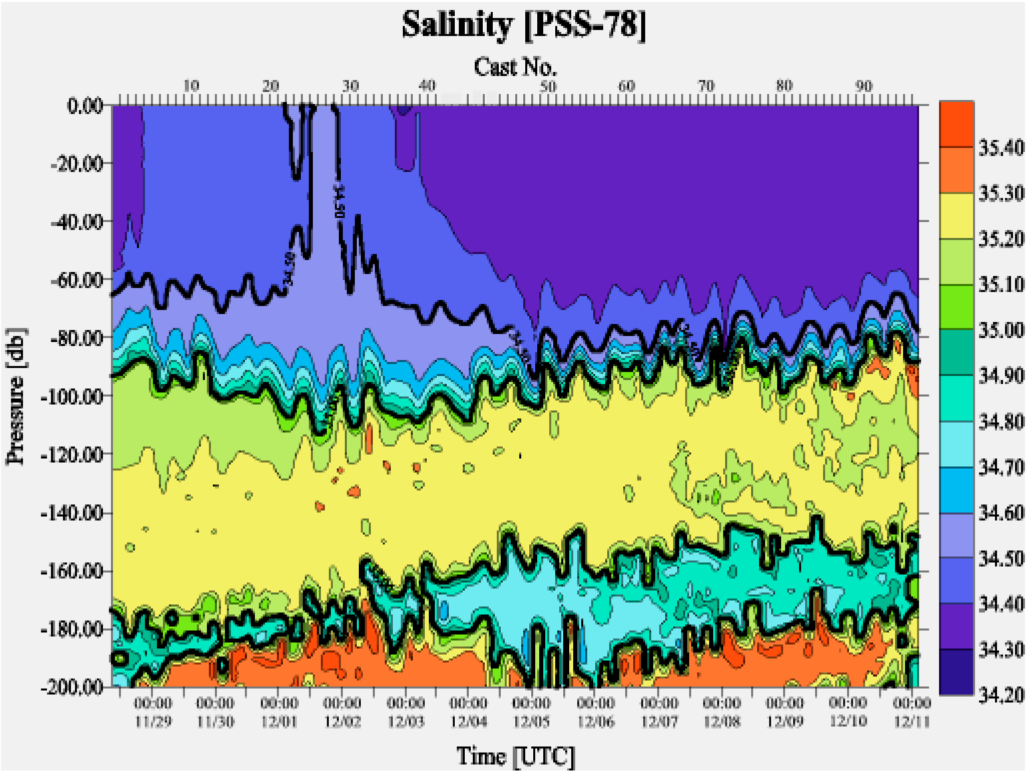

Fig 6.8.1-2: Temporal variations of the vertical profile of salinity

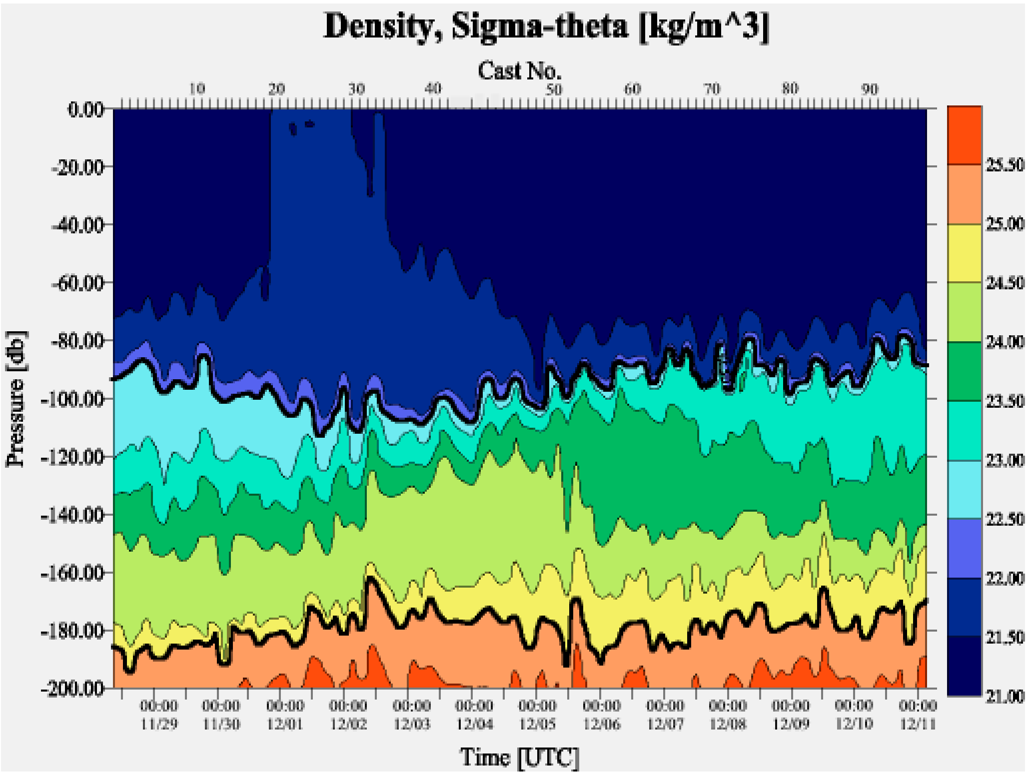

Fig 6.8.1-3: Temporal variations of the vertical profile of density (sigma-theta)

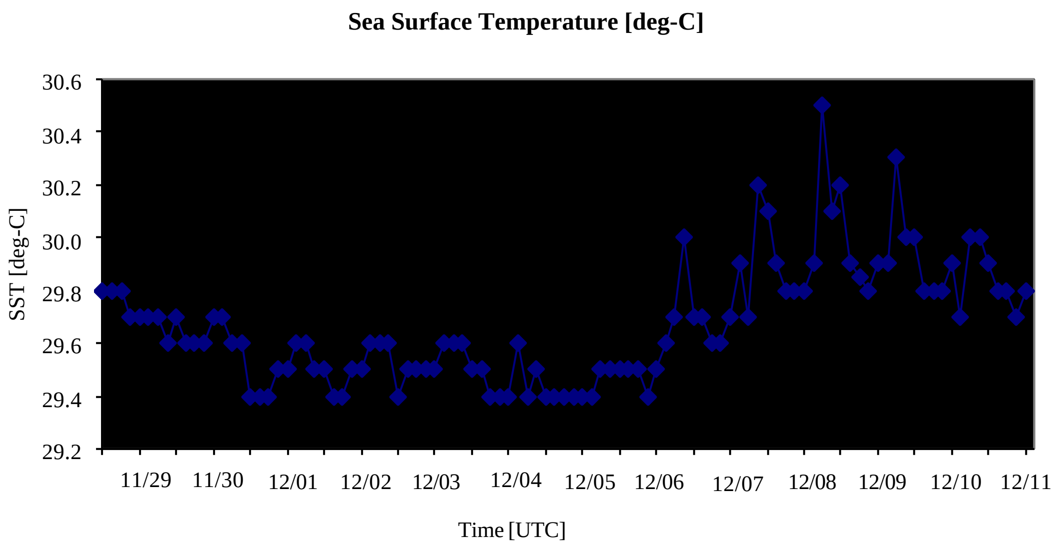

Fig. 6.8-4: Temporal variation of the sea surface temperature obtained from bucket water sampling.

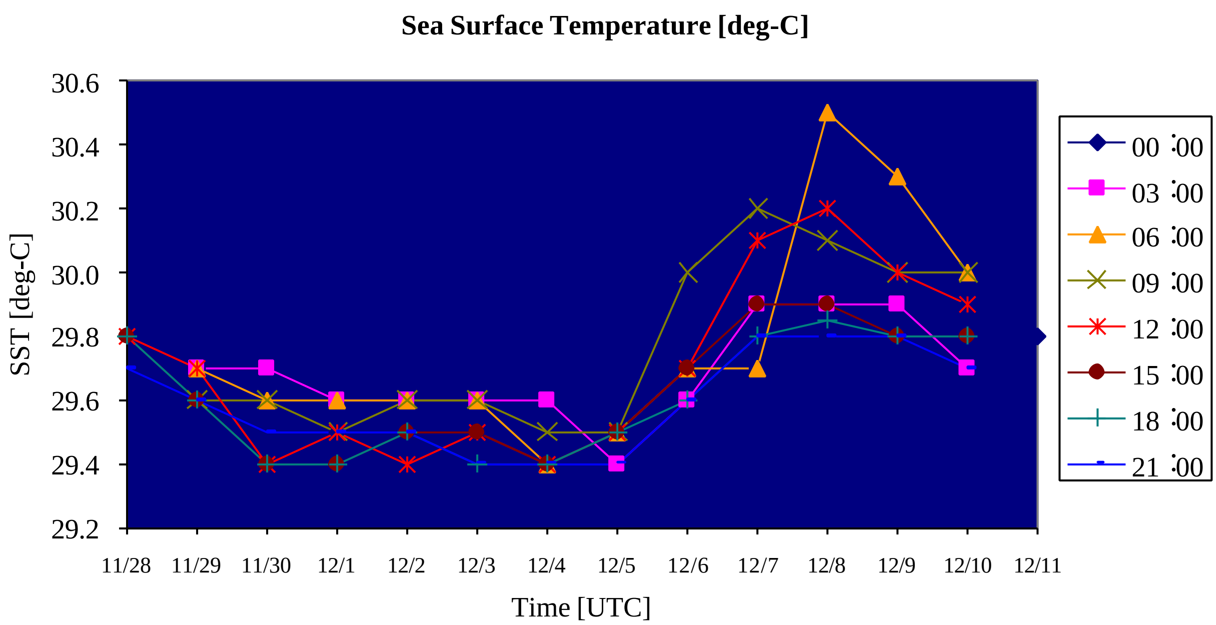

Fig. 6.8-5: Same as Fig. 6.8-4, but for each local time.

6.8.2 Salinity Measurements of Sampled Water

(1) Personal
Hirokatsu Uno (MWJ): Operation Leader
Asako Inoue (MWJ)

(2) Objectives
Calibration of the salinity data obtained by CTD.

(3) Methods

Salinity was measured by a Guildline Autosal salinometer model 8400B, which was modified by addition of an Ocean Science International peristalitic-type sample intake pump. A double conductivity ratio was defined as median of 31 times readings of the salinometer. Data collection started after 5 seconds and it took about 10 seconds to collect 31 reading by a personal computer.

Water sampling was done at CTD cast (00UTC) of the stationary station in 2N, 138E. The water sampling stratum was all 1000 m.

The salinometer was operated in the air-conditioned ship's laboratory at bath temperature of 24ºC. Room temperature varied from approximately 23.5ºC to 23.7ºC.

1. Salinity Sample Bottles
   The bottles in which the salinity samples are collected and stored are 250 ml brown glass bottles with screw caps.
2. Salinity Sample Collection and Temperature Equilibration
   Each bottle was rinsed three times with sample water and was filled to the shoulder of the bottle. Its cap was also thoroughly rinsed. Salinity samples were stored more than 24 hours in same laboratory were the salinity measurement was made.
3. Standardization
   Autosal model 8400B was standardized before and after sequence of measurements by use of IAPSO Standard Seawater batch P137 (conductivity ratios were 0.99990).
4. Sub-Standard Seawater
   We also used sub-standard seawater which was deep-sea water filtered by pore
   Size of 0.45 micrometer and stored in a 20 liter cubical made of polyethylene and stirred for at least 24 hours before measuring. It was measured every 8 samples in older to check the drift.

(4) Preliminary results

The preliminary results are shown in Table 6.8.2. Standard deviation of difference of salinity for sample water taken from Niskin bottles is 0.0011.

(5) Data archive

The data of sample measured and worksheets of calculation of salinity concentration were stored on floppy disks. All data will be submitted to JAMSTEC Data Management Office (DMO) and under its control.

Table 6.8.2-1: Difference of salinity data between CTD and sampled water

Cast	File Name	Depth(m)	Sal.(psu)				Avg.	CTD Sal	Difference
5	K7S005	1000	34.5502	34.5506	34.5504	34.5508	34.5505	34.5514	0.0009
13	K7S013	1000	34.5510	34.5510			34.5510	34.5508	-0.0002
21	K7S021	1000	34.5520	34.5518	34.5518		34.5518	34.5520	0.0002
29	K7S029	1000	34.5527	34.5529	34.5531	34.5533	34.5530	34.5535	0.0005
37	K7S037	1000	34.5527	34.5531	34.5529	34.5533	34.5530	34.5545	0.0015
42	K7S042	1000	34.5517	34.5514	34.5517		34.5516	34.5523	0.0007
48	K7S048	1000	34.5531	34.5533	34.5498	34.5498	34.5515	34.5548	0.0033
56	K7S056	1000	34.5525	34.5522	34.5498	34.5498	34.5511	34.5529	0.0018
64	K7S064	1000	34.5500	34.5500			34.5500	34.5507	0.0007
72	K7S072	1000	34.5512	34.5514	34.5510		34.5512	34.5535	0.0023
80	K7S080	1000	34.5494	34.5492	34.5496		34.5494	34.5510	0.0016
88	K7S088	1000	34.5490	34.5490	34.5486		34.5489	34.5509	0.0020
96	K7S096	1000	34.5453	34.5453	34.5451		34.5452	34.5483	0.0031
								Avg.=	0.0014
								Std=	0.0011

6.9 Shipboard ADCP observation

(1) Personnel

Masaki Hanyu (GODI): Operation Leader
Kiyotake Kouzuma (GODI)
Souichiro Sueyoshi (GODI)

(2) Objectives

The ocean current profiles are measured for the use of large fields of oceanography, as the basic dataset.

(3) Methods

We measured current profiles by VM-75 (RD Instruments Inc., U.S.A.) shipboard ADCP (Acoustic Doppler Current Profiler) from 27 November 2000 to 20 December 2000. The N-S (North-South) and E-W (East-West) velocity components of each depth cell [cm/s], and echo intensity of each depth cell [dB] are measured.

Major parameters for the measurement configuration are as follows:

Frequency:	75 kHz
Average:	every 300 sec
Depth cell length:	1600cm
Number of depth cells:	40
First depth cell position:	30.9m
Last depth cell position:	654.9m
ADCP ensemble time:	32.4 sec
Ping per ADCP raw data:	16

(4) Preliminary Results

Fig.6.9-1, 2 shows time series of current velocity component profile during the IOP. Fig.6.9-3 shows time series of current velocity vector profile during the IOP.

(5) Data Archive

ADCP data obtained in this cruise will be submitted to the DMO (Data Management Office), JAMSTEC and will be under their control.

(6) Remarks

ADCP frequently stopped from the start of the leg to 7 December because of trouble on deck unit cooling fan. We used Navigation-track data to convert from RAW data to RDI-ASCII data.

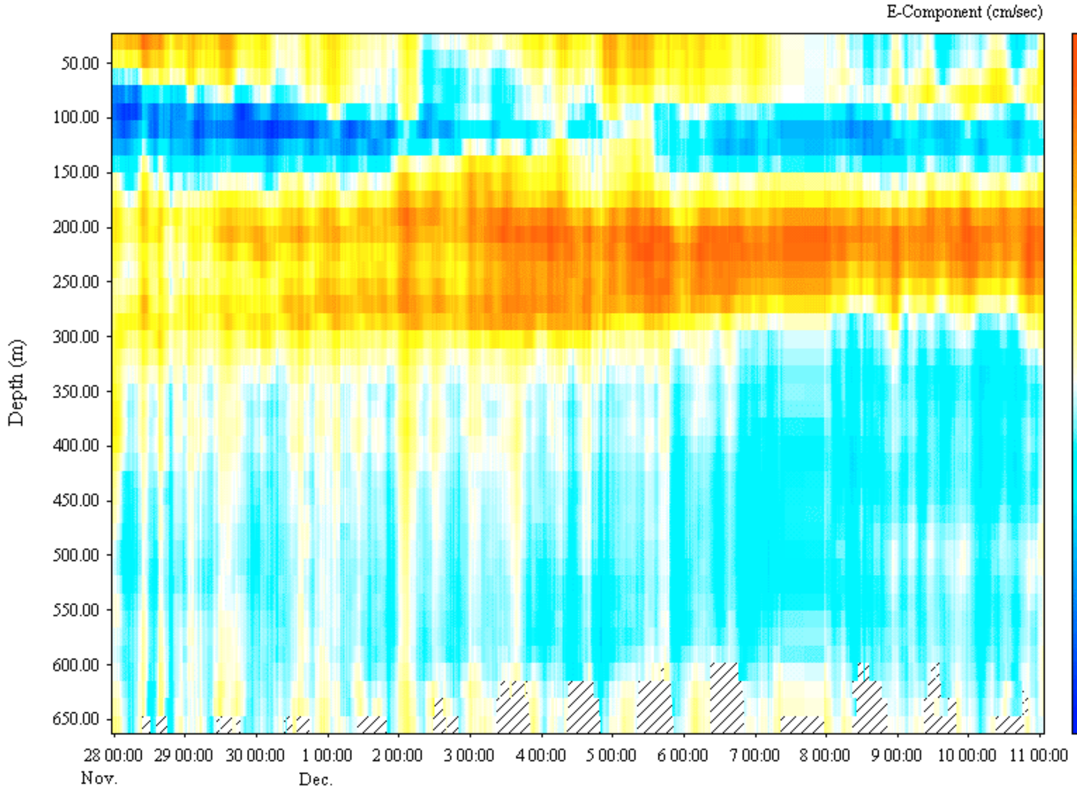

Fig. 6.9-1 Time-depth current velocity component (E-W) during the IOP

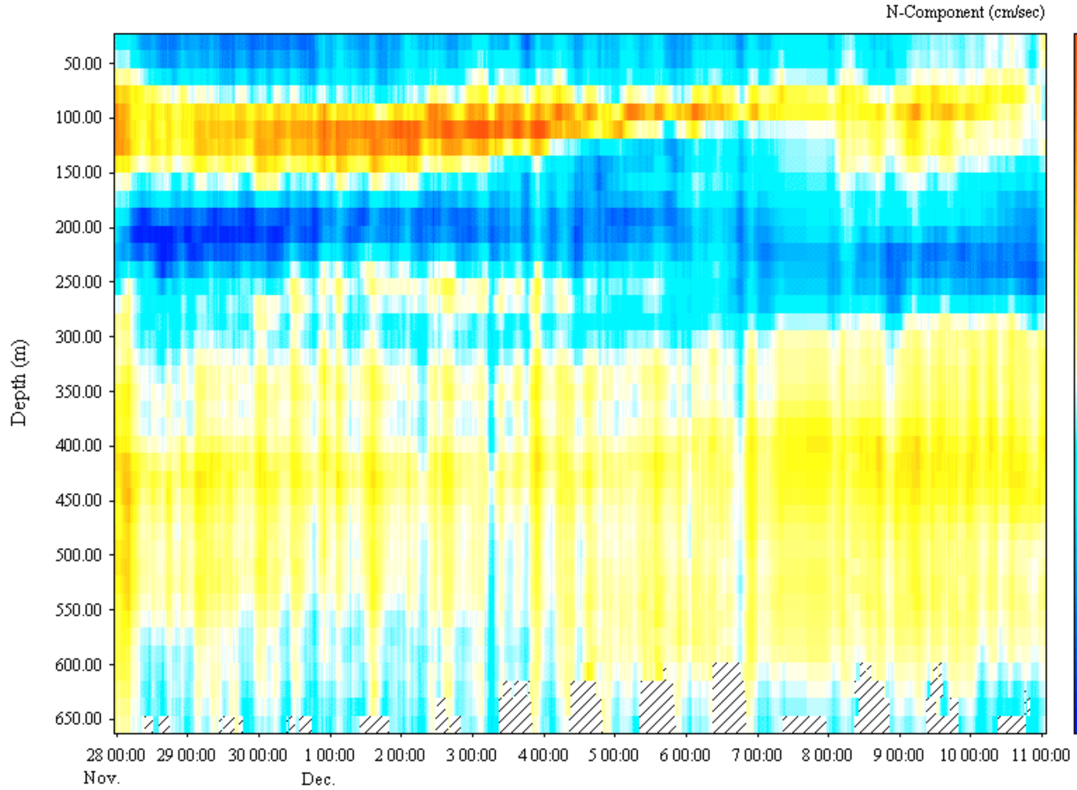

Fig.6.9-2 Time-depth current velocity component (N-S) during the IOP

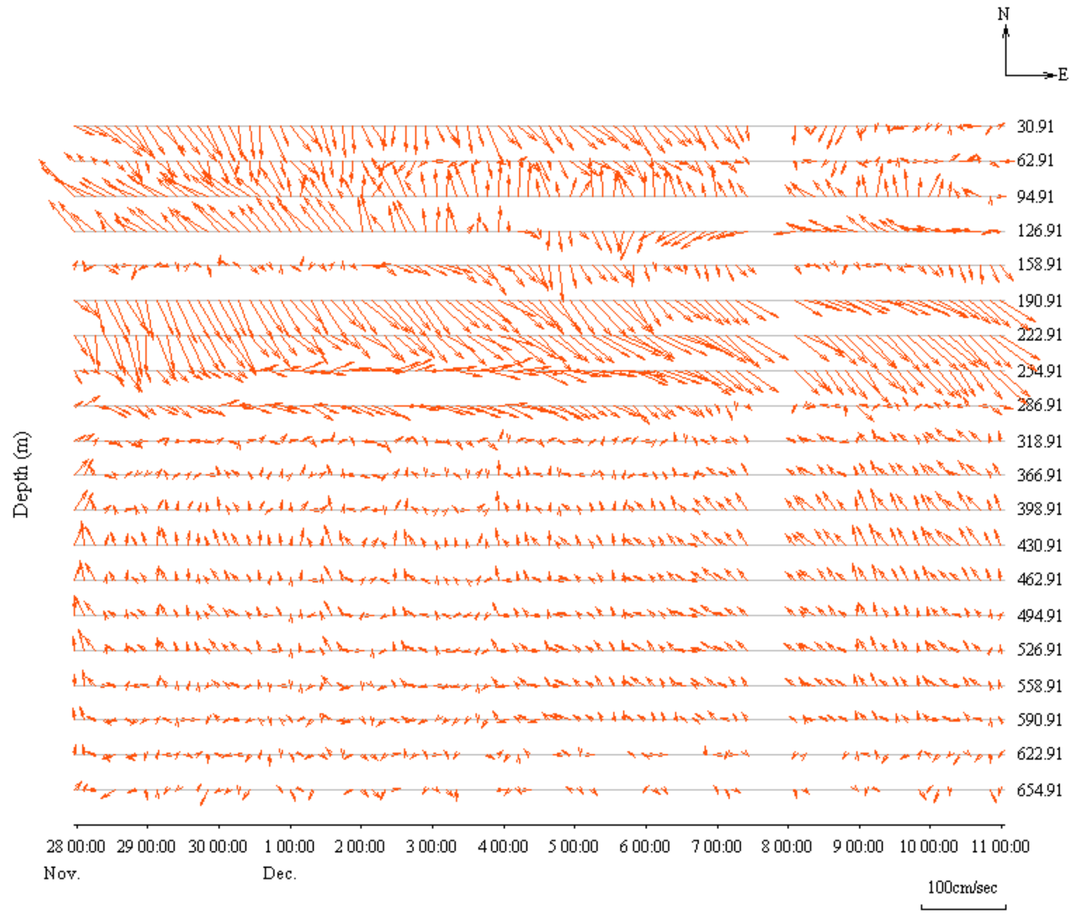

Fig.6.9-3 Time-depth current velocity vectors during the IOP

6.10 Sea surface water monitoring

(1) Personnel

Takayoshi SEIKE (Marine Works Japan LTD)

(2) Objectives

In order to measure sea surface temperature, salinity, dissolved oxygen and fluorescence along the ship's track with integrated monitoring system of surface seawater.

(3) Methods

This system can measure temperature, salinity, dissolved oxygen, fluorescence and particle size of surface water continuously on real time. It set in the sea surface monitoring laboratory on this ship. Sea surface water is pumped up to the laboratory and flowed through a vinyl-chloride pipe. The flow rate is controlled by several valves.

This system is connected to shipboard LAN-system. Measured data is stored in a hard disk of computer every one minute.

The measured duration is from 27 November to 20 December, 2000. The flow rate is measured with two flow meters and each values were checked everyday.

Specifications of the sensors were listed below.

a) Temperature and Salinity sensor

SEACAT THERMOSALINOGRAPH
Model: SBE-21, SEA-BIRD ELECTRONICS, INC.
Serial number: 2113117-2175
(Temperature sensor is first, Salinity is second)
Measurement range: -5 to +35℃, 0 to 6.5 S m^{-1}
Accuracy: 0.01 ℃ $6month^{-1}$, 0.001 S m^{-1} $month^{-1}$
Resolution: 0.001℃, 0.0001 S m^{-1}

b) Dissolved Oxygen sensor

Model: 2127, Oubisufair Laboratories Japan INC.
Serial number: 31757
Measurement range: 0 to 14 ppm
Accuracy: ±1% at 5 ℃ of correction range
Stability: 1% $month^{-1}$

c) Fluorometer

Model: 10-AU-005, TURNER DESIGNS
Serial number: 5562 FRXX
Detection limit: 5 ppt or less for chlorophyl a
Stability: 0.5% $month^{-1}$ of full scale

d) Particle Size sensor

Model: P-05, Nippon Kaiyo LTD.
Serial number: P5024
Measurement range: 0.02681 mmt to 6.666 mm

Accuracy: ±10% of range

Reproducibility: ±5%

Stability: 5% $week^{-1}$

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}

(4) Preliminary results

Preliminary data of salinity, temperature, fluorescence and dissolved oxygen at sea surface between 28 Nov. and 11 Dec. [UTC] are shown in Figs. 6.10-1 to 6.10-4. They show the respective trend of salinity, temperature, fluorescence and dissolved oxygen distributions on the ship's track every ten minutes (average). Fig. 6.10-1 is the figure of salinity. Fig. 6.10-2 is the figure of temperature (RMT). Fig. 6.10-3 is the figure of fluorescence. Fig. 6.10-4 is the figure of dissolved oxygen.

(5) Data archive

The data were stored on a magnetic optical disk, which will be kept in Ocean Research Department, JAMSTEC.

(6) Remarks

The instruments are in maintenance for the following two periods.

<1> Dec.01, 17:36 - 18:53

<2> Dec.08, 19:37 - 21:11

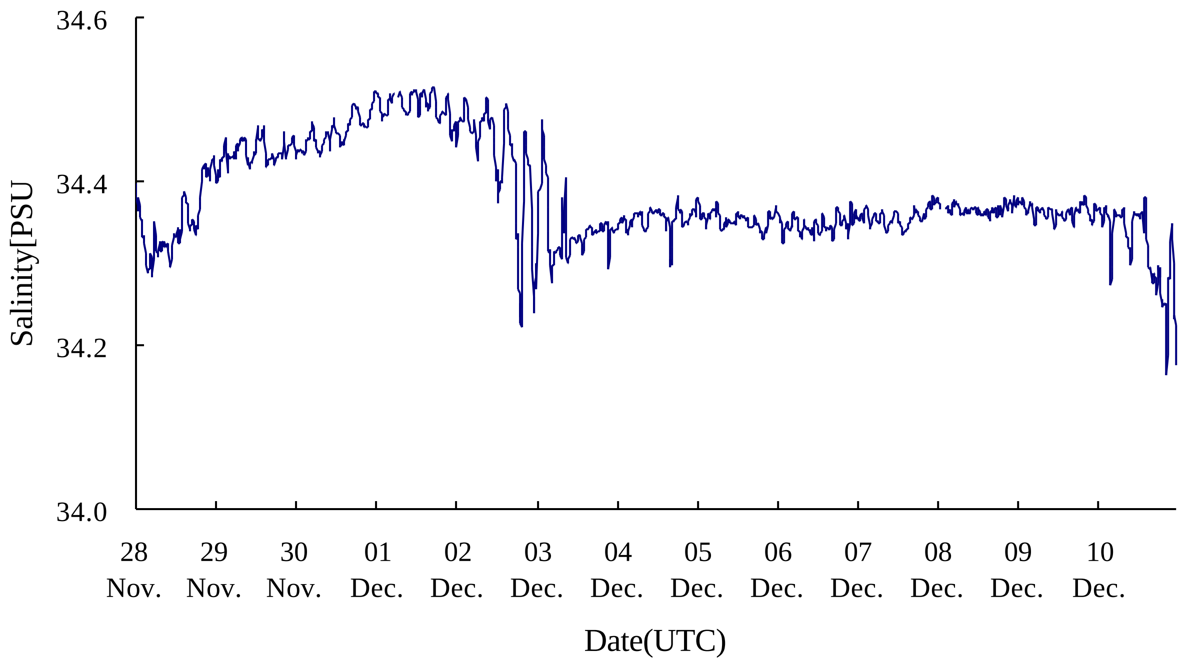

Fig. 6.10-1: Temporal variation of the salinity.

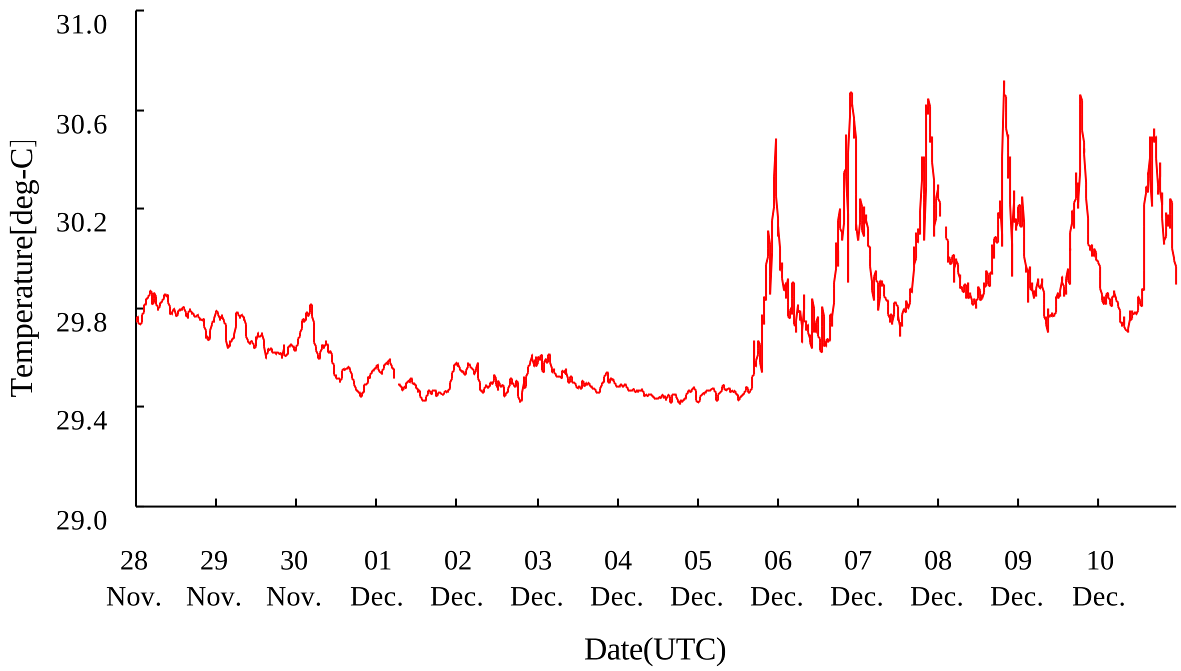

Fig. 6.10-2: Temporal variation of the temperature.

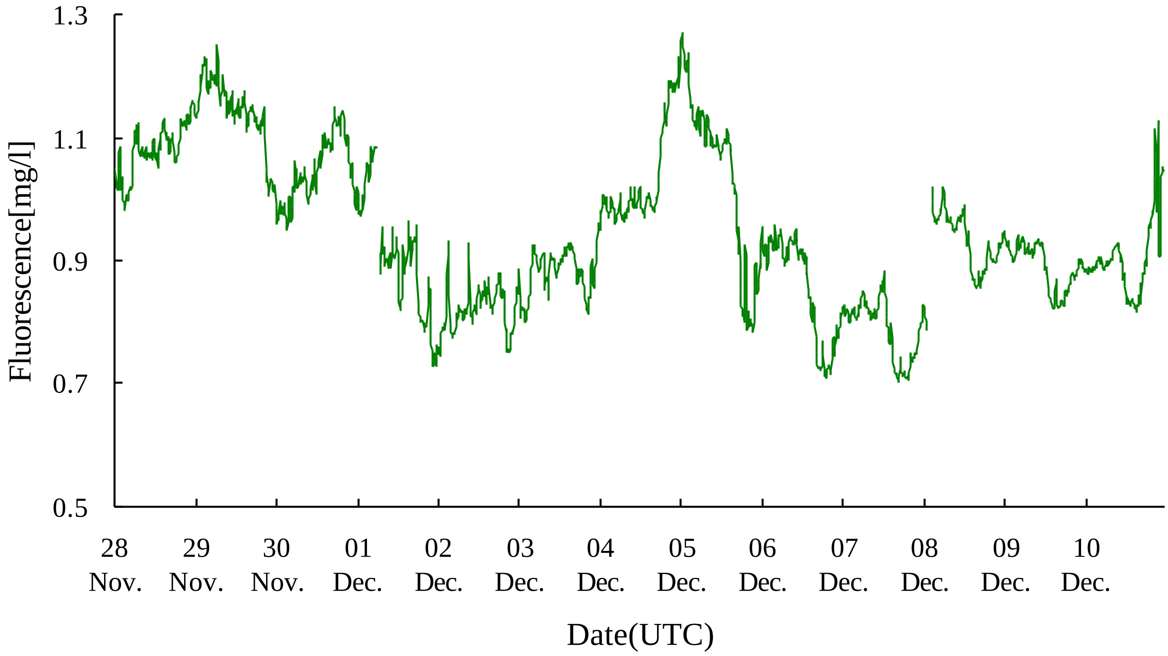

Fig. 6.10-3: Temporal variation of the fluorescence.

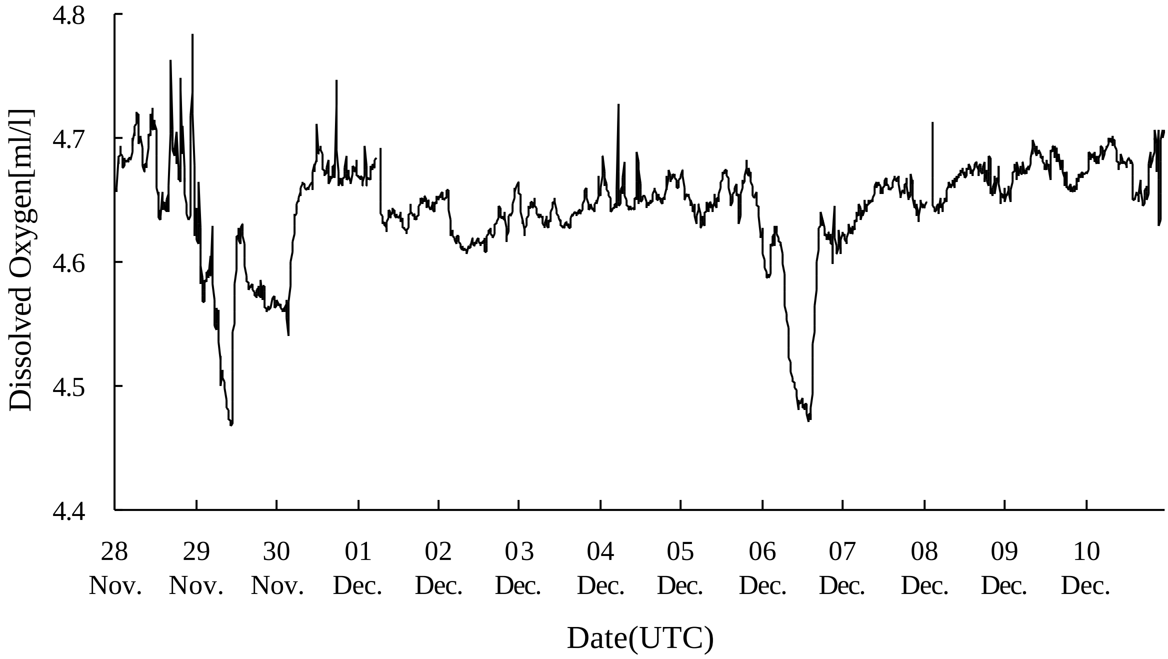

Fig. 6.10-4: Temporal variation of the dissolved oxygen.

6.11 Underway geophysical observation

(1) Personnel

Masaki Hanyu (GODI): Operation Leader
Kiyotake Kouzuma (GODI)
Souichiro Sueyoshi (GODI)

(2) Objectives

The spatial and temporal variation of the parameters at / below the sea bottom --- gravity, magnetic force and sea bottom depth --- are basic data for the many fields of geophysics. However, the chance to measure these parameters is rare. The observation in this cruise is carried out to accumulate these data to fill the basic dataset of the geophysics.

(3) Methods

Bathymetry data was obtained by using SeaBeam2112.004 (SeaBeam, Inc., USA) 12kHz multi-narrow beam echo sounding system. The sea surface gravity was obtained by S-116 (LaCoste-Romberg, U.S.A.) onboard gravity meter. The surface magnetic force was obtained by three-axis fluxgate magnetometer (Tierra Tecnica, Japan) at 8 Hz sampling rate.

All of these observations were carried out from 28 November 2000 to 19 December 2000, in the open seas, Japanese EEZ and Japansese territorial seas.

(4) Preliminary results

The results will be public after the analyses in future.

(5) Data archives

The dataset obtained in this cruise will be submitted to the DMO (Data Management Office), JAMSTEC and will be archived there.