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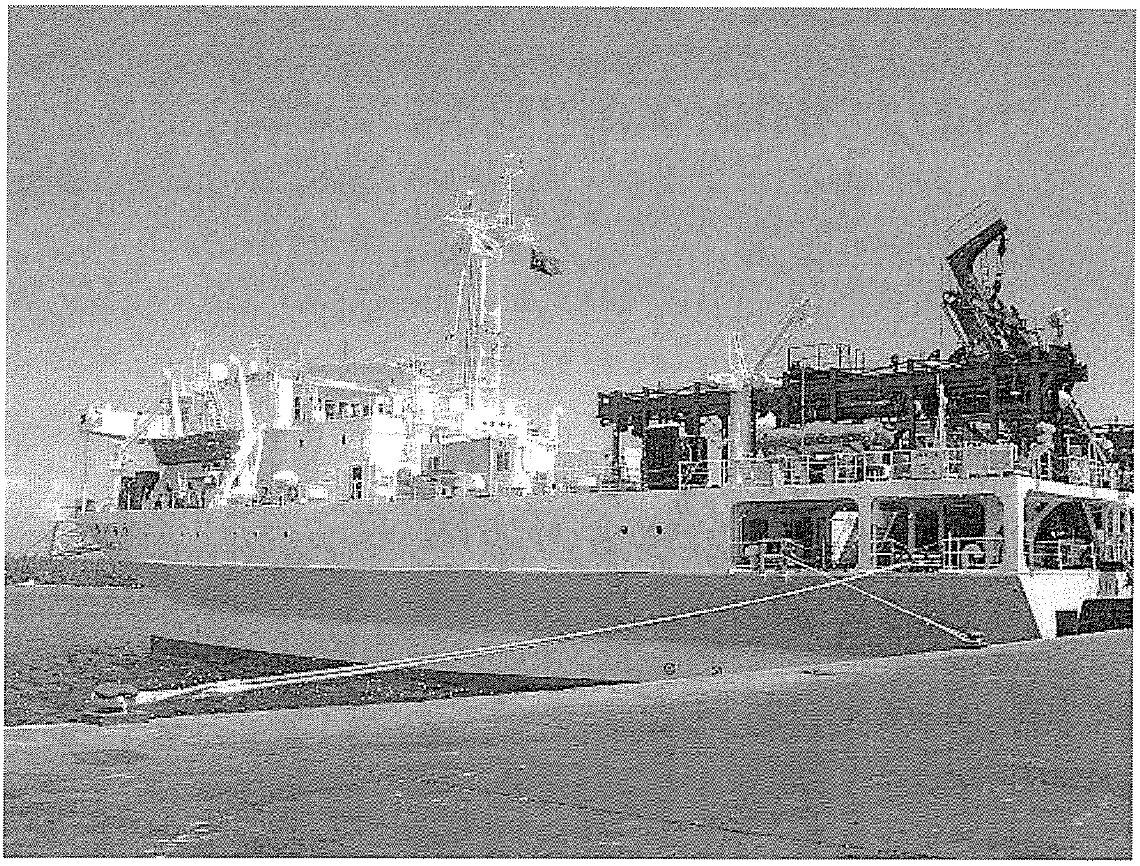
Tropical Ocean Climate Study
TOCS



KY02-10 Cruise Report

September 30, 2002 – October 31, 2002

Japan Marine Science and Technology Center(JAMSTEC)

TOCS KY02-10 Cruise Report

1. Cruise Summary

Ship : R/V KAIYO
Chief Investigator : Leg.1: Hideaki Hase (JAMSTEC)
Leg.2: Shinya Minato (JAMSTEC)
Cruise Code : KY02-10
Project Title : Tropical Ocean Climate Study
Period : September 30, 2002 – October 31, 2002
Ports of call : Yokosuka (Japan)
Kavieng (Papua New Guinea)
Koror (Republic of Palau)
Institute : JAMSTEC (Japan Marine Science and Technology Center)
MWJ (Marine Work Japan Co. LTD)
NME (Nippon Marine Enterprise Co. LTD)
BPPT (Badan Pengkajian dan Penerpan Teknologi, Indonesia)
NWS (PNG National Weather Service, Papua New Guinea)

Purpose:

The purpose of this cruise is to observe currents, temperature, salinity etc., in the western equatorial Pacific to understand the ENSO (El Nino/Southern Oscillation) phenomena. The reason for investigating in the region is that the El Nino is occurred with migration of the warm water pool in the western equatorial Pacific. To investigate this mechanism, variability of the warm water pool is focused in this study. TRITON and ADCP moorings are the key instruments for this investigation and they have to be maintained to continue observation, therefore TRITON buoys check and deployment/recovery of ADCP mooring are main works during this cruise.

Observation Summery:

(Leg 1: Yokosuka-Kavieng)

* 1 ADCP mooring at (0,156E) was recovered and re-installed.
* 4 TRITON buoys were checked at (8N,156E), (5N,156E), (2N,156E) and (0,156E).
* 14 ARGO floats were deployed along cruise track from (29N,148E) to (5N,156E).
* 6 CTD casts using SBE 911 plus were conducted near TRITON buoys and at ARGO floats cast to check temperature and salinity values derived from CT sensors of the TRITON buoys and ARGO floats.
* 18 XCTD casts were conducted to measure vertical profiles of temperature and salinity
* Sea water at 1000m depth were sampled by Niskin bottles at CTD casts to check value of conductivity sensor of CTD
* Current along the cruise track was measured by a shipboard ADCP from 30m to 1000m depth

(Leg 2: Kavieng-Koror)

* 7 TRITON buoys were checked at (5N,147E), (2N,147E), (0,147E), (0,138E), (2N138E), (5N,137E) and (8N,137E).
* 4 ADCP moorings at (0,147E), (2.5S,142E), (0,138E) and (2N,138E) were recovered and 3 ADCP moorings were deployed at (0,147E), (2.5S,142E) and (2N,138E)
* 16 CTD casts were conducted near to check temperature, salinity values derived from CT sensors of the TRITON buoys along 142E/138E and to observe water masses along these lines
* Sea water at 1000m depth were sampled by Niskin bottles at CTD casts to check conductivity sensor of CTD along 142E/138E lines.

- * 14 XCTD casts were conducted to measure vertical profiles of temperature and salinity
- * Current along the cruise track was measured by a shipboard ADCP from 30m to 1000m depth

Preliminary Results:

The main purpose of this Kaiyo cruise (KY02-10) was to recover and deploy ADCP moorings, check TRITON buoys and launch Argo floats. But influence of typhoon, the ship had to stay in Tokyo bay for two days and some plan of Leg.1 was changed because of lack of ship time. One was that Launching points of Argo floats were changed from along 156E line to along passage to the first TRITON point. Another was that Two TRITON buoys check (2N, 5N 156E) and some CTD/XCTD observations were omitted. In Leg.2, weather and ocean conditions were fine, so planned observations/works were almost carried out except for CTD observations change to XCTD in some points because of some troubles.

Recovery and deployment of ADCP moorings almost did well. But some troubles were occurred in recovered ADCP and CTD records/instruments. The data and those works in detail will be informed later.

TRITON buoys checks were carried out to check buoys, weather sensors and ARGOS messages. Some troubles were found on some TRITON buoys, such as broken wind/humidity sensors and frames. But there was no fatal damage on all buoys/sensors.

Argo floats launched in Leg.1. The first plan is to launch 16 floats at 10 points, but two of all floats were stopped to launch. One is at (5N,156E) because of instruction from director of Argo group. Another is at (4N,156E) because starting of the float could not be confirmed. CTD/XCTD observations for calibration of CT sensors were carried out at all launching points. At this point in time (Oct. 30, 2002), it is informed that almost all floats that have been launched are observing normally.

Hydrographic measurements were carried out by CTD and XCTD observations, and some interesting results were found. During this cruise, El nino event was on set. Correspondently, warm water in western Pacific seemed less than usual situation in temperature distributions along all observing lines. Also, surface salinity around equatorial region is higher than in La nina condition (1998-2001), these results indicate moving warm water in the western Pacific to the east.

Shipboard ADCP observation was carried out through this cruise. The result for it is that eastward current was seen in the western Pacific broadly at shallower layers. This may be caused by strong westerly wind for several months. And also, equatorial under current was weakened and unclear, this may be caused by El nino on set time.

Acknowledgments:

We would like to express special thanks to Captain K. Hasegawa and crew of R/V Kaiyo. During the cruise, technicians of Marine Work Japan Co. Ltd. and Nihon Marine Enterprise Co. Ltd., participated in this cruise and helpfully supported us.

This cruise was conducted under the Tropical Ocean Climate Study (TOCS) project. We thank our colleagues of JAMSTEC for their efforts in conducting this cruise.

To get the clearances from Indonesia, Micronesia, Papua New Guinea, and Republic of Palau, many persons in these countries and of Japanese Government worked. We would also like to say thanks for their works.

2. Time table of TOCS KY02-10 Cruise

Sep. 30 (Mon.)

13:00	Departure from Yokosuka (Leg.1)
14:00-14:45	Briefing for safety life on the ship
15:00-16:00	Boat drill
16:45-17:00	Konpira-san

Oct. 1 (Tue.)

	Staying in Tokyo bay

Oct. 2 (Wed.)

	Cruise to (29N, 148E)
21:00	Ship mean time adjustment (SMT=UTC+9h->+9h30m)

Oct. 3 (Thu.)

	Cruise to (29N, 148E)
21:00	Ship mean time adjustment (SMT=UTC+9h30m->+10h)

Oct. 4 (Fri.)

13:45-15:55	Free fall of CTD wire at (29-01.52N, 147-59.39E)
16:16-17:39	CTD and water sampling at C01 (29-00.28N, 148-00.06E), down to 2000m
18:01	Argo float (1) launching at (28-59.23N, 148-00.93E)
18:09	Argo float (2) launching at (28-59.14N, 148-01.07E)
18:19	Argo float (3) launching at (28-59.06N, 148-01.23E)
18:27	Argo float (4) launching at (28-58.96N, 148-01.40E)

Oct. 5 (Sat.)

05:42-07:03	CTD and water sampling at C02 (26-46.11N, 148-54.66E), down to 2000m
07:13	Argo float (5) launching at (26-46.08N, 148-55.06E)
07:23	Argo float (6) launching at (26-46.10N, 148-55.15E)
07:28	Argo float (7) launching at (26-46.12N, 148-55.19E)
17:02	Argo float (8) launching at (25-00.07N, 149-36.93E)
17:09	XCTD at X01 (24.59.80N, 149-37.18E)

Oct. 6 (Sun.)

09:13	Argo float (9) launching at (22-00.21N, 150-46.95E)
09:20	XCTD at X02 (22-00.12N, 150-47.00E)
23:56	Argo float (10) launching at (19-20.07N, 151-48.12E)

Oct. 7 (Mon.)

00:04	XCTD at X03 (19-19.88N, 151-48.20E)
12:53	Argo float (11) launching at (17-00.08N, 152-41.97E)
13:01	XCTD at X04 (16-59.87N, 152-42.03E)

Oct. 8 (Tue.)

11:23	Argo float (12) launching at (12-59.91N, 154-11.87E)
11:32	XCTD at X05 (12-59.68N, 154-11.93E)

Oct. 9 (Wed.)

	Cruise to (8N, 156E)

Oct. 10 (Thu.)

08:00-08:50	TRITON buoy check (8N, 156E)
09:17	Argo float (13) launching at (08-00.06N, 155-57.59E)
09:30	XCTD at X06 (07-59.93N, 155-57.58E)
12:32	XCTD at X07 (07-29.77N, 156-00.03E)
15:30	XCTD at X08 (06-59.88N, 155-59.99E)
18:15	XCTD at X09 (06-29.92N, 156-00.00E)
21:00	XCTD at X10 (05-59.96N, 156-00.00E)
23:52	XCTD at X11 (05-27.56N, 155-59.99E)

Oct. 11 (Fri.)

08:31-09:58	CTD and water sampling at C03 (04-57.55N, 156-05.59E), down to 2000m
10:10	Argo float (14) launching at (04-57.44N, 156-05.25E)
10:30-10:45	TRITON buoy check (5N, 156E)
13:18	XCTD at X12 (04-29.99N, 156-00.00E)
15:55-17:09	CTD and water sampling at C04 (04-00.06N, 156-00.15E), down to

2000m

20:03 XCTD at X13 (03-29.96N, 156-00.00E)

22:20 XCTD at X14 (02-59.97N, 155-59.59E)

Oct. 12 (Sat.)

00:37 XCTD at X15 (02-29.78N, 156-00.00E)

08:32-09:18 CTD and water sampling at C05 (01-54.73N, 155-58.28E), down to 1000m

09:30-09:45 TRITON buoy check (2N, 156E)

11:52 XCTD at X16 (01-29.99N, 156-00.00E)

14:22 XCTD at X17 (00-58.76N, 155-59.99E)

16:44 XCTD at X18 (00-30.01N, 156-00.00E)

Oct. 13 (Sun.)

08:00-10:53 Recovery of ADCP mooring at (0, 156E)

13:39-15:00 Deployment of ADCP mooring at (0, 156E)

17:00-17:20 TRITON buoy check (0, 156E)

19:21-20:03 CTD and water sampling at C06 (00-01.52S, 155-58.39E), down to 1000m

Oct. 14 (Mon.)

Cruise to Kavieng

Oct. 15 (Tue.)

09:10 Arrival at Kavieng, Papua New Guinea

Oct. 16 (Wed.)

Oct. 17 (Thu.)

09:00 Departure from Kavieng

13:00-14:00 Meeting for Leg.2

Oct. 18 (Fri.)

Cruise to (5N, 147E)

Oct. 19 (Sat.)

08:22-09:19 CTD and water sampling at C07 (05-22.01N, 146-55.87E), down to

	1000m
09:30-09:55	TRITON buoy check (5N, 147E)
12:35	XCTD at X19 (04-29.99N, 146-59.99E)
15:05	XCTD at X20 (03-59.99N, 146-59.99E)
17:35	XCTD at X21 (03-29.98N, 146-59.99E)
20:06	XCTD at X22 (02-59.64N, 146-59.99E)
22:40	XCTD at X23 (02-29.93N, 146-59.99E)

Oct. 20 (Sun.)

08:24-09:02	CTD and water sampling at C08 (01-59.43N, 147-02.21E), down to 1000m
09:15-09:30	TRITON buoy check (2N, 147E)
12:18	XCTD at X24 (01-29.98N, 147-00.21E)
14:53	XCTD at X25 (00-59.98N, 147-00.00E)
17:30	XCTD at X26 (00-29.68N, 147-00.00E)

Oct. 21 (Mon.)

08:01-11:22	Recovery of ADCP mooring at (0, 147E)
13:41-15:15	Deployment of ADCP mooring at (0, 147E)
16:44-17:20	CTD and water sampling at C09 (00-01.04N, 147-01.15E), down to 1000m
17:30-17:55	TRITON buoy check at (0, 147E)

Oct. 22 (Tue.)

	Cruise to (2.5S, 142E)

Oct. 23 (Wed.)

06:57-09:30	Recovery of ADCP mooring at (2.5S, 142E)
12:33-13:53	Deployment of ADCP mooring at (2.5S, 142E)
15:18-16:11	CTD and water sampling at C10 (02-29.52S, 141-57.76E), down to 1000m
17:28	XCTD at X27 (02-42.04S, 142-00.01E)
21:03	XCTD at X28 (01-59.98S, 142-00.01E)
23:30	XCTD at X29 (01-29.96S, 141-59.99E)

Oct. 24 (Thu.)

02:03	XCTD at X30 (00-59.93S, 142-00.00E)
04:35	XCTD at X31 (00-30.01S, 142-00.01E)
07:20-08:15	CTD and water sampling at C11 (00-00.06S, 142-00.04E), down to 1000m

Oct. 25 (Fri.)

07:00-07:54	CTD and water sampling at C12 (01-15.15S, 138-00.01E), down to 1000m
10:38-11:28	CTD and water sampling at C13 (01-00.08S, 138-00.06E), down to 1000m
13:49	XCTD at X32 (00-30.31S, 138-00.00E)
16:33-17:20	CTD and water sampling at C14 (00-01.14N, 137-53.31E), down to 1000m
17:25-17:45	TRITON buoy check at (0, 138E)
20:49	XCTD at X33 (00-30.01N, 138-00.00E)

Oct. 26 (Sat.)

06:57-10:11	Recovery of ADCP mooring at (0, 138E)
13:00-14:12	Deployment of ADCP mooring at (0, 138E)
20:37-21:32	CTD and water sampling at C15 (00-59.95N, 138-00.00E), down to 1000m

Oct. 27 (Sun.)

00:04	XCTD at X34 (01-29.94N, 137-59.99E)
07:55-10:41	Recovery of ADCP mooring at (2N, 138E)
11:30-12:13	CTD and water sampling at C16 (01-58.91N, 138-06.48E), down to 1000m
12:25-12:30	TRITON buoy check at (2N, 138E)
15:44	XCTD at X35 (02-30.00N, 138-00.00E)
18:17-19:04	CTD and water sampling at C17 (02-59.97N, 137-59.93E), down to 1000m
21:33	XCTD at X36 (03-29.99N, 137-59.99E)

Oct. 28 (Mon.)

00:06-00:57	CTD and water sampling at C18 (03-59.96N, 137.59.95E), down to 1000m

04:24	XCTD at X37 (04-30.58N, 13734.64E)
08:24-09:11	CTD and water sampling at C19 (04-51.57N, 137-17.02E), down to 1000m
09:15-09:23	TRITON buoy check (04-51N, 137-17E)
12:56	XCTD at X38 (05-30.01N, 137-00.00E)
15:29-16-16	CTD and water sampling at C20 (05-59.91N, 136-59.87E), down to 1000m
18:46	XCTD at X39 (06-30.00N, 137-00.00E)
21:18-22:11	CTD and water sampling at C21 (07-00.02N, 136-59.97E), down to 1000m

Oct. 29 (Tue.)

00:39	XCTD at X40 (07-29.99N, 137-00.00E)
08:26-09:19	CTD and water sampling at C22 (07-38.87N, 136-41.16E), down to 1000m
09:25-09:30	TRITON buoy check (07-38N, 136-41E)
13:09-15:05	Free fall of CTD wire

Oct. 30 (Wed.)

09:50	Arrival at Koror, Republic of Palau

Oct. 31 (Thu.)

3.Participants List

On board Scientists / Technical staff

Name	Organization	On boad
Hideaki Hase	JAMSTEC	Yokosuka - Kavieng
Shinya Minato	JAMSTEC	Kavieng - Palau
Shigeki Hosoda	JAMSTEC	Yokosuka - Palau
Masaki Taguchi	MWJ	Yokosuka - Palau
Takeo Matsumto	MWJ	Yokosuka - Palau
Kentaro Shiraishi	MWJ	Yokosuka - Palau
Yuichi Sonoyama	MWJ	Yokosuka - Palau
Tomoyuki Takamori	MWJ	Yokosuka - Palau
Teppei Sagara	MWJ	Yokosuka - Palau
Shintaro Oku	MWJ	Yokosuka - Palau
Ikumasa Terada	NME	Kavieng - Palau
Andri Purwandani	BPPT	Kavieng - Palau
Dadan Gunawan	BPPT	Kavieng - Palau
Cuncun Sunarya	Indonesia NAVY	Kavieng - Palau
Jimmy Gomoga	NWS	Kavieng - Palau

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NWS:
PNG National Weather Service
P.O.Box 1240, Boroko NCD, Papua New Guinea

Ship Crew

Captain	Kiyoshi Hasegawa
Chief Officer	Shinya Ryono
Second Officer	Daisuke Sasaki
Third Officer	Hiroyuki Kato
Jr. Third Officer	Masaki Hayashi
Chief Engineer	Toshihiro Kimura
First Engineer	Kimio Matsukawa
Second Engineer	Toshinobu Nagai
Third Engineer	Shingo Harada
Chief Radio Officer	Tokinori Nasu
Second Radio Officer	Jun Suenaga
Boatswain	Yoshikane Oda
Able Seaman	Shigeo Masuda
Able Seaman	Shuji Takuno
Able Seaman	Kazumi Ogasawara
Able Seaman	Osamu Tokunaga
Able Seaman	Tetsuo Shirayama
Able Seaman	Katsumi Abe
No.1 Oiler	Masaru Kitano
Oiler	Kunio Honda
Oiler	Takeshi Fukubara
Oiler	Toshikazu Ikeda
Oiler	Tsuyoshi Baba
Chief Steward	Kiyotoshi Teranishi
Steward	Shinichi Amasaki
Steward	Teruyuki Yoshikawa
Steward	Isao Matsumoto
Steward	Hiroyuki Oba

4.List of Instruments

(1) CTD (Conductivity-Temperature-Depth profiler)

SBE9-11 plus system, Sea-Bird Electronics,Inc.,USA

CTD Fish for 10,500m	S/N 09P8010-0319
C-Sensor	S/N 040960
T-Sensor	S/N 031465
D.O.-Sensor	S/N 130318
P-Sensor	S/N 41223

(2) Shipboard ADCP (Acoustic Doppler Current Profiler)

Ocean Surveyor,RD Instruments,USA

(3) Salinity

Guildline Autosal Model 8400B

(4) Dissolved Oxygen

D.O.meter:TOA portable Dissolved Oxygen Meter Model DO-25A
Titrater:Metrohm Model 716 DMS Titrino/10ml of tritration vessel
Detector:Pt Electrode/6.0401.100
Software:Data acquisition/Metrohm,Tinet 2.4

5. Hydrographic mesurement

(1) Peronnel

Hideaki Hase	(JAMSTEC):on board Leg1 Principal Investigator
Shinya Minato	(JAMSTEC):on board Leg2 Principal Investigator
Shigeki Hosoda	(JAMSTEC):on board Leg2
Masaki Taguchi	(MWJ)
Takeo Matsumoto	(MWJ)
Kentaro Shiraishi	(MWJ)
Tomoyuki Takamori	(MWJ)
Yuichi Sonoyama	(MWJ)
Shintaro Oku	(MWJ)
Teppei Sagara	(MWJ)

(2) Objectives

Observation of Hydrographic

(3) Parameters

Pressure, Temperature, Conductivity, Oxygen

(4) Method

CTD/Carousel Sampler Systems and XCTD were used during this cruise. It was the 5-liters 12-positions water sampler with Sea-Bird Electronics Inc. CTD(SBE9/11plus). The sensors attached on CTD were one temperature sensor, one conductivity sensor, one pressure sensor and one D.O. sensor. XCTD was Tsurumi seiki Ltd. XCTD(1000). Items of CTD Cast Table(Table5.2.) and Observation points(Fig.5.1.) are position, date(UTC), time(UTC).

The CTD raw data was acquired on real time by using the SEASAVE Win32 utility from the SEASOFT software (ver.5.25) provided by SBE and stored on the hard disk of a IBM. personal computer. Water samplings were made during up cast by sending a fire command from the computer.

The CTD raw data was processed by using the SBE Data processing (ver.5.25). Data processing procedures and used utilities of the SBE Data processing were as follows:

DATCNV : Converts the binary raw data to output on physical units. Output items are scan number, pressure, depth(salt water), temperature(ITS-90), salinity(PSS-78), oxygen current, oxygen temperature, decent rate.
This utility selects the CTD data when bottles closed to output on another file.

SECTION : Remove the unnecessary data.

ALIGN CTD: Advance oxygen relative to pressure approximately +3 seconds.

CELL T.M.: Perform conductivity cell thermal mass correction if salinity accuracies of better than 0.01 PSU in regions with steep gradients are desired. Typical values are alpha=0.03 and 1/beta.

FILTER: Low-pass filter A pressure with a time constant of 0.15 seconds to increase pressure resolution for "LOOP EDIT".

LOOP EDIT: Mark scans where CTD is moving less than minimum velocity or traveling backwards due to ship roll.

DERIVE: Compute oxygen from oxygen current and oxygen temperature.

BINAVG : Calculates the averaged data in every 1 db..

DERIVE: Compute salinity, density(σ θ), potential temperautre from conductivity, temperature and pressure.

SPLIT : Splits the data made by BINAVG into down cast data. and up cast data.

ROSSUM : Edits the data of water sampled to output a summary file.

Specifications of the sensors are listed below.

CTD : SBE 911 plus CTD system

- Under water unit:CTD 9plus Calibrated 24 Sep. 1993
(S/N 09P8010-0319,Sea-Bird Electronics,Inc.)

- Temperature sensor:SBE3-04/F Primary Sensor Calibrated 29 Jan. 2002
  (S/N 031465,Sea-Bird Electronics,Inc.)
- Conductivity sensor:SBE4-04/0 Primary Sensor Calibrated 30 Jan. 2002
  (S/N 040960,Sea-Bird Electronics,Inc.)
- Oxygen sensor:MODEL 13-04-B Calibrated 29 Jan. 2002
  (S/N 130318,Sea-Bird Electronics,Inc.)
- Deck unit: SBE11 (S/N 11P9833-0345,Sea-Bird Electronics,Inc.)

(5)Result

See the attached figures(Fig.5.3.～Fig.5.4).

(6)Data archive

All of raw and processed CTD/XCTD data files were copied into 3.5 inch magnetic optical disks (230MB,) and submitted to JAMSTEC Data Management Office.

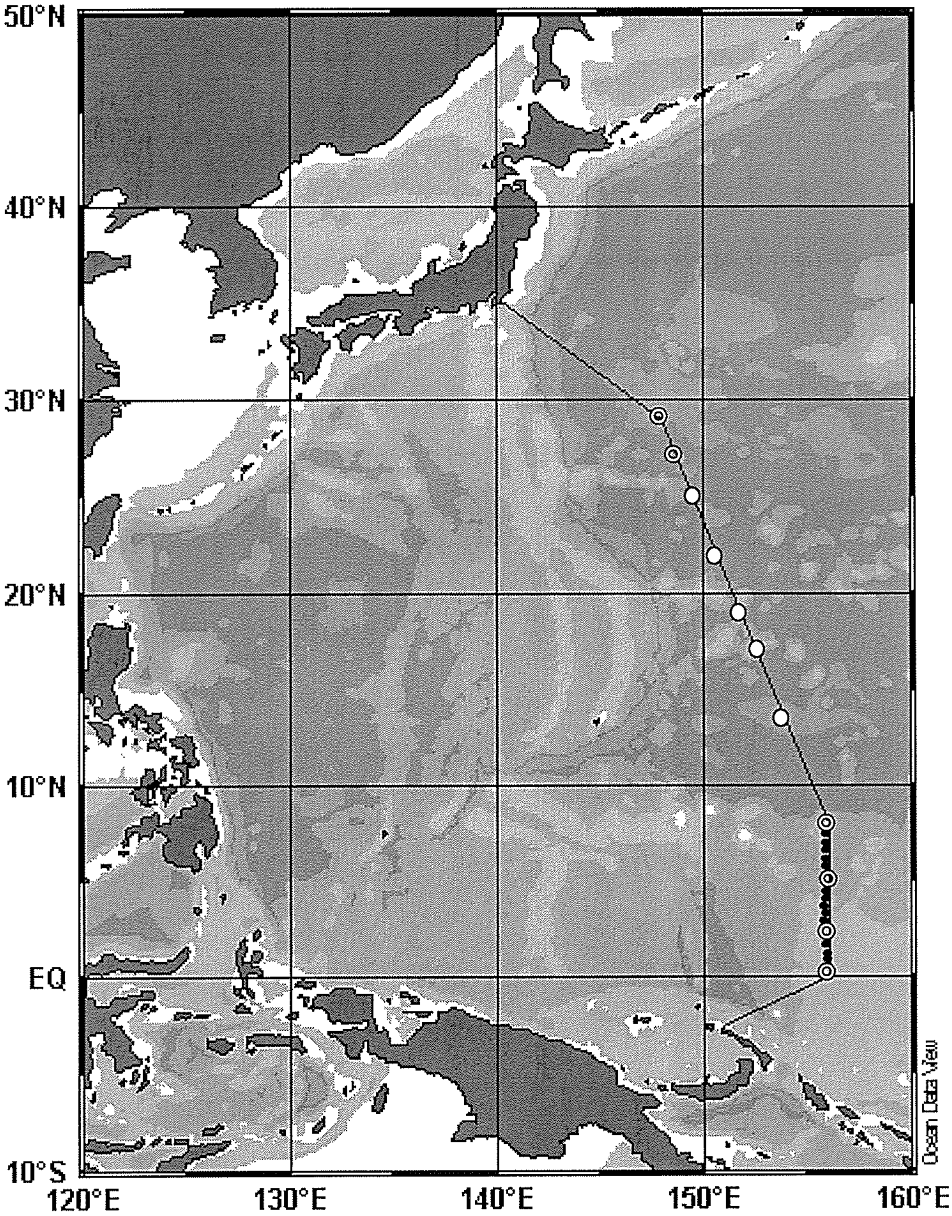


Fig.5.1.-1 Observation Points To Kevien form Yokosuka

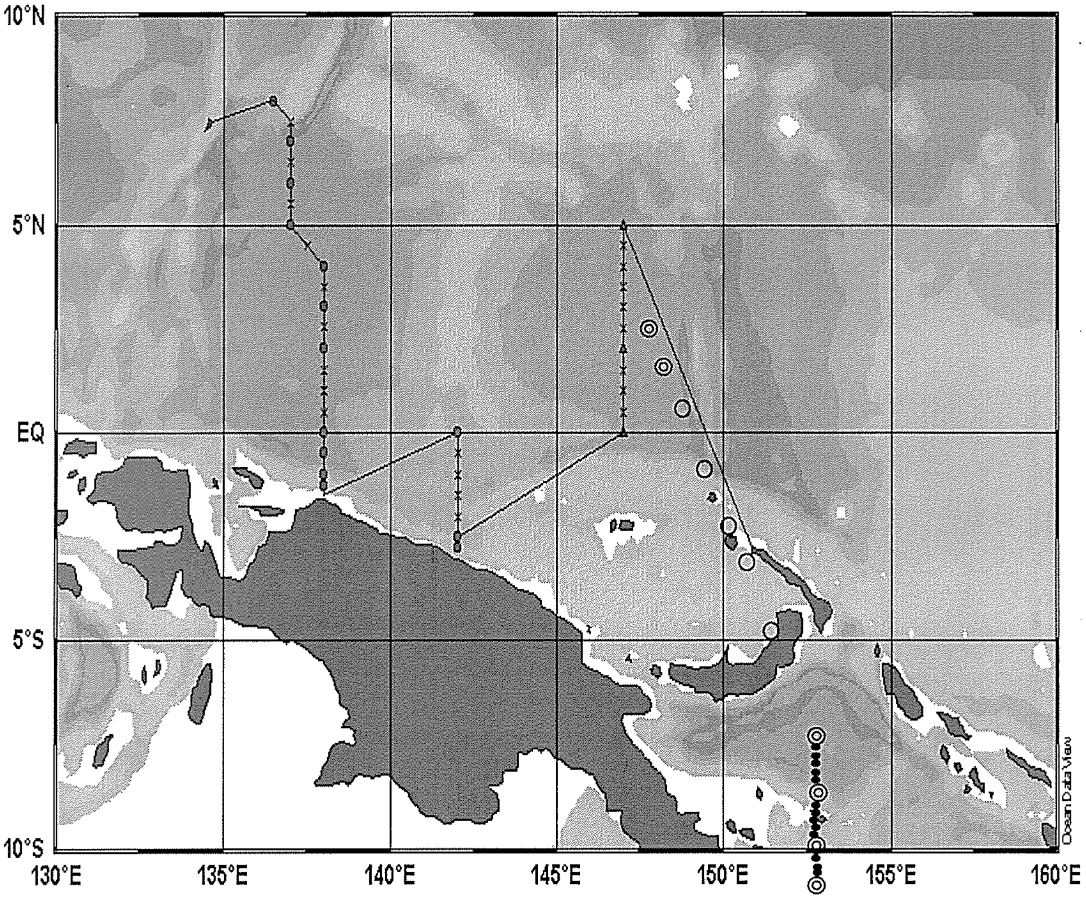


Fig.5.1.-2 Observation Points To Palau from Kevien

Table 5.2. CTD/XCTD Cast Table about KY02-10

Leg.	Station	Sensor	Start				End	Water	Memo
			Date	Time	Latitude	Lngitude	Time	Depth(m)	
1	C01	CTD	10/4	06:23	29-00.30N	148-00.57E	07:38	6240	ARGO
1	C02	CTD	10/4	19:45	26-46.00N	148-55.00E	19:00	5844	ARGO
1	X01	XCTD	10/5	07:09	24-59.80N	149-37.18E			ARGO
1	X02	XCTD	10/5	23:20	22-00.12N	150-47.00E		5667	ARGO
1	X03	XCTD	10/6	14:04	19-19.88N	151-48.19E		4856	ARGO
1	X04	XCTD	10/7	03:01	16-59.87N	152-42.02E		5483	ARGO
1	X05	XCTD	10/8	01:32	12-59.68N	154-11.93E		5996	ARGO
1	X06	XCTD	10/9	23:30	07-59.93N	155-57.58E			TRITON and ARGO
1	X07	XCTD	10/10	02:32	07-29.77N	156-00.02E		4354	
1	X08	XCTD	10/10	05:30	06-59.89N	155-59.99E		4400	
1	X09	XCTD	10/10	08:15	06-29.92N	156-00.00E		4400	
1	X10	XCTD	10/10	11:00	05-59.96N	156-00.00E		4143	
1	X11	XCTD	10/10	13:52	05-27.56N	155-59.99E		3718	
1	C03	CTD	10/10	22:35	04-57.76N	156-05.58E	23:57		TRITON and ARGO
1	X12	XCTD	10/11	03:18	04-29.99N	156-00.00E		3556	
1	C04	CTD	10/11	05:58	04-00.08N	156-00.16E	07:06	3466	ARGO
1	X13	XCTD	10/11	10:03	03-29.96N	156-00.00E		3240	
1	X14	XCTD	10/11	12:20	02-59.97N	155-59.59E		2860	
1	X15	XCTD	10/11	14:37	02-29.78N	156-00.00E		2648	
1	C05	CTD	10/11	22:35	01-54.82N	155-58.23E	23:17	2515	TRITON
1	X16	XCTD	10/12	01:52	01-29.99N	156-00.00E		2411	
1	X17	XCTD	10/12	04:22	00-58.76N	155-59.99E		2260	
1	X18	XCTD	10/12	06:44	00-30.01N	156-00.00E		2146	
1	C06	CTD	10/13	09:23	00-01.52N	155-58.33E	10:02	1944	TRITON
2	C07	CTD	10/18	22:25	05-01.83N	146-55.50E	23:17	4257	TRITON
2	X19	XCTD	10/19	02:35	04-29.99N	146-59.99E		3990	
2	X20	XCTD	10/19	05:05	03-59.99N	146-59.99E		4662	
2	X21	XCTD	10/19	07:35	03-29.98N	146-59.99E		4249	
2	X22	XCTD	10/19	10:06	02-59.64N	146-59.99E		4449	
2	X23	XCTD	10/19	12:40	02-29.93N	146-59.99E		4420	
2	C08	CTD	10/19	22:28	01-59.43N	147-02.30E	23:00	4520	TRITON
2	X24	XCTD	10/20	02:18	01-29.98N	147-00.21E		4505	
2	X25	XCTD	10/20	04:53	00-59.98N	147-00.00E		4510	
2	X26	XCTD	10/20	07:30	00-29.68N	147-00.00E		4518	
2	C09	CTD	10/21	06:46	00-01.04N	147-01.14E	07:20	4541	TRITON
2	X27	XCTD	10/23	07:28	02-45.00S	142-00.01E		3250	
2	C10	CTD	10/23	05:19	02-29.49S	141-57.77E	06:11	3484	
2	X28	XCTD	10/23	11:03	01-59.98S	142-00.01E		3603	
2	X29	XCTD	10/23	13:30	01-29.96S	141-59.99E		3503	
2	X30	XCTD	10/23	16:03	00-59.93S	142-00.00E		3024	
2	X31	XCTD	10/23	18:35	00-30.01S	142-00.01E		3396	
2	C11	CTD	10/23	21:22	00-00.03N	142-00.01E	22:16	3398	
2	C12	CTD	10/24	21:04	01-05.00S	138-00.00E	21:54	2003	
2	C13	CTD	10/25	0:37	00-59.95S	138-00.00E	1:27	4029	
2	X32	XCTD	10/25	3:49	00-30.01S	138-00.00E		4472	
2	C14	CTD	10/25	6:35	00-01.12S	137-53.32E	7:19	4343	TRITON
2	X33	XCTD	10/25	10:49	00-30.01N	138-00.00E		3938	
2	X34	XCTD	10/25	14:04	01-29.99N	137-59.99E		4375	
2	C15	CTD	10/26	10:38	00-59.91N	138-00.04E		4217	
2	C16	CTD	10/27	1:30	01-58.92N	138-06.45E	2:12	3421	TRITON
2	X35	XCTD	10/27	5:44	02-30.00N	138-00.00E		4460	

Table 5.2. CTD/XCTD Cast Table about KY02-10

Leg.	Station	Sensor	Start				End	Water	Memo
			Date	Time	Latitude	Lngitude	Time	Depth(m)	
2	C17	CTD	10/27	8:18	02-59.19N	138-59.93E	9:01	4507	
2	X36	XCTD	10/27	11:33	03-29.99N	137-59.99E		4307	
2	C18	CTD	10/27	14:04	03-59.19N	137-59.94E	14:55	4490	
2	X37	XCTD	10/27	18:24	04-30.59N	137-34.64E		4566	
2	C19	CTD	10/27	22:24	04-51.60N	137-17.03E	23:08	4099	TRITON
2	X38	XCTD	10/28	2:56	05-30.01N	137-00.00E		4705	
2	C20	CTD	10/28	5:31	05-59.90N	136-59.92E	6:31	4498	
2	X39	XCTD	10/28	8:46	06-30.00N	137-00.00E		4464	
2	C21	CTD	10/28	11:17	06-59.99N	136-59.99E	12:09	4262	
2	X40	XCTD	10/28	14:39	07-29.99N	137-00.00E		5779	
2	C22	CTD	10/28	22:30	07-38.92N	136-41.15E	23:16	3171	TRITON

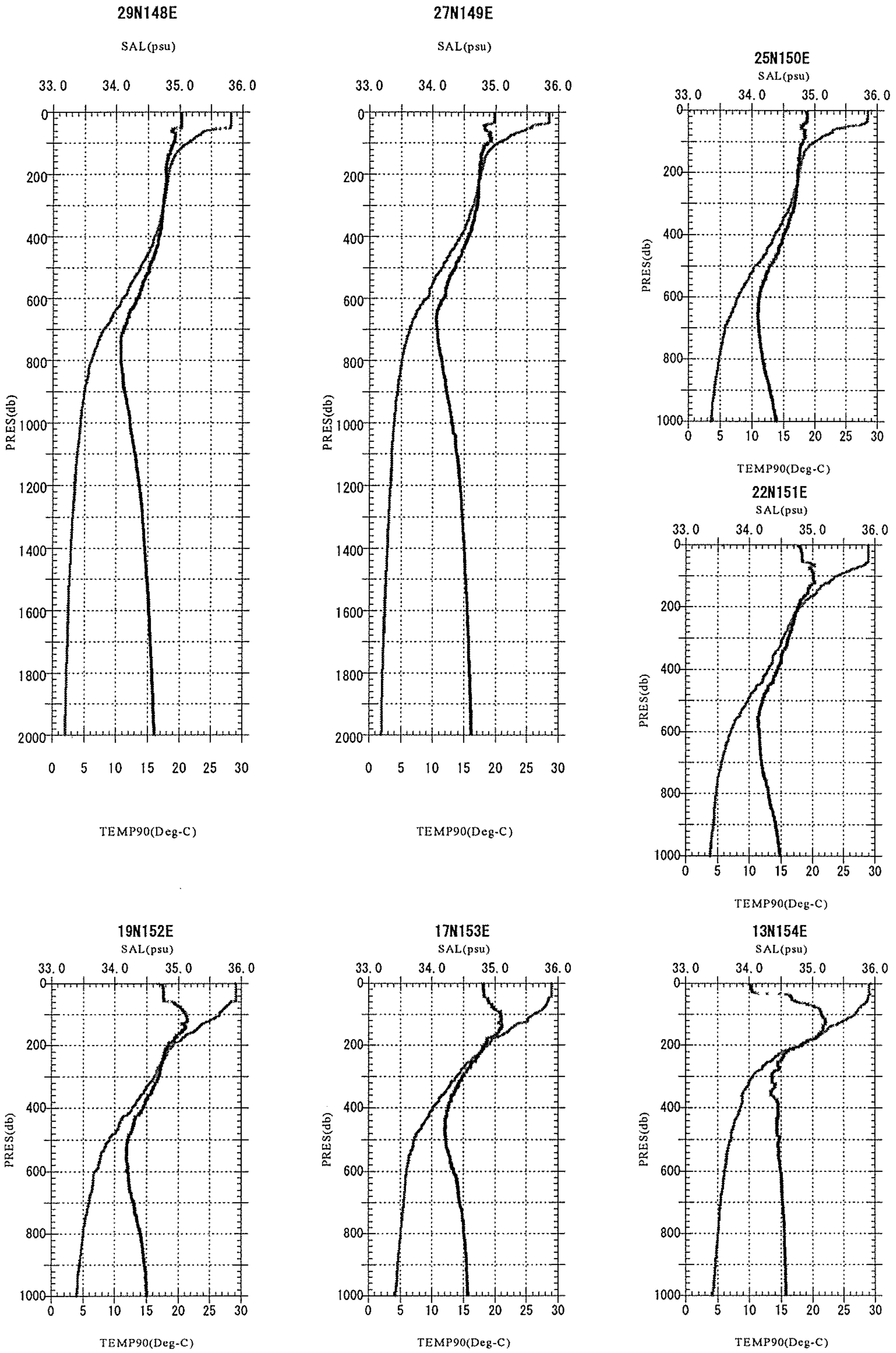


Fig.5.3.-1 Vertical Profile of CTD and XCTD

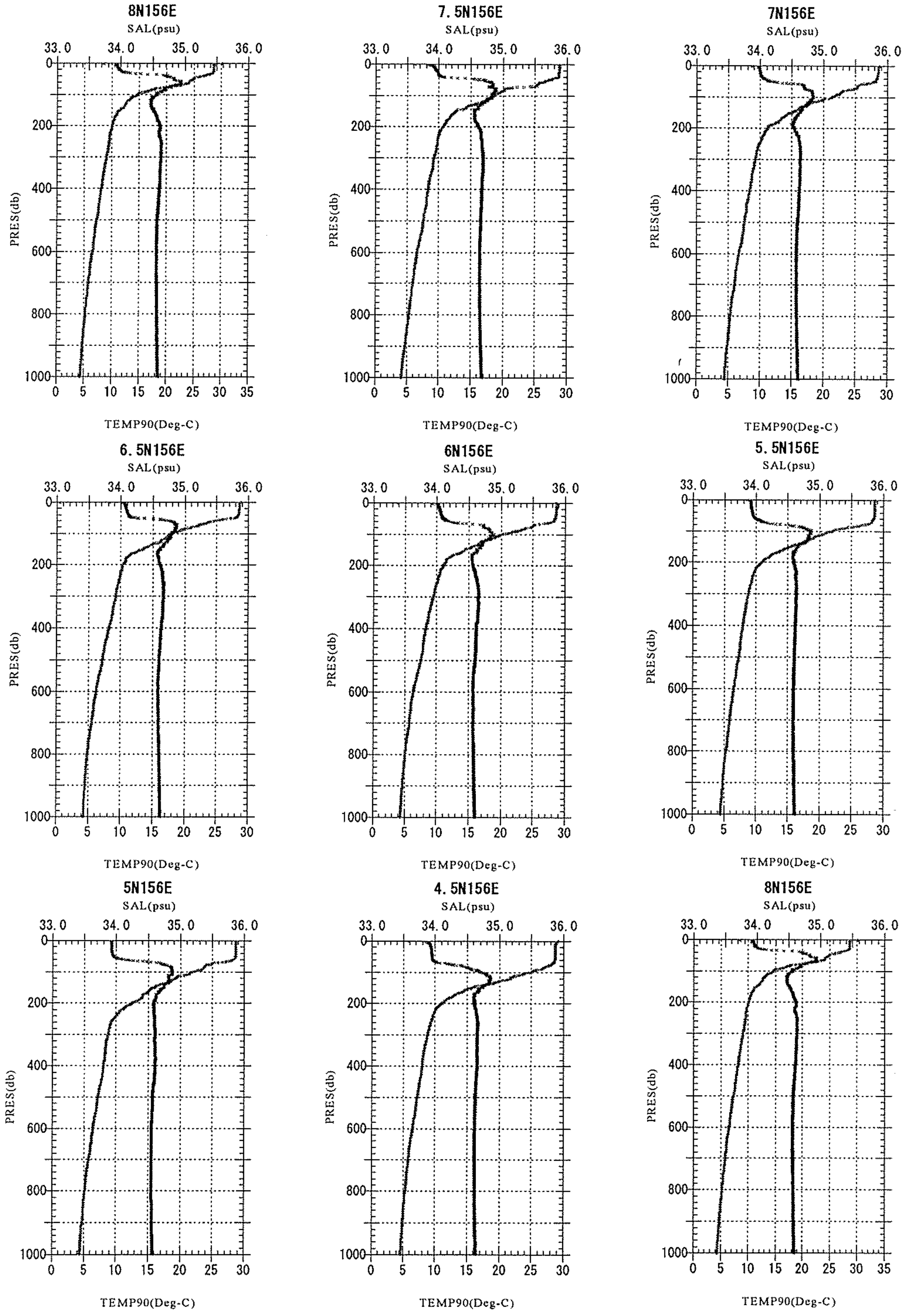


Fig.5.3.-2 cotinued

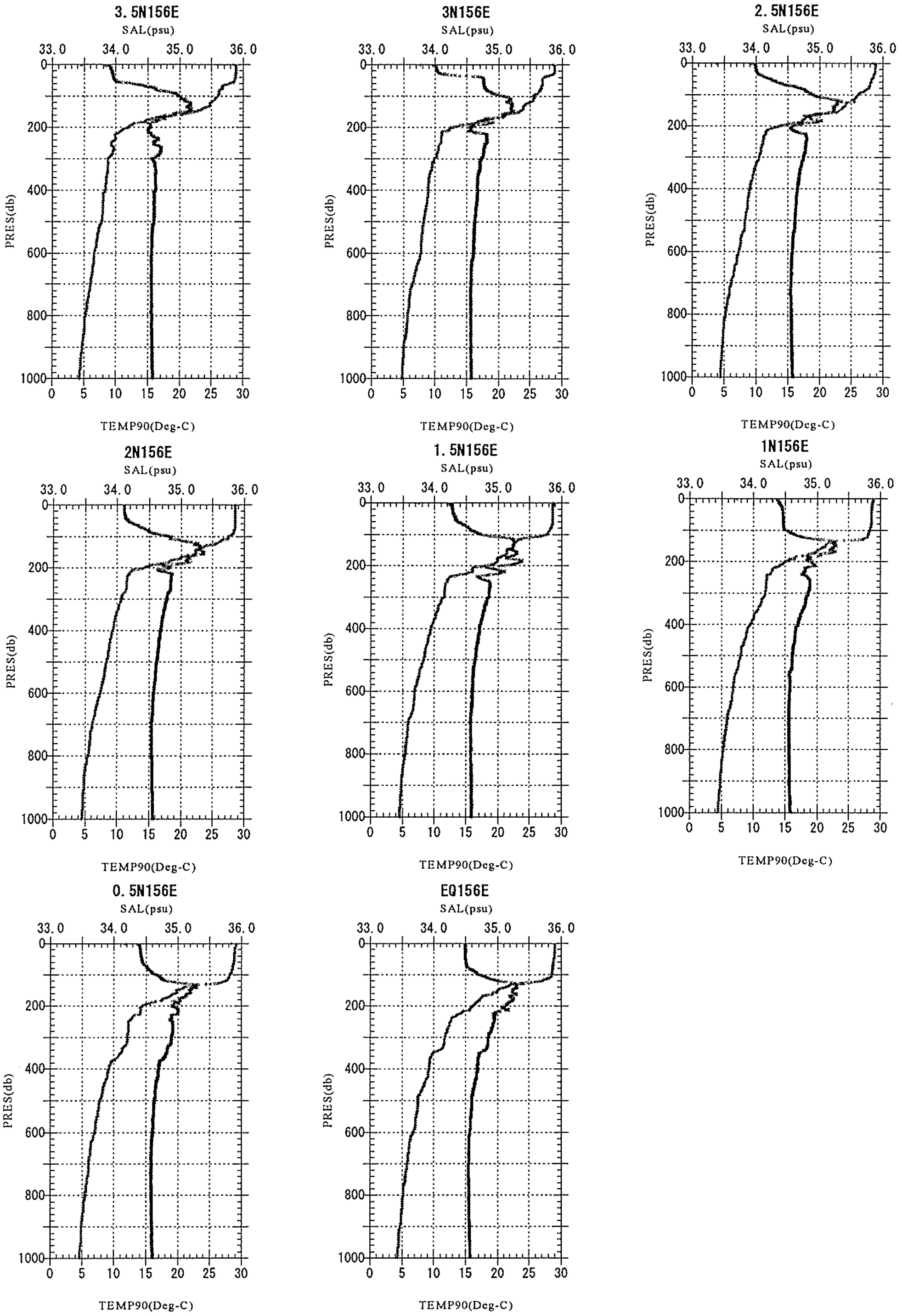


Fig.5.3.-3 cotinued

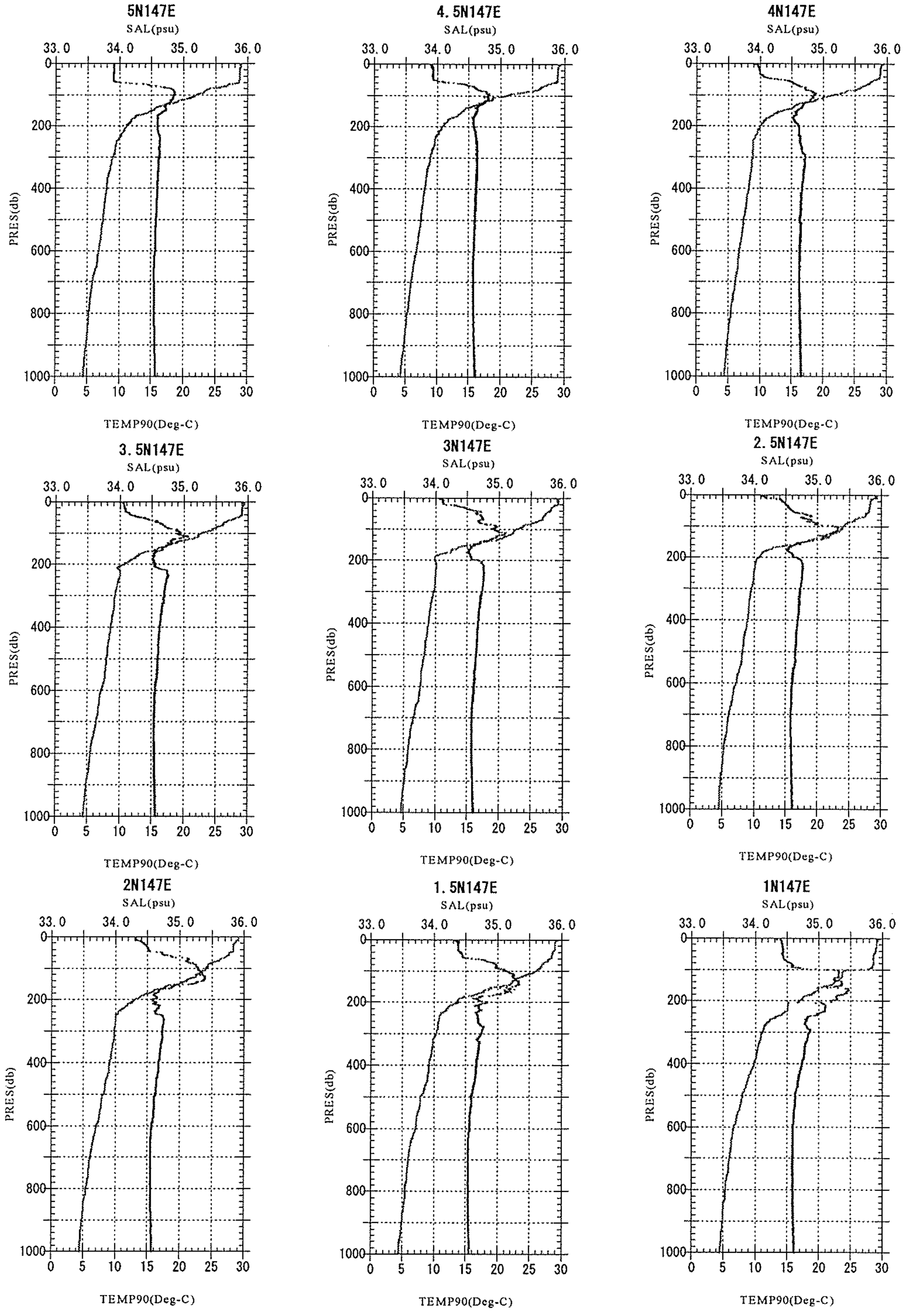


Fig.5.3.-4 cotinued

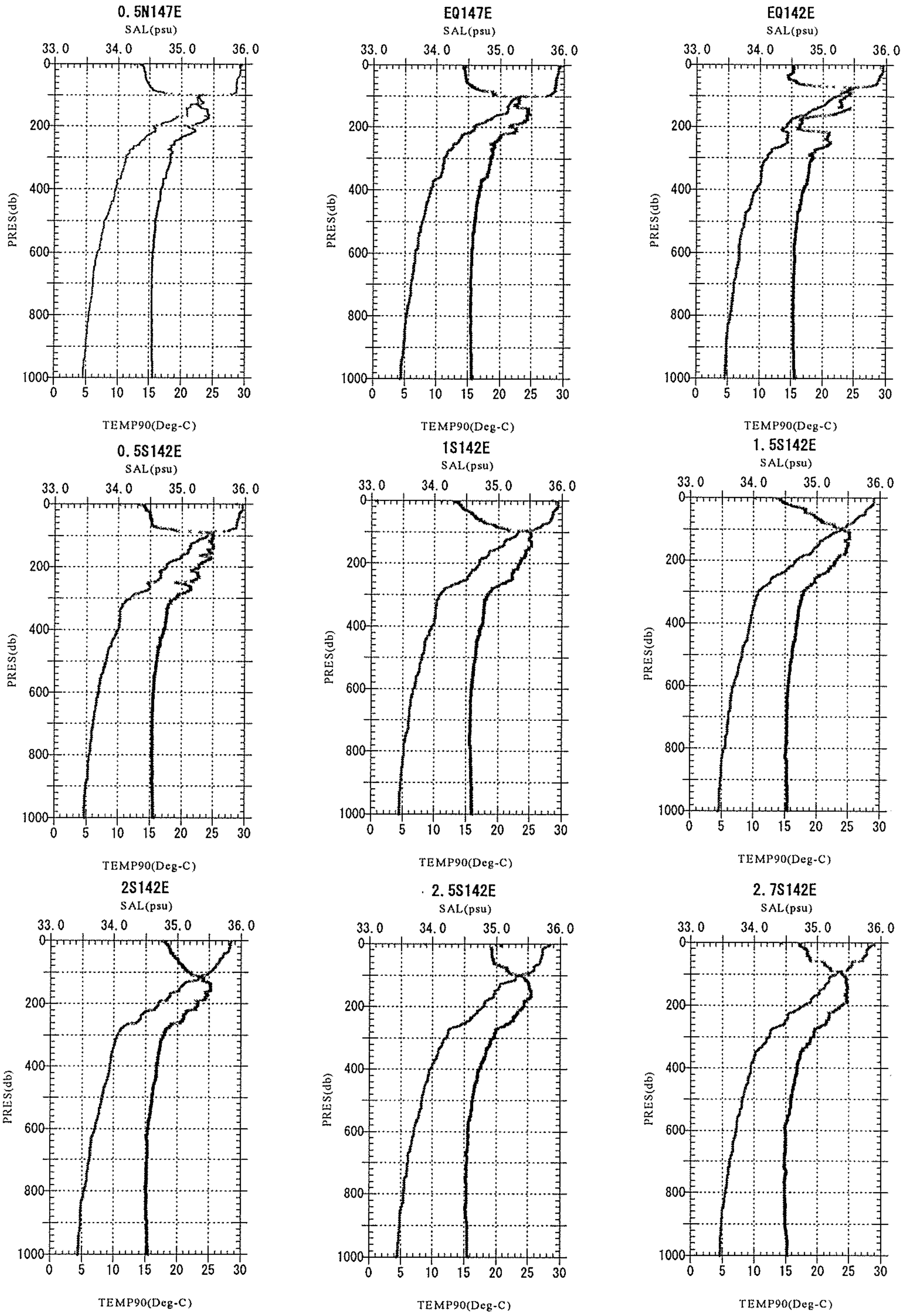


Fig.5.3.-5 cotinued

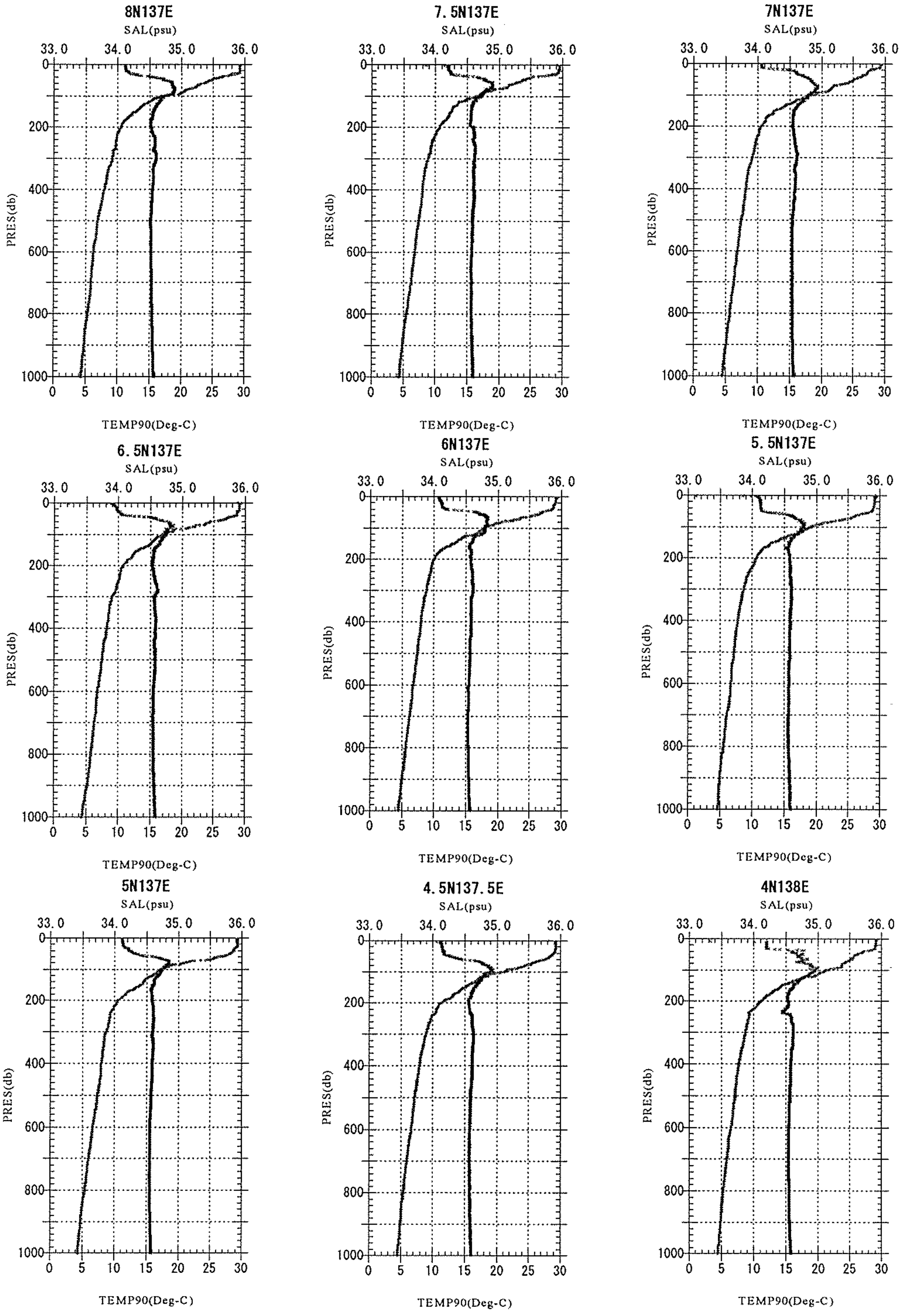


Fig.5.3.-6 cotinued

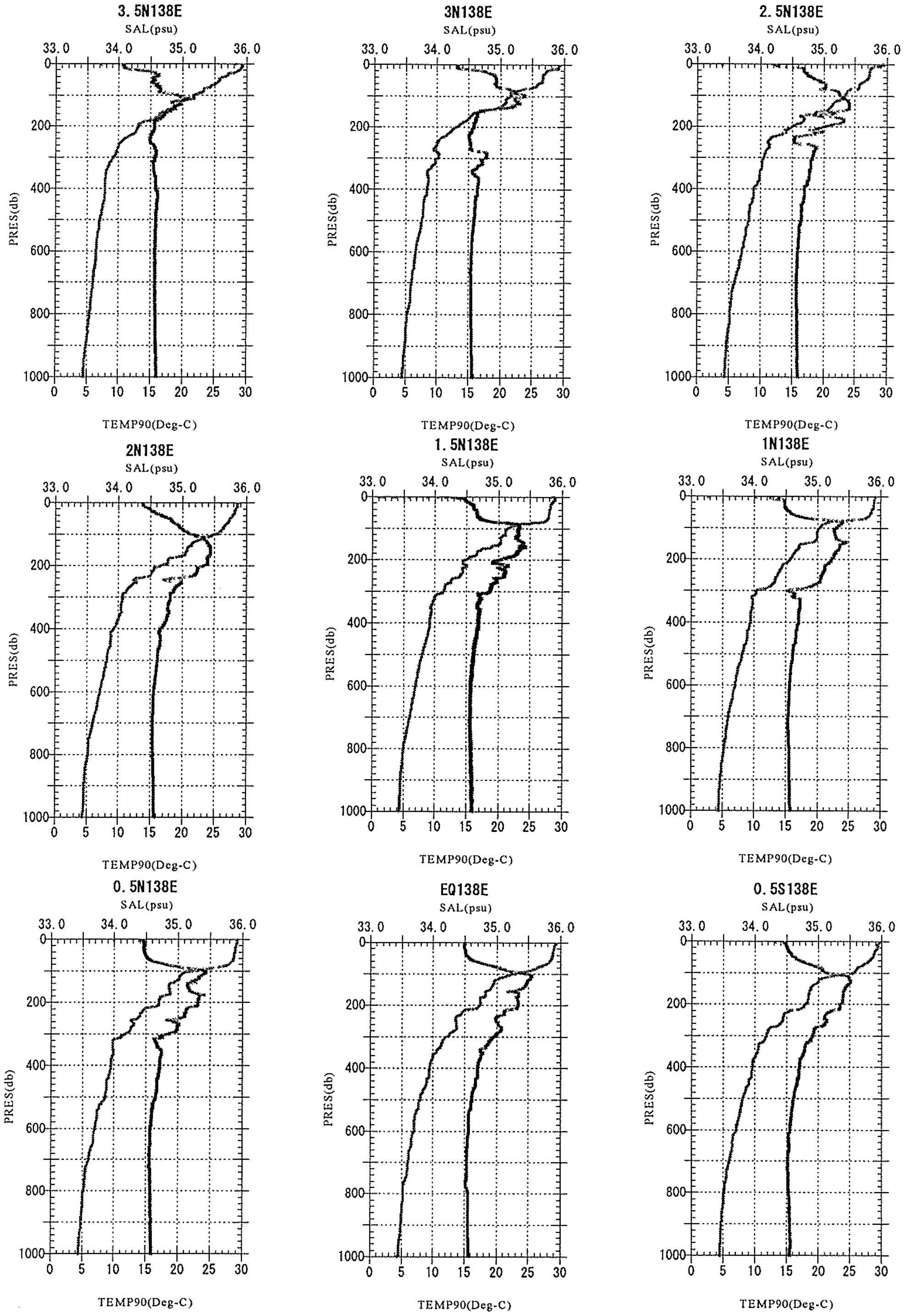


Fig.5.3.-7 cotinued

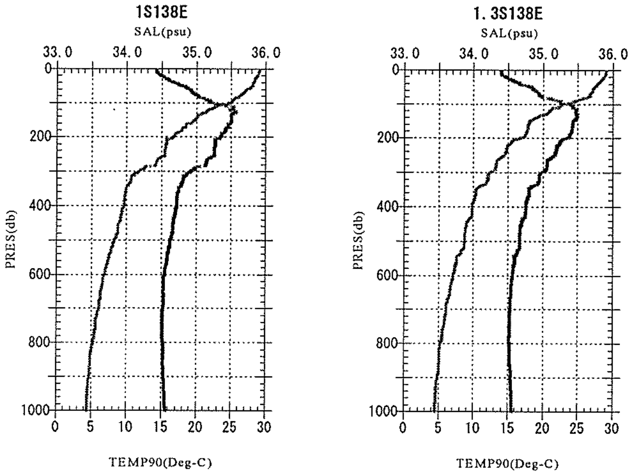


Fig.5.3.-8 cotinued

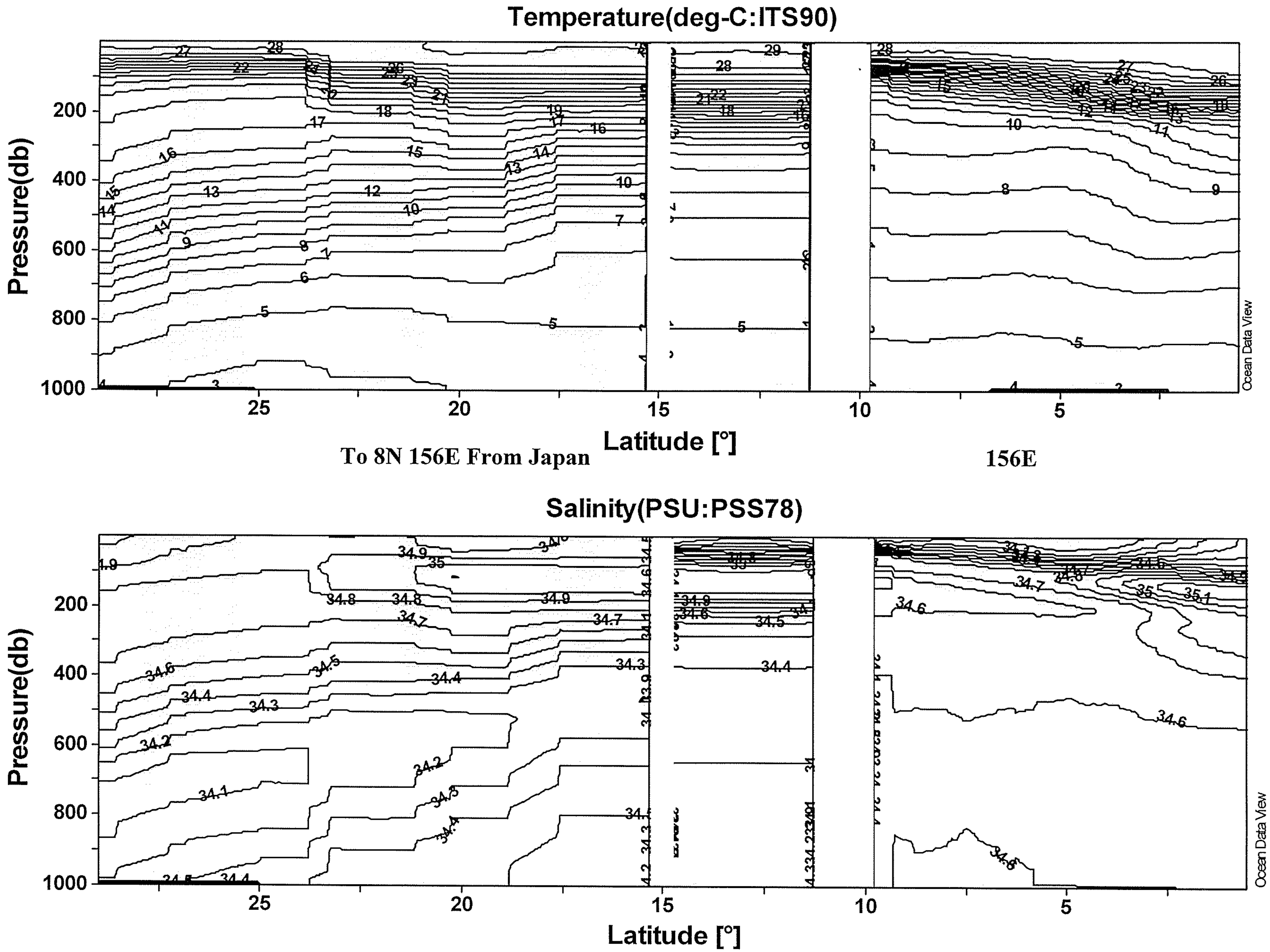


Fig.5.4.-1 Section along 156E

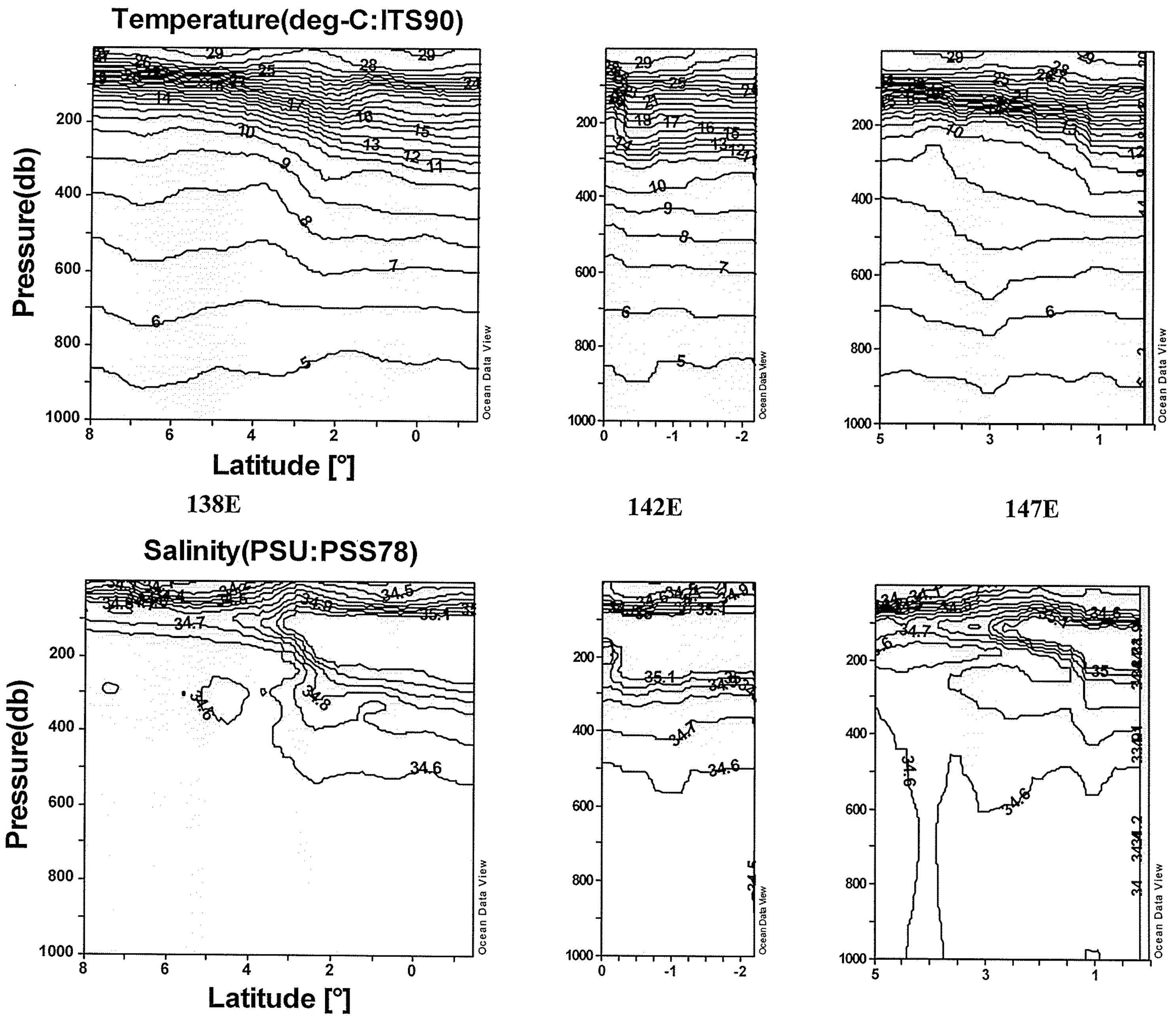


Fig.5.4.-2 Section along 138E,142E,147E

5.5 Salinity measurements of sampled seawater for validation of CTD cast data

(1) Peronnel

Hideaki Hase	(JAMSTEC):on board Leg1 Principal Investigator
Takeo Matsumoto	(MWJ): on board Leg1, 2 Operation Leader

(2) Objectives

To check the quality of CTD salinity.

(3) Parameters

Salinity of sampled water

(4) Method

Seawater samples were collected with 5-liter Niskin bottles for the deepest layer(2000db) and the other layers. They were stored in 250ml Phoenix brown glass bottles. The salinity analysis of samples were carried out using "Guildline Autosal 8400B Salinometer" on cruise KY02-10, which was modified by addition of an Ocean Scientific International peristaltic-type sample intake pump. The instrument was operated "No.4 Laboratoly" of R/V KAIYO constant temperature laboratory at a bath temperature of 24 deg-C with the laboratory set under 27 deg-C.A double conductivity ratio was defined as a median of 31 readings of the salinometer. Data collection was started after 5 seconds and it took about 10 seconds to collect 31 readings by a personal computer. The salinometer standardzations were made with IAPSO Standard Seawater batch P142 , of which 10 ampoules were consumed. These conductivity ration is 0.99991 (2K 1.99982, salinity 34.996). Sub-standard seawater was used to check the drift of the Autosal.

(5)Results

Analysis data of all samples were shown in table.5.5.-1. Ten pairs of duplicate samples taken by the same Niskin bottle and bucket were analyzed to estimate the precision of this method. To check the salinity data of CTD, we compared the salinity of all samples except for the surface samples.

The mean standardization drift was 0.00000 by 2K. There were 2 pairs of duplicate samples drawn. The standard deviations and mean of sample pairs were shown in table.5.5.-2.

(6)Data archive

The data of salinity sample will be submitted to the DMO at JAMSTEC.

Table.5.5.-1. Analysis data of all samples. Comparison Autosal and CTD

Station	Bottle	Smeasure	Niskin Bottle No.	Pressure	CTD Sal.	Sal Difference
C01	98	34.5872	2	1998.604	34.5875	-0.0003
	99	34.5874	2	1998.604	34.5875	-0.0001
	100	34.4732	3	1499.865	34.4746	-0.0014
	101	34.2063	5	1000.969	34.2079	-0.0016
	103	34.5117	6	499.410	34.5050	0.0067
	105	34.8900	8	100.017	34.8718	0.0182
C02	109	34.6029	1	1999.698	34.6024	0.0005
	110	34.6030	1	1999.698	34.6024	0.0006
	112	34.5156	3	1500.139	34.5154	0.0002
	114	34.2849	5	999.578	34.2855	-0.0006
	115	34.3592	6	500.543	34.3584	0.0008
	117	34.8934	8	99.024	34.8832	0.0102
C03	122	34.6414	1	1999.361	34.6404	0.0010
	123	34.6413	1	1999.361	34.6404	0.0009
	124	34.5990	3	1500.911	34.5978	0.0012
	125	34.5591	5	1001.315	34.5582	0.0009
	126	34.5621	7	501.598	34.5611	0.0010
	127	34.8600	9	99.524	34.8514	0.0086
C04	128	34.6395	1	1999.416	34.6387	0.0008
	129	34.6391	1	1999.416	34.6387	0.0004
	130	34.5969	3	1500.189	34.5973	-0.0004
	131	34.5547	5	1001.485	34.5542	0.0005
	132	34.5702	7	499.506	34.5698	0.0004
	133	34.8242	9	99.255	34.8216	0.0026
C05	134	34.5499	1	1000.927	34.5501	-0.0002
	135	34.5500	1	1000.927	34.5501	-0.0001
C06	136	34.5574	1	1001.436	34.5573	0.0001
	137	34.5580	1	1001.436	34.5573	0.0007
C07	138	34.5574	1	1000.074	34.5560	0.0014
	139	34.5559	1	1000.074	34.5560	-0.0001
C08	140	34.5527	1	1000.290	34.5526	0.0001
	141	34.5527	1	1000.290	34.5526	0.0001
C09	142	34.5507	1	1001.054	34.5508	-0.0001
	143	34.5553	1	1001.054	34.5508	0.0045
C10	144		1	1000.567	34.5414	
	145	34.7472	1	1000.567	34.5414	0.2058
C11	146	34.5460	1	1000.606	34.5473	-0.0013
	147	34.5467	1	1000.606	34.5473	-0.0006
C12	148	34.5443	1	1000.608	34.5455	-0.0012
	149	34.5438	1	1000.608	34.5455	-0.0017
C13	150	34.5475	1	999.719	34.5479	-0.0004
	151	34.5477	1	999.719	34.5479	-0.0002
C14	152	34.5535	1	1001.299	34.5501	0.0034
	153	34.5491	1	1001.299	34.5501	-0.0010
C15	154	34.5545	2	1002.056	34.5547	-0.0002
	155	34.5541	2	1002.056	34.5547	-0.0006
C16	156	34.5536	1	1000.478	34.5543	-0.0007
	157	34.5529	1	1000.478	34.5543	-0.0014
C17	158	34.5514	2	1002.775	34.5517	-0.0003
	159	34.5509	2	1002.775	34.5517	-0.0008
C18	160	34.5578	1	1000.487	34.5581	-0.0003
	161	34.5574	1	1000.487	34.5581	-0.0007
C19	162	34.5596	1	1000.145	34.5600	-0.0004
	163	34.5593	1	1000.145	34.5600	-0.0007
C20	164	34.5507	1	1000.429	34.5520	-0.0013
	165	34.5506	1	1000.429	34.5520	-0.0014
C21	166	34.5494	1	1001.532	34.5504	-0.0010
	167	34.5498	1	1001.532	34.5504	-0.0006
C22	168	34.5550	2	1001.343	34.5564	-0.0014
	169	34.5552	2	1001.343	34.5564	-0.0012
	30	34.7753	1	2022.182	34.7728	0.0025

Bad sample

Table.5.5.-2. There were 2 pairs of duplicate samples drawn.

Station	Sample Bottle	Sample Bottle	Sal mes	Sal mes	Niskin Bottle No.	CTD Pressure	CTD Sal	Dupri Sal
C01	98	99	34.5872	34.5874	2	1998.604	34.5875	0.0002
C02	109	110	34.6029	34.6030	1	1999.698	34.6024	0.0001
C03	122	123	34.6414	34.6413	1	1999.361	34.6404	0.0001
C04	128	129	34.6395	34.6391	1	1999.416	34.6387	0.0004
C05	134	135	34.5499	34.5500	1	1000.927	34.5501	0.0001
C06	136	137	34.5574	34.5580	1	1001.436	34.5573	0.0006
C07	138	139	34.5574	34.5559	1	1000.074	34.5560	0.0016
C08	140	141	34.5527	34.5527	1	1000.29	34.5526	0.0000
C11	146	147	34.5460	34.5467	1	1000.606	34.5473	0.0008
C12	148	149	34.5443	34.5438	1	1000.608	34.5455	0.0005
C13	150	151	34.5475	34.5477	1	999.719	34.5479	0.0002
C15	154	155	34.5545	34.5541	2	1002.056	34.5547	0.0004
C16	156	157	34.5536	34.5529	1	1000.478	34.5543	0.0007
C17	158	159	34.5514	34.5509	2	1002.775	34.5517	0.0005
C18	160	161	34.5578	34.5574	1	1000.487	34.5581	0.0004
C19	162	163	34.5596	34.5593	1	1000.145	34.5600	0.0003
C20	164	165	34.5507	34.5506	1	1000.429	34.5520	0.0001
C21	166	167	34.5494	34.5498	1	1001.532	34.5504	0.0004
							Avg.	0.0004
							Stdv.	0.0004

5.6 Dissolved Oxygen

(1) Personnel

Shinya Minato (JAMSTEC) Principal Investigator (Leg.2)
Shigeki Hosoda (JAMSTEC)
Yuichi Sonoyama (Marine Works Japan Ltd.)
Shintaro Oku (Marine Works Japan Ltd.)

(2) Objective

Precise determination of dissolved oxygen (below D.O.) using the Winkler titration with potentiometric detection.

(3) Instruments and Apparatus

Titrator:
Metrohm Model 716 DMS Titrino, capable of titrating $Na_2S_2O_3$ solution for 0.001 ml.
Metrohm Pt Electrode 6.0401.100
Software:
Data acquisition/ Metrohm, Tinet 2.4
Sample flasks:
BOD flasks of 180ml nominal capacity with glass stoppers.
OPTIFIX:
Capable of dispensing 1ml pickling reagents.
Dispensers:
Metrohm Model 765 Multi Dosimat, capable of dispensing standard KIO_3 solution.
Eppendorf:
Capable of dispensing 1ml 5M H_2SO_4 and standard KIO_3 solution.

(4) Methods

Sampling and analytical methods were based on the WHP Operations and Methods (Culberson, 1991, Dickson, 1994).

(a) Sampling

Seawater were sampled from 5 litters Niskin bottles to the calibrated dry glass bottles on the stations whose number was from C10 to C22. At each stations, we collected seawater samples from 1000m to surface for 11 layers. During each sampling, 3 bottle volumes of seawater were overflowed to minimize contamination with atmospheric oxygen. After the sampling, $MnCl_2$ (aq.) 1ml and NaOH / NaI (aq.) 1ml were added into the glass bottle, and then shook well. After the precipitation was setteled, we shook the bottle vigorously to disperse the precipitation.

(b) Analytical methods

The samples were analyzed by 1 sets of Metrohm titrator with 10 ml piston burette and Pt electrode. Titration values was determined by the potentiometeric methods, and the endpoint for titration was evaluated by the software of Metrohm, Tinet 2.4. From the titration values, we calculated concentration of dissolved oxygen by WHP Operations and Methods (Culberson, 1991, Dickson, 1994).

(5) Result

(a) Precision of Winkler titration data

We took 28 duplicate samples for Winkler titration method in this cruise. The standard deviation of anlytical values was 0.244 µmol/kg-sw (Table 5.6) , and was satisfied WOCE precision (below 0.5μmol/kg-sw).

(b) Vertical profiles

The vertical profiles of dissolved oxygen were shown in Fig. 5.6-1～2, and the correlation between CTD D.O. sensor values and anlytical values were shown in Fig. 5.6-3. The section along 138E was shown in Fig. 5.6-4.

$$Y = 1.1281 * X - 7.603 \quad (R^2 = 0.9895)$$

Y: Winkler method value [μmol/kg-sw]
X: CTD D.O. sensor value [μmol/kg-sw]

(6) References

Culberson, C.H. (1991) Dissolved Oxygen, in WHP Operations and Methods, Woods Hole., pp1-15.

Culberson, C.H., G.Knapp, R.T.Williams and F.Zemlyak (1991) A comparison of methods for the determination of dissolved oxygen in seawater. (WHPO 91-2)

Dickson, A.G. (1994) Determination of dissolved oxygen in seawater by Winkler titration, in WHP Operations and Methods, Woods Hole., pp1-14.

Murray, N., J.P.Riley and T.R.S. Wilson (1968) The solubility of oxygen in Winkler regents used for the determination of dissolved oxygen, Deep-Sea Res.,15, 237-238.

Table 5.6 The standard deviations of the duplicate samples at each stations.

Cast	Niskin No.	Pressure (db)	Dissolved Oxygen (μmol/kg-sw)		
			Sample 1	Sample 2	Difference
C10	6	500.447	152.948	153.379	0.431
	8	300.818	158.054	157.784	0.270
C11	2	1000.368	103.920	103.035	0.885
	6	500.354	106.790	106.280	0.510
	8	300.037	144.006	143.421	0.585
	11	100.271	138.919	139.073	0.154
C12	2	1000.408	113.980	113.076	0.904
C13	2	999.493	104.784	104.644	0.140
C16	2	1001.210	99.063	99.093	0.030
	6	500.516	111.861	112.379	0.517
	11	100.902	157.228	156.860	0.368
C17	2	1002.775	103.065	103.800	0.735
	6	500.592	134.160	134.204	0.044
	11	99.883	144.151	144.044	0.107
C18	2	1000.466	97.150	96.765	0.385
	6	499.752	105.054	104.881	0.173
	11	99.768	158.750	159.145	0.395
C19	2	1000.189	88.897	88.603	0.295
	6	498.965	81.935	82.280	0.345
	11	100.277	146.474	146.742	0.268
C20	2	1000.347	92.767	92.461	0.306
	11	100.494	144.989	145.311	0.323
C21	2	1001.51	90.780	90.568	0.212
	6	500.848	93.189	93.189	0.000
	11	99.163	150.064	149.983	0.081
C22	2	1001.144	86.741	86.810	0.070
	6	500.153	87.498	87.800	0.302
	11	100.308	139.787	139.742	0.045
				Ave.	0.317
				S.D.	0.244

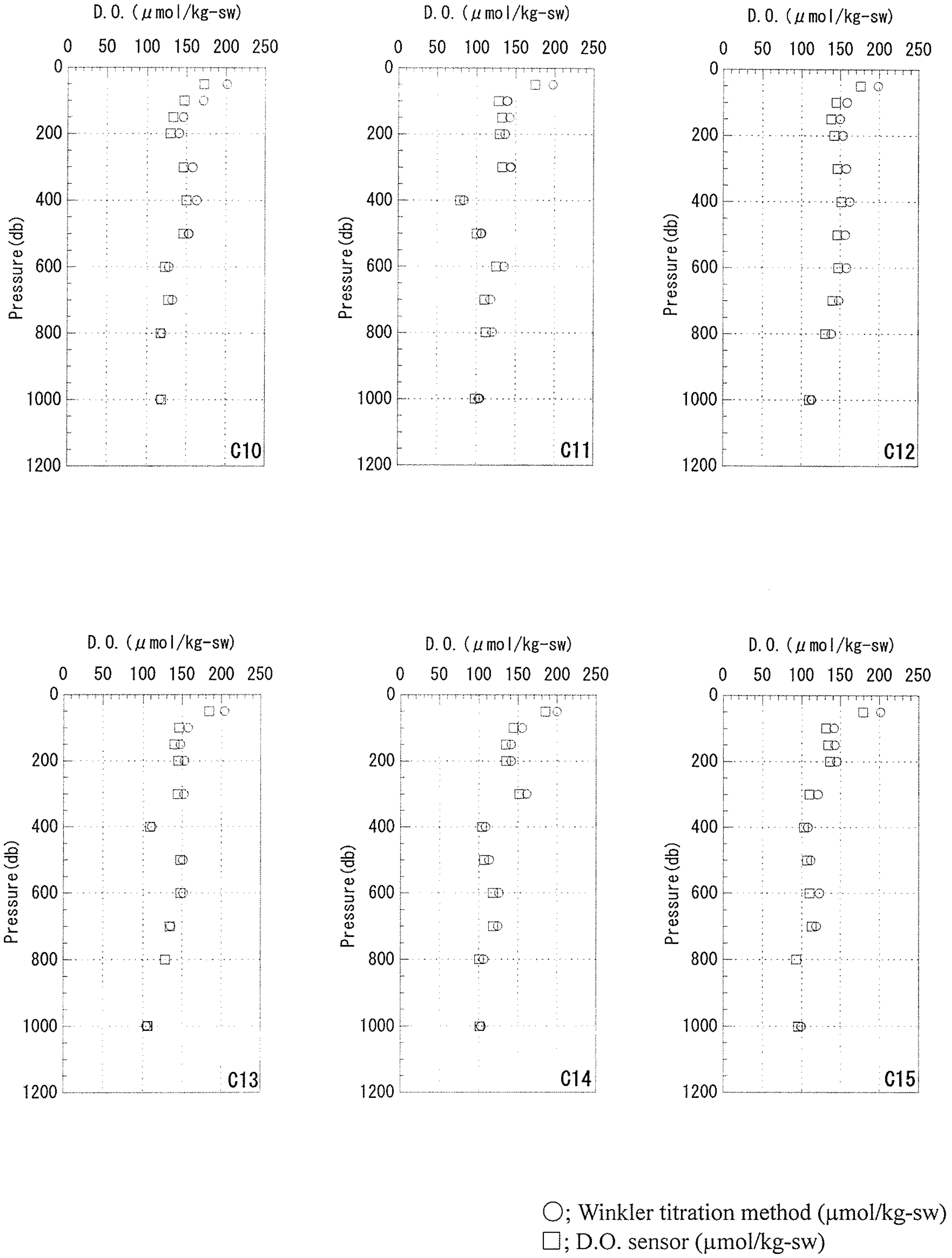
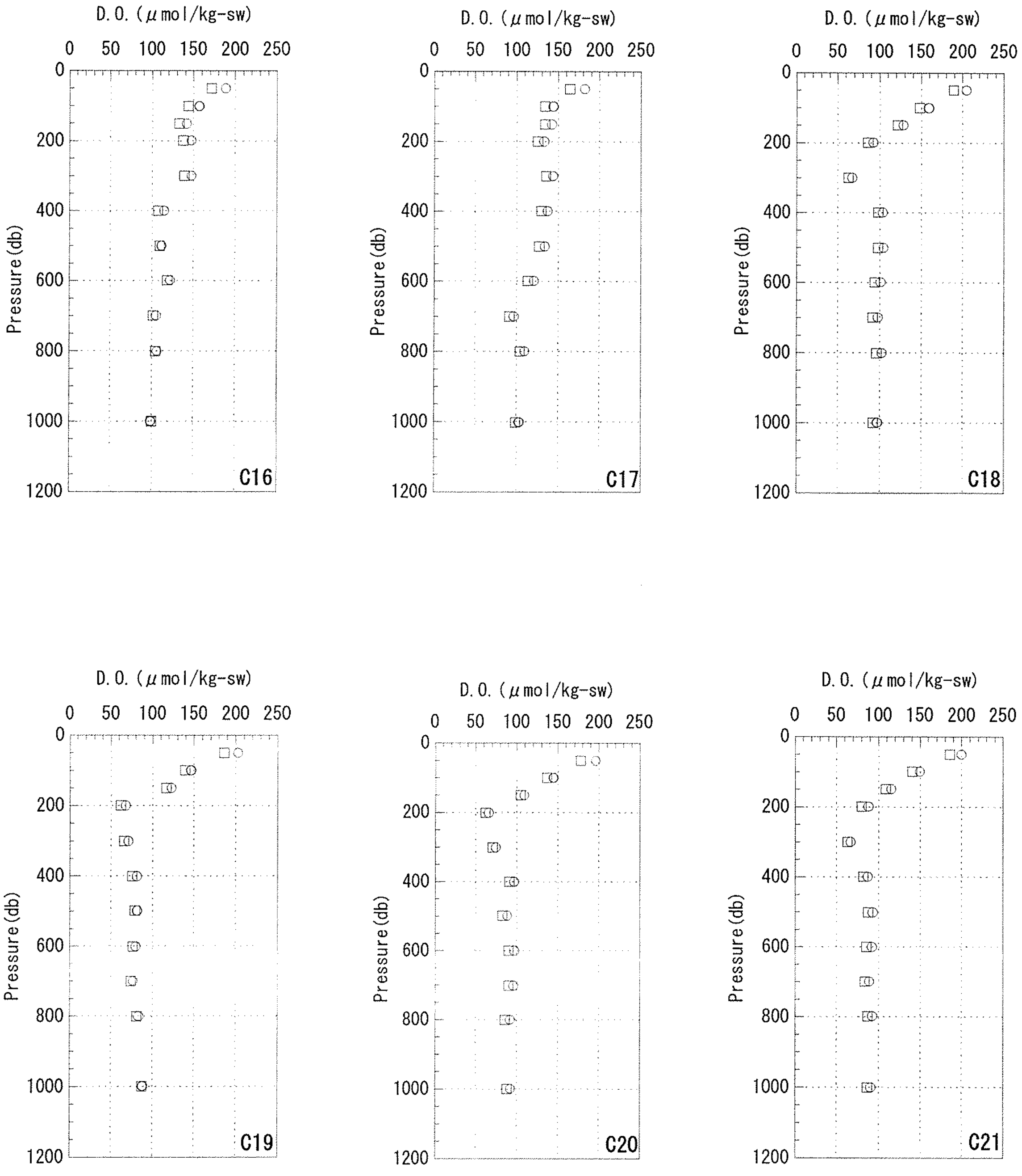
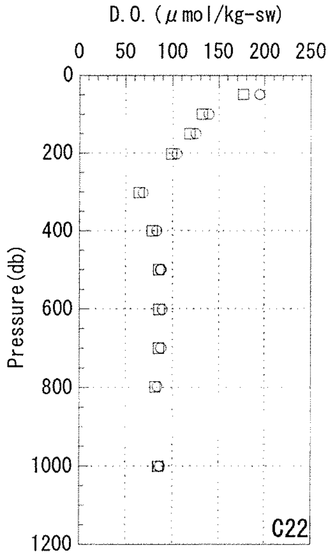


Fig. 5.6 -1 Vertical profiles of dissolved oxygen at each stations (Cast10～15).



○; Winkler titration method (μmol/kg · sw)
□; D.O. sensor (μmol/kg · sw)

Fig. 5.6-2 Vertical profiles of dissolved oxygen at each stations (Cast16～22).



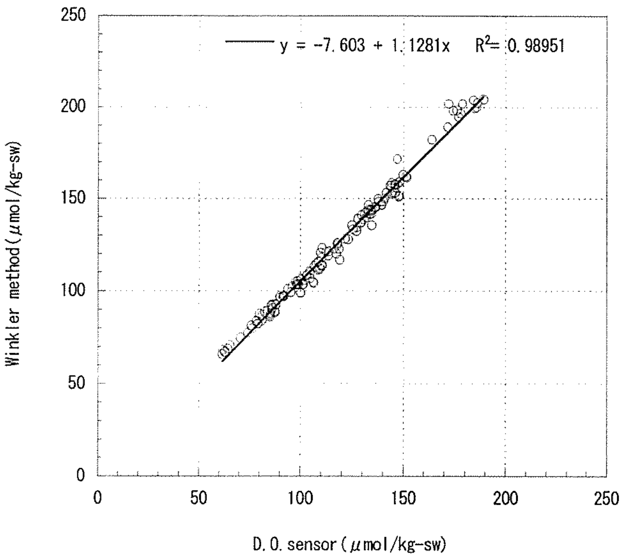


Fig. 5.6-3 The correlation between D.O.sensor values and Winkler method values in all stations.

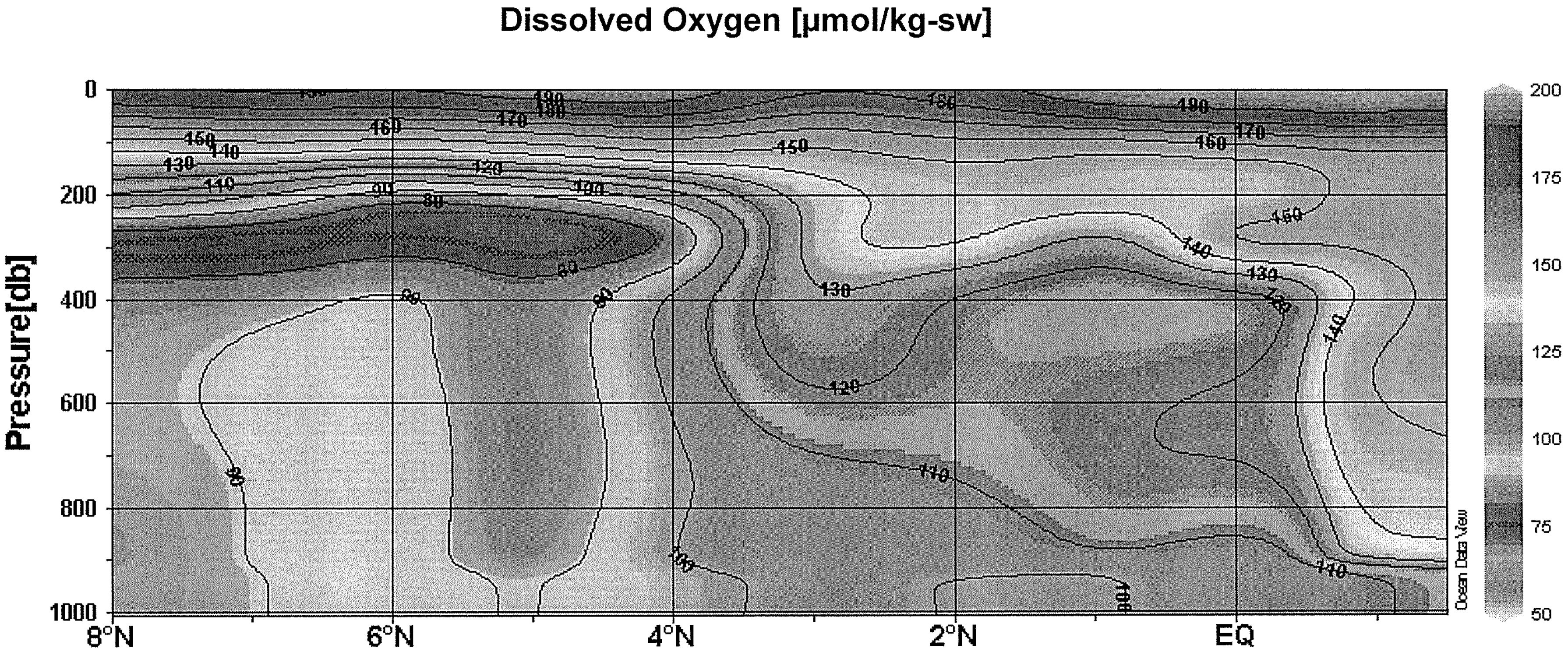


Fig. 5.6-4 Section along 138E.

6. Shipboard ADCP

Objectives:

In this cruise, we measured current velocity using shipboard ADCP in order to understand physical process in the western equatorial pacific as a part of "Tropical Ocean Climate Study". We processed acquired data using CODAS (Chapter 6-2).

Participants:

Ikumasa Terada (NME) -Leg2-

6-1 Data acquisition

Instrument and Method:

Shipboard ADCP measurement was performed using instrument and measurement parameters as shown in Table6-1. We acquired ADCP data in all route of this cruise.

Table6-1. Instrument and Acquisition parameters

Instrument

Ocean Surveyor Ⅱ (RD Instruments)	
Transducer	VM-38
Frequency	38400 Hz
Configuration	4 Beams
Beam Angle	30 degrees
Beam Pattern	Convex
Acquisition Software Package	VMDAS

Acquisition parameter

Mode	Watertrack (Narrow Band)
Depth Cell Size	16 Meters
Number of Profile Depth Cells	75 Depth cells
Blanking Distance	16 Meters
Ensemble Time	2.0 Seconds
First Bin Depth	36.95 Meters
Last Bin Depth	1220.95 Meters
Transducer Depth	5.0 Meters
Ensemble Averaging Interval	60 Seconds, 300 Seconds

Description of acquired data:

A list of the acquired data is shown in Table 6-2 (Leg1) and Table 6-3 (Leg2).

Table6-2. Acquired data files (Leg1; Yokosuka-Kevieng)

No.	File name		Time (UTC)		Latitude	Longitude	Remarks	DB name
1	KY0210001_0000 *	start	30-Sep-02	3:00:40	35 16 54 N	139 40 41 E	TOKYO Bay	t0201 *1
		end	1-Oct-02	3:06:15	35 30 26 N	139 56 37 E		
2	KY0210002_0000 *	start	1-Oct-02	3:06:38	35 30 26 N	139 56 37 E		t0202 *1
		end	1-Oct-02	23:03:04	35 30 11 N	139 56 32 E		
3	KY0210003_0000 *	start	1-Oct-02	23:03:30	35 30 11 N	139 56 29 E	to CTD freefall point	t0203
		end	4-Oct-02	3:40:02	29 01 41 N	147 59 04 E		
4	KY0210004_0000 *	start	4-Oct-02	3:40:27	29 01 40 N	147 59 04 E	CTD freefall	t0204
		end	4-Oct-02	8:46:32	28 57 10 N	148 02 05 E		
5	KY0210005_0000 *	start	4-Oct-02	8:46:56	28 57 05 N	148 02 07 E	to ARGO floot deployment point (27N)	
		end	4-Oct-02	19:42:06	26 46 06 N	148 54 40 E		
6	KY0210006_0000 *	start	4-Oct-02	19:42:30	26 46 06 N	148 54 40 E	CTD & ARGO (27N)	
		end	4-Oct-02	21:31:58	26 46 06 N	148 55 18 E		
7	KY0210007_0000 *	start	4-Oct-02	21:32:19	26 46 06 N	148 55 18 E	to ARGO floot deployment point (25N)	
		end	5-Oct-02	6:56:28	25 00 06 N	149 36 55 E		
8	KY0210008_0000 *	start	5-Oct-02	6:56:56	25 00 06 N	149 36 55 E	XCTD & ARGO (25N)	t0208
		end	5-Oct-02	7:19:54	24 59 08 N	149 37 29 E		
9	KY0210009_0000 *	start	5-Oct-02	7:20:18	24 59 07 N	149 37 29 E	to ARGO floot deployment point (22N)	
		end	5-Oct-02	23:12:26	22 00 12 N	150 46 57 E		
10	KY0210010_0000 *	start	5-Oct-02	23:12:50	22 00 12 N	150 46 57 E	XCTD & ARGO (22N)	
		end	5-Oct-02	23:28:10	21 59 10 N	150 47 19 E		
11	KY0210011_0000 *	start	5-Oct-02	23:28:35	21 59 06 N	150 47 20 E	to ARGO floot deployment point (19N)	
		end	6-Oct-02	13:51:07	19 20 03 N	151 47 60 E		
12	KY0210012_0000 *	start	6-Oct-02	13:51:38	19 20 03 N	151 48 01 E	XCTD & ARGO (19N)	t0212
		end	6-Oct-02	14:07:15	19 19 36 N	151 48 16 E		
13	KY0210013_0000 *	start	6-Oct-02	14:07:37	19 19 34 N	151 48 17 E	to ARGO floot deployment point (17N)	
		end	7-Oct-02	2:47:41	17 00 03 N	152 41 56 E		
14	KY0210014_0000 *	start	7-Oct-02	2:48:06	17 00 03 N	152 41 56 E	XCTD & ARGO (17N)	
		end	7-Oct-02	2:58:08	16 59 59 N	152 42 03 E		
15	KY0210015_0000 *	start	7-Oct-02	2:58:33	16 59 58 N	152 42 03 E	to ARGO floot deployment point (13N)	
		end	8-Oct-02	1:16:45	12 59 56 N	154 11 54 E		
16	KY0210016_0000 *	start	8-Oct-02	1:17:11	12 59 55 N	154 11 54 E	XCTD & ARGO (13N)	
		end	8-Oct-02	1:29:20	12 59 49 N	154 11 56 E		
17	KY0210017_0000 *	start	8-Oct-02	1:29:47	12 59 47 N	154 11 56 E	to TRITON buoy (8N,156E)	t0217
		end	9-Oct-02	21:07:10	8 01 18 N	155 58 20 E		
18	KY0210018_0000 *	start	9-Oct-02	21:09:20	8 01 16 N	155 58 20 E	TRITON buoy (8N,156E)	t0218
		end	9-Oct-02	23:25:11	7 59 43 N	155 57 46 E		
19	KY0210019_0000 *	start	9-Oct-02	23:25:33	7 59 41 N	155 57 47 E	to TRITON buoy (5N,156E)	
		end	10-Oct-02	20:17:56	4 57 47 N	156 04 23 E		
20	KY0210020_0000 *	start	10-Oct-02	20:18:41	4 57 50 N	156 04 27 E	TRITON buoy (5N,156E)	
		end	11-Oct-02	0:54:29	4 57 54 N	156 04 45 E		
21	KY0210021_0000 *	start	11-Oct-02	0:55:11	4 57 53 N	156 04 46 E	to CTD (4N,156E)	
		end	11-Oct-02	5:49:19	4 00 05 N	156 00 09 E		
22	KY0210022_0000 *	start	11-Oct-02	5:49:47	4 00 05 N	156 00 09 E	CTD (4N,156E)	t0222
		end	11-Oct-02	7:34:55	4 00 04 N	156 00 13 E		
23	KY0210023_0000 *	start	11-Oct-02	7:35:20	4 00 03 N	156 00 13 E	to TRITON buoy (2N,156E)	
		end	11-Oct-02	20:17:03	1 54 54 N	155 57 58 E		
24	KY0210024_0000 *	start	11-Oct-02	20:18:02	1 54 58 N	155 57 59 E	TRITON buoy (2N,156E)	t0224 *2
		end	11-Oct-02	23:59:57	1 54 34 N	155 57 39 E		
25	KY0210025_0000 *	start	12-Oct-02	0:00:19	1 54 32 N	155 57 39 E	to TRITON buoy (0,156E)	
		end	12-Oct-02	9:44:00	0 00 17 N	156 08 18 E		
26	KY0210026_0000 *	start	12-Oct-02	9:44:27	0 00 17 N	156 08 19 E	TRITON buoy & ADCP buoy (0,156E)	t0226
		end	13-Oct-02	10:26:38	0 02 38 S	155 56 56 E		
27	KY0210027_0000 *	start	13-Oct-02	10:27:02	0 02 40 S	155 56 53 E	to Kevieng	t0227 *2
		end	14-Oct-02	22:51:52	2 35 03 S	150 47 15 E		

Table6-3. Acquired data files (Leg2; Kevieng-Palau)

No.	File name		Time (UTC)		Latitude	Longitude	Remarks	DB name
28	KY0210028_0000 *	start	16-Oct-02	22:08:49	2 35 05 S	150 47 18 E	Kevieng to TRITON buoy (5N,147E)	t0228
		end	18-Oct-02	23:35:43	5 02 23 N	146 57 05 E		
29	KY0210029_0000 *	start	18-Oct-02	23:36:10	5 02 23 N	146 57 06 E	to TRITON buoy (2N,147E)	t0229
		end	19-Oct-02	23:06:54	1 59 30 N	147 02 09 E		
30	KY0210030_0000 *	start	19-Oct-02	23:07:15	1 59 30 N	147 02 08 E	to TRITON buoy & ADCP buoy (0,147E)	t0230
		end	20-Oct-02	21:37:24	0 00 13 S	147 04 18 E		
31	KY0210031_0000 *	start	20-Oct-02	21:37:49	0 00 13 S	147 04 18 E	to TRITON buoy & ADCP buoy (2.5S,142E)	t0231
		end	22-Oct-02	20:28:15	2 28 56 S	141 57 42 E		
32	KY0210032_0000 *	start	22-Oct-02	20:28:41	2 28 56 S	141 57 42 E	to CTD (0,142E)	t0232
		end	23-Oct-02	22:22:09	0 00 10 S	141 59 51 E		
33	KY0210033_0000 *	start	23-Oct-02	22:22:32	0 00 11 S	141 59 48 E	to CTD (1.3S,138E)	t0233
		end	24-Oct-02	21:53:47	1 14 54 S	137 59 24 E		
34	KY0210034_0000 *	start	24-Oct-02	21:54:18	1 14 54 S	137 59 24 E	to TRITON buoy & ADCP buoy (0,138E)	t0234
		end	26-Oct-02	5:30:17	0 00 26 S	138 01 54 E		
35	KY0210035_0000 *	start	26-Oct-02	5:30:37	0 00 24 S	138 01 55 E	to TRITON buoy & ADCP buoy (2N,138E)	t0235
		end	27-Oct-02	2:20:32	1 59 32 N	138 06 35 E		
36	KY0210036_0000 *	start	27-Oct-02	2:20:55	1 59 34 N	138 06 35 E	to TRITON buoy (5N,137E)	t0236
		end	27-Oct-02	23:20:56	4 51 31 N	137 16 12 E		
37	KY0210037_0000 *	start	27-Oct-02	23:21:22	4 51 31 N	137 16 12 E	to TRITON buoy (8N,137E)	t0237
		end	28-Oct-02	23:36:59	7 39 47 N	136 41 16 E		
38	KY0210038_0000 *	start	28-Oct-02	23:38:09	7 39 49 N	136 41 12 E	to Palau	t0238
		end	30-Oct-02	1:00:54	7 19 50 N	134 27 29 E		

*1 These databases were acquired shallow sea area in the Tokyo Bay.

*2 These databases couldn't be performed Calibration process, therefore only Load and Navigation process (Chapter 6-2).

6-2 Data processing

ADCP data was processed using the CODAS, short for Common Oceanographic Data Access System. Fig.6-1 shows the procedure of processing data.

Processing data was performed using not raw data but data averaged for 5 minutes First, I performed data processing for acquired data files that were divided into 27 lines for a Leg1 period and 11 lines for a Leg2 period. Second several-processed database was merged to each leg database. Finally the vector plot (one hour averaged) like the next pages was drawn from the database made through process as shown in a Fig6-1.

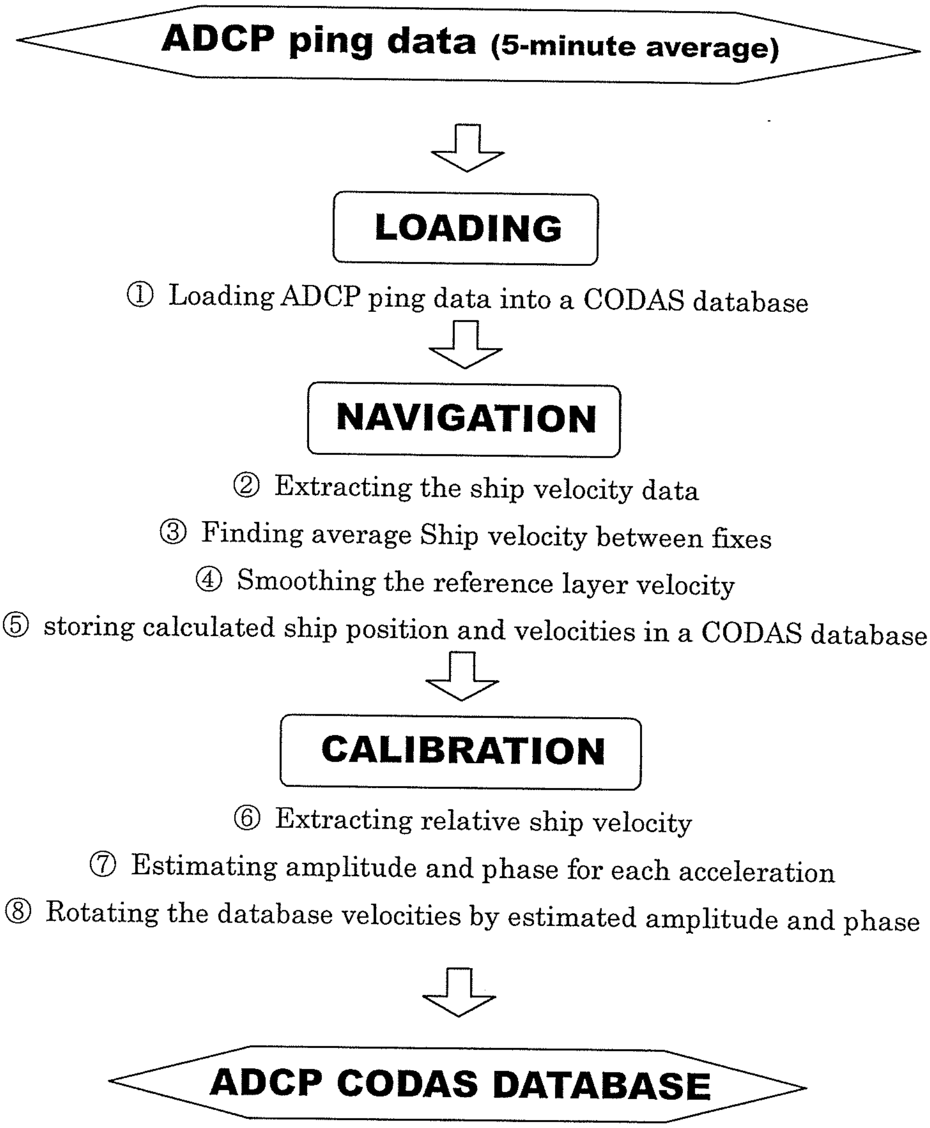
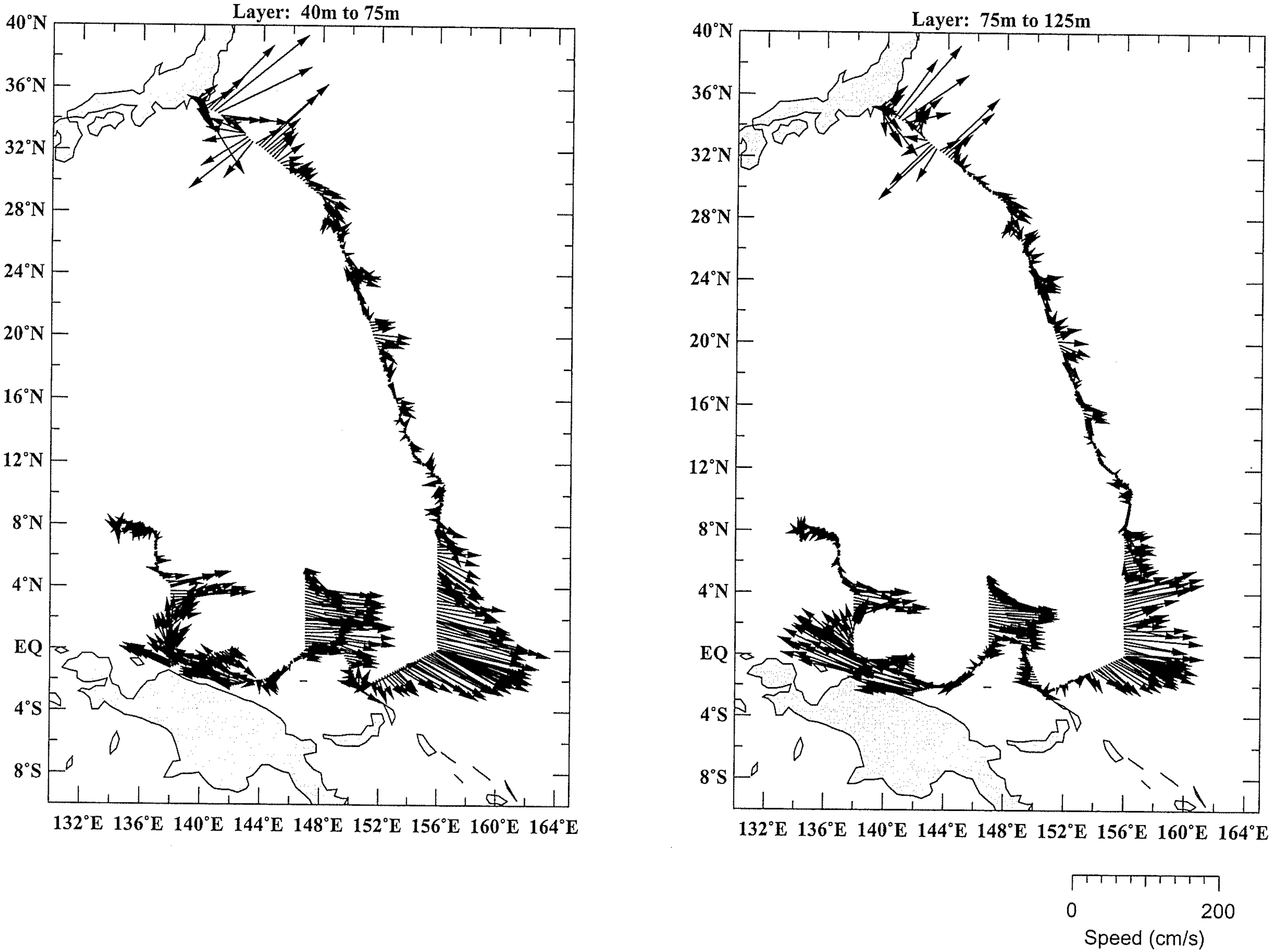


Fig.6-1 ADCP data processing flowchart

KY02-10 SHIPBOARD ADCP

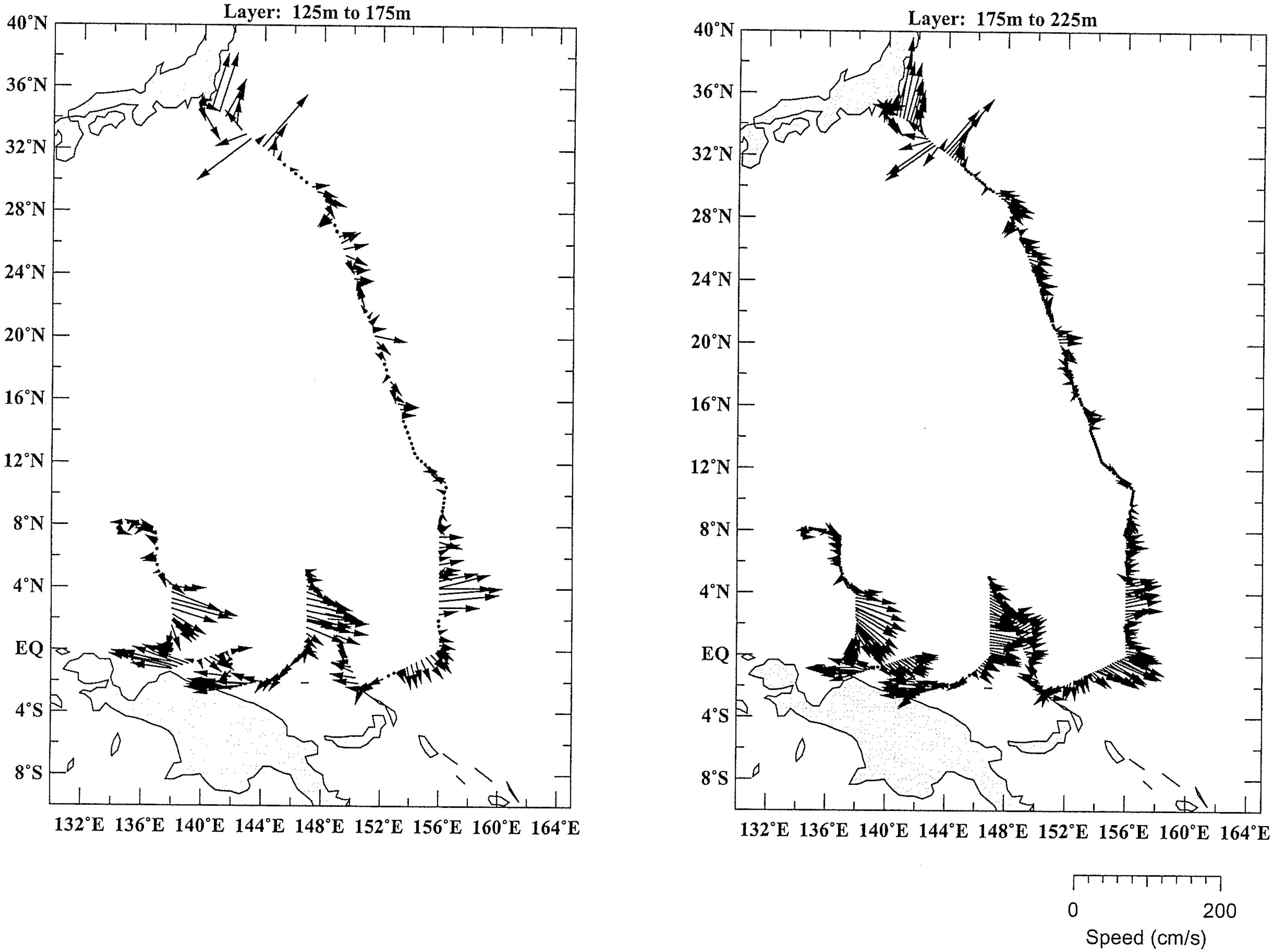
30 September to 30 October, 2002 Yokosuka - Kevieng - Palau



Thu Oct 31 09:24:06 2002
JAMSTEC

KY02-10 SHIPBOARD ADCP

30 September to 30 October, 2002 Yokosuka - Kevieng - Palau

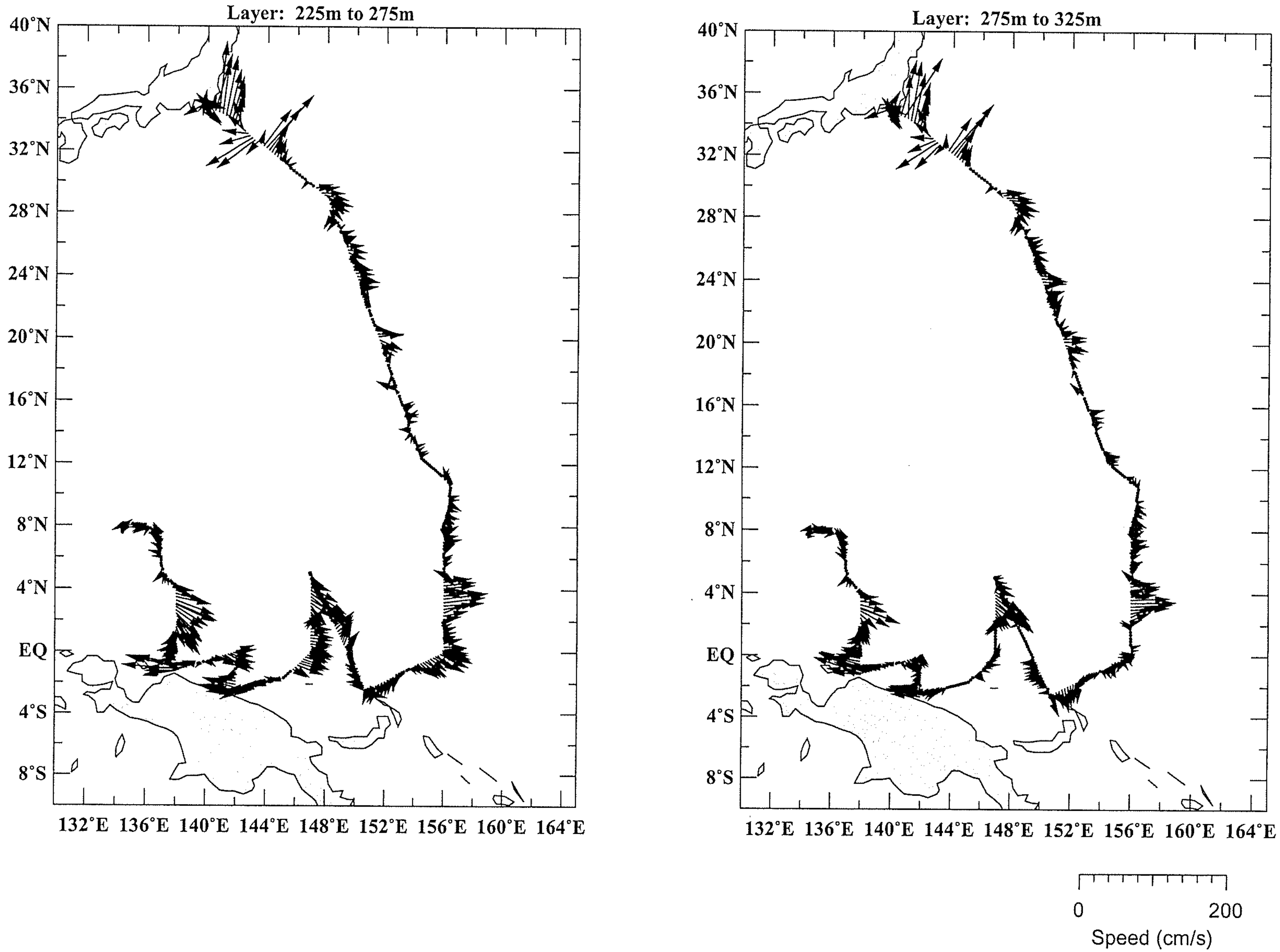

Layer: 125m to 175m

Layer: 175m to 225m

Thu Oct 31 09:24:06 2002
JAMSTEC

KY02-10 SHIPBOARD ADCP

30 September to 30 October, 2002 Yokosuka - Kevieng - Palau



Layer: 225m to 275m

Layer: 275m to 325m

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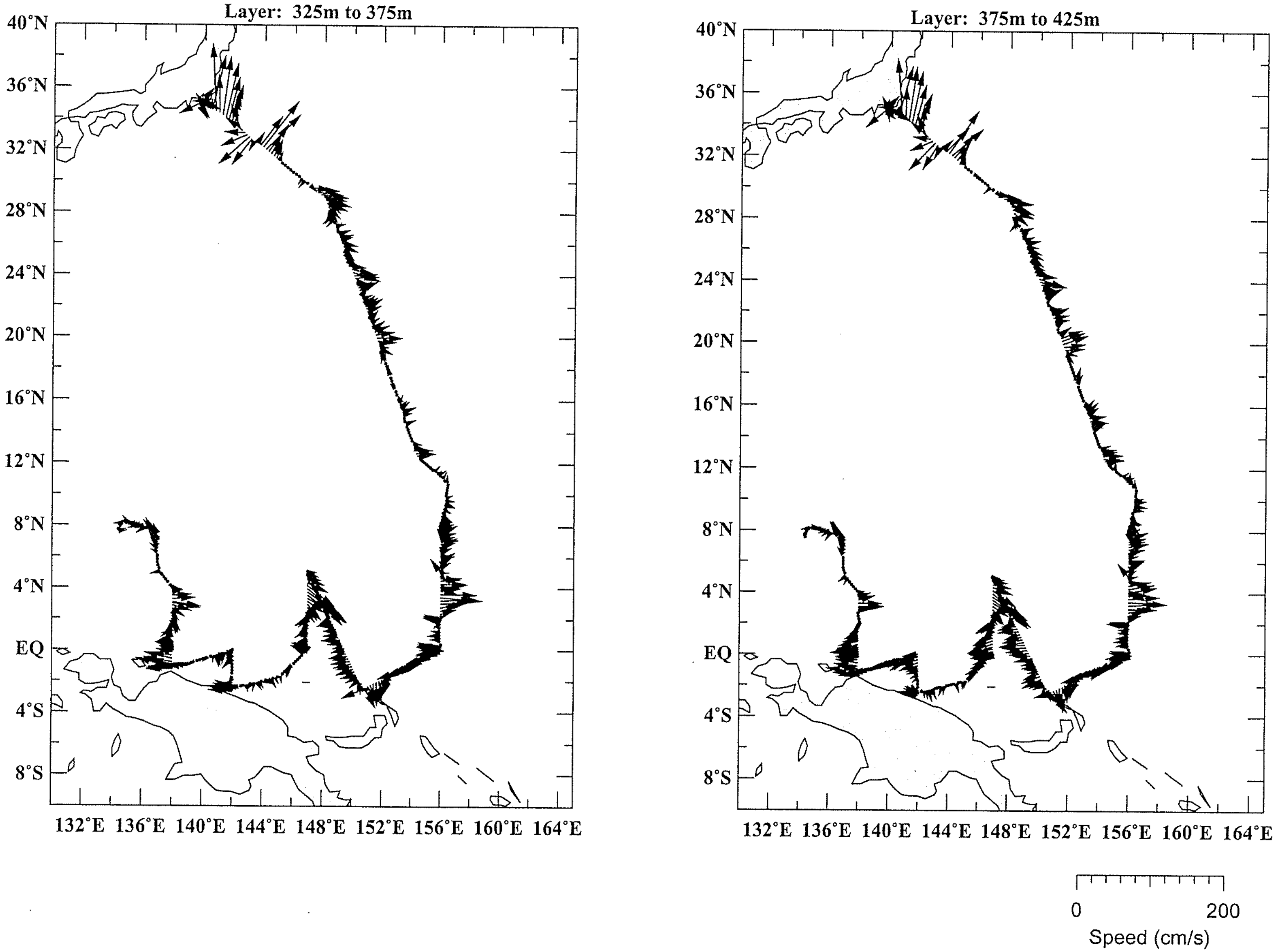
JAMSTEC

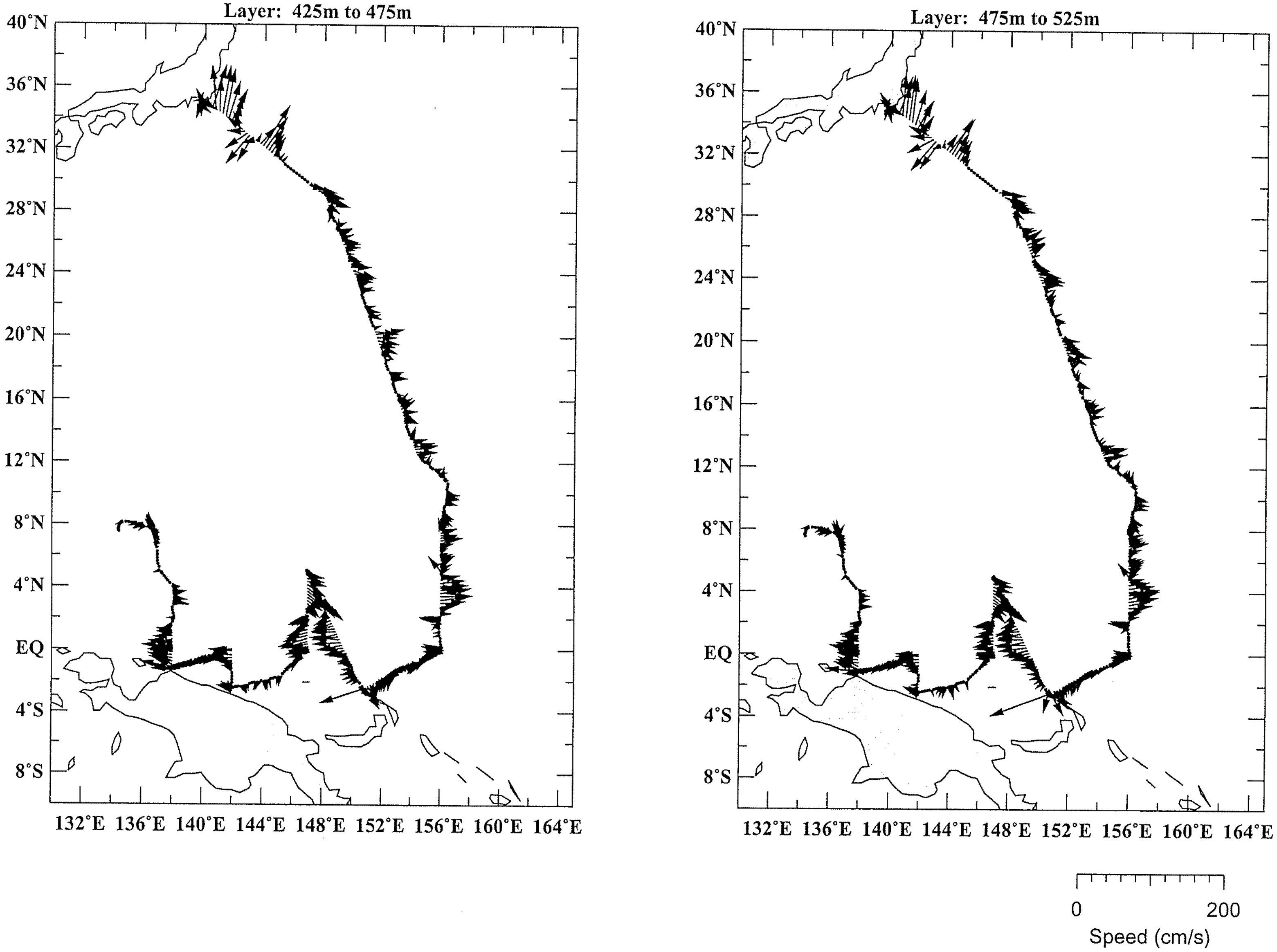
KY02-10 SHIPBOARD ADCP

30 September to 30 October, 2002 Yokosuka - Kevieng - Palau



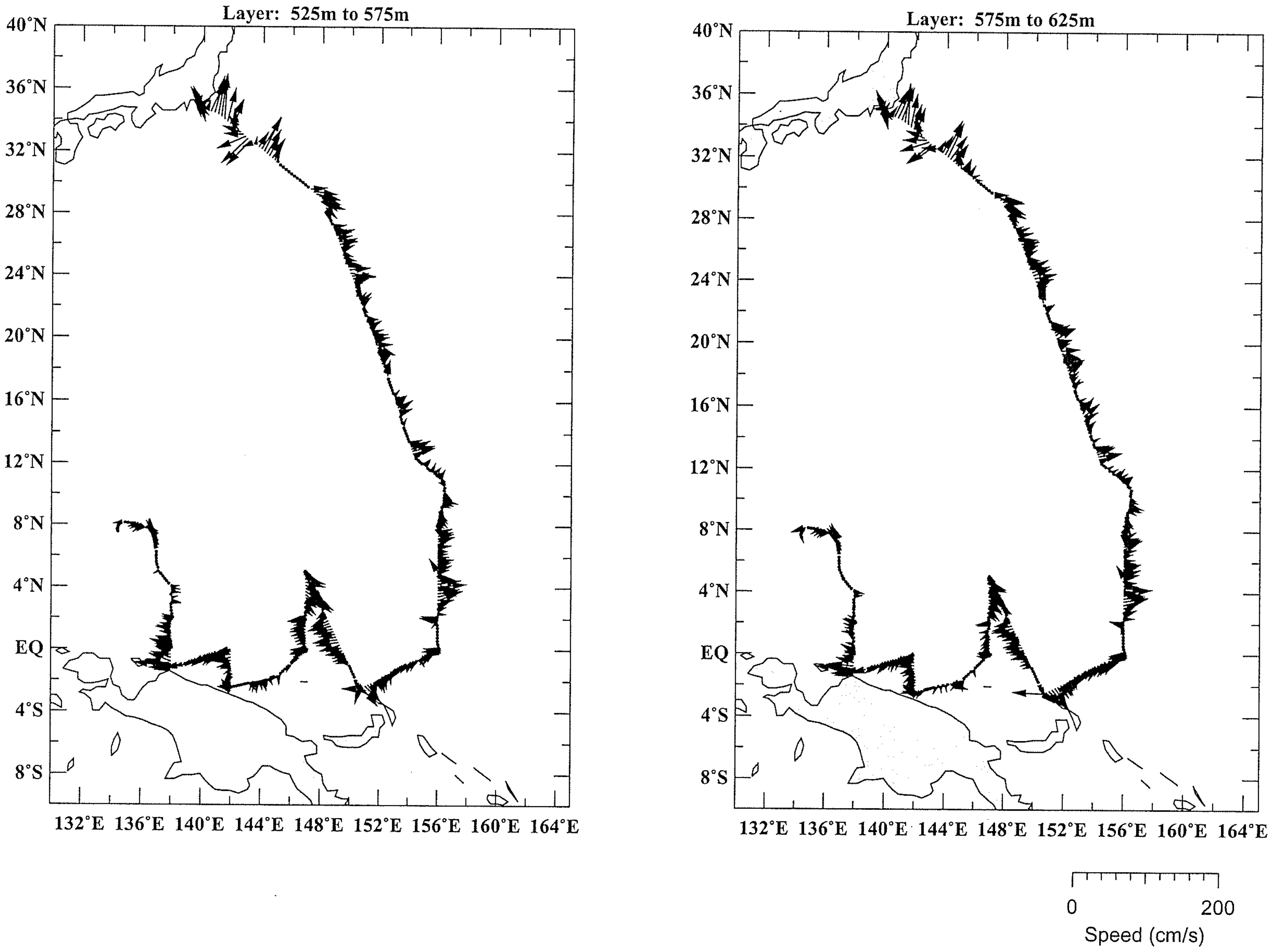
KY02-10 SHIPBOARD ADCP

30 September to 30 October, 2002 Yokosuka - Kevieng - Palau



KY02-10 SHIPBOARD ADCP

30 September to 30 October, 2002 Yokosuka - Kevieng - Palau



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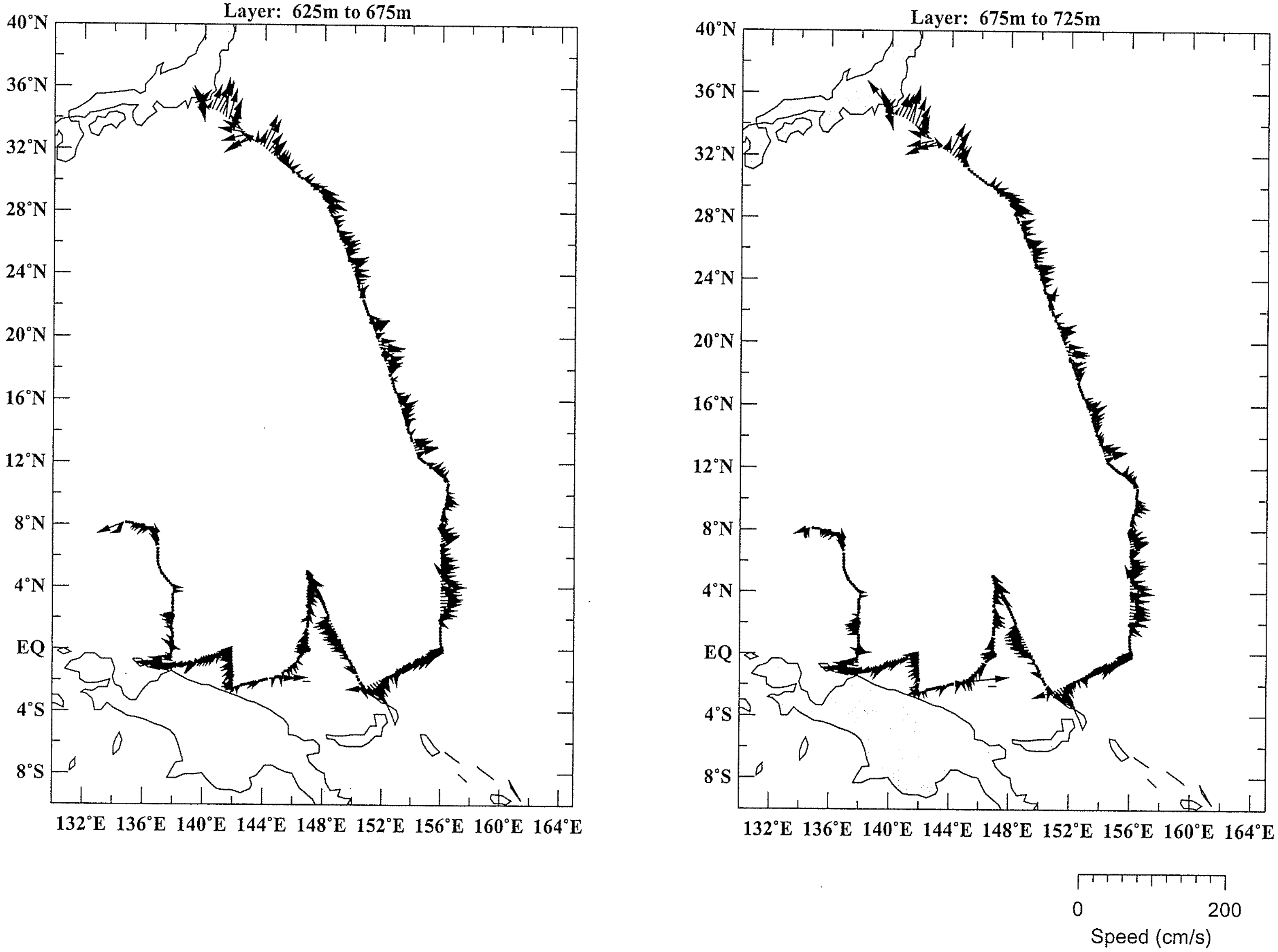
JAMSTEC

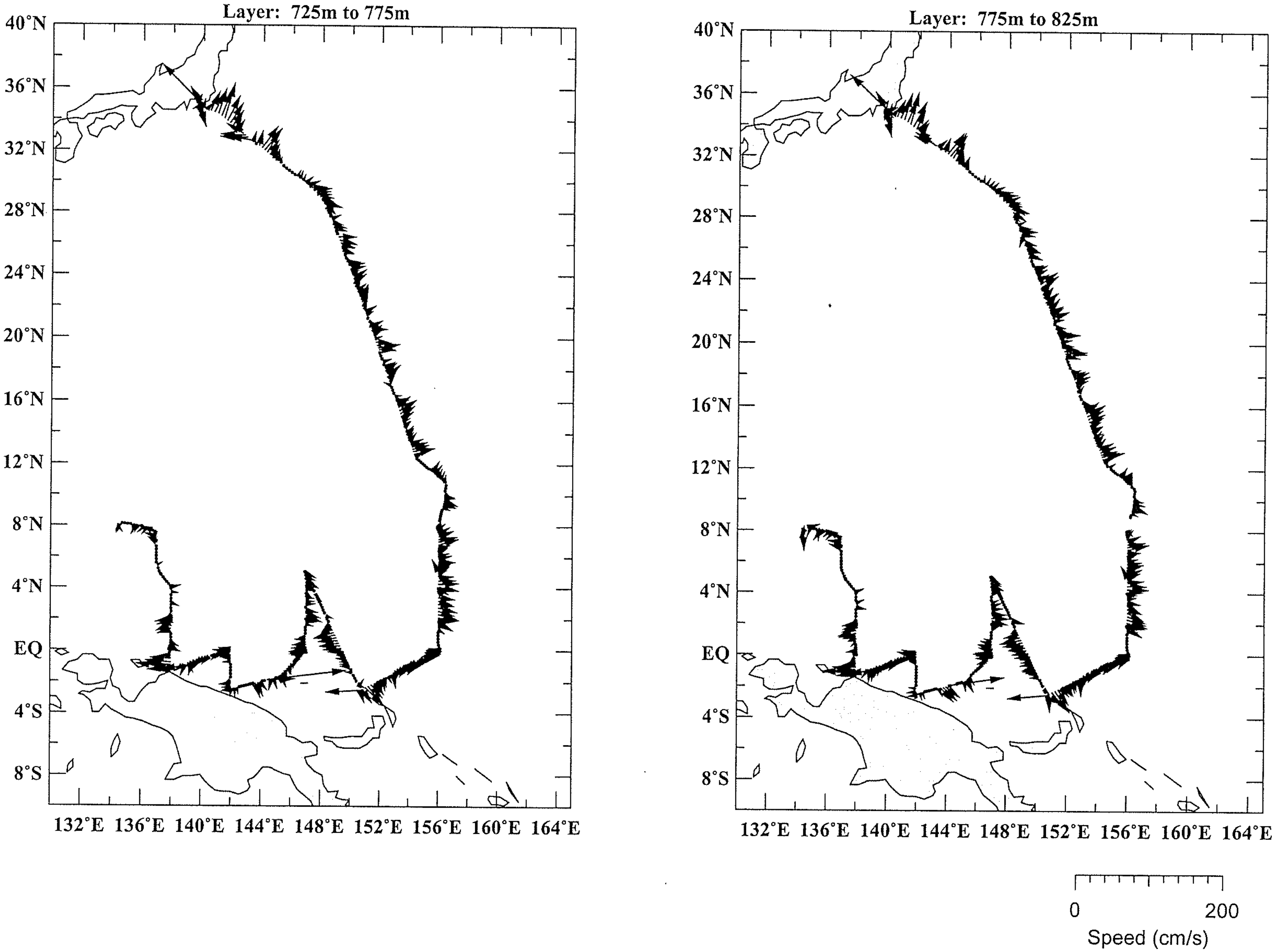
KY02-10 SHIPBOARD ADCP

30 September to 30 October, 2002 Yokosuka - Kevieng - Palau



KY02-10 SHIPBOARD ADCP

30 September to 30 October, 2002 Yokosuka - Kevieng - Palau



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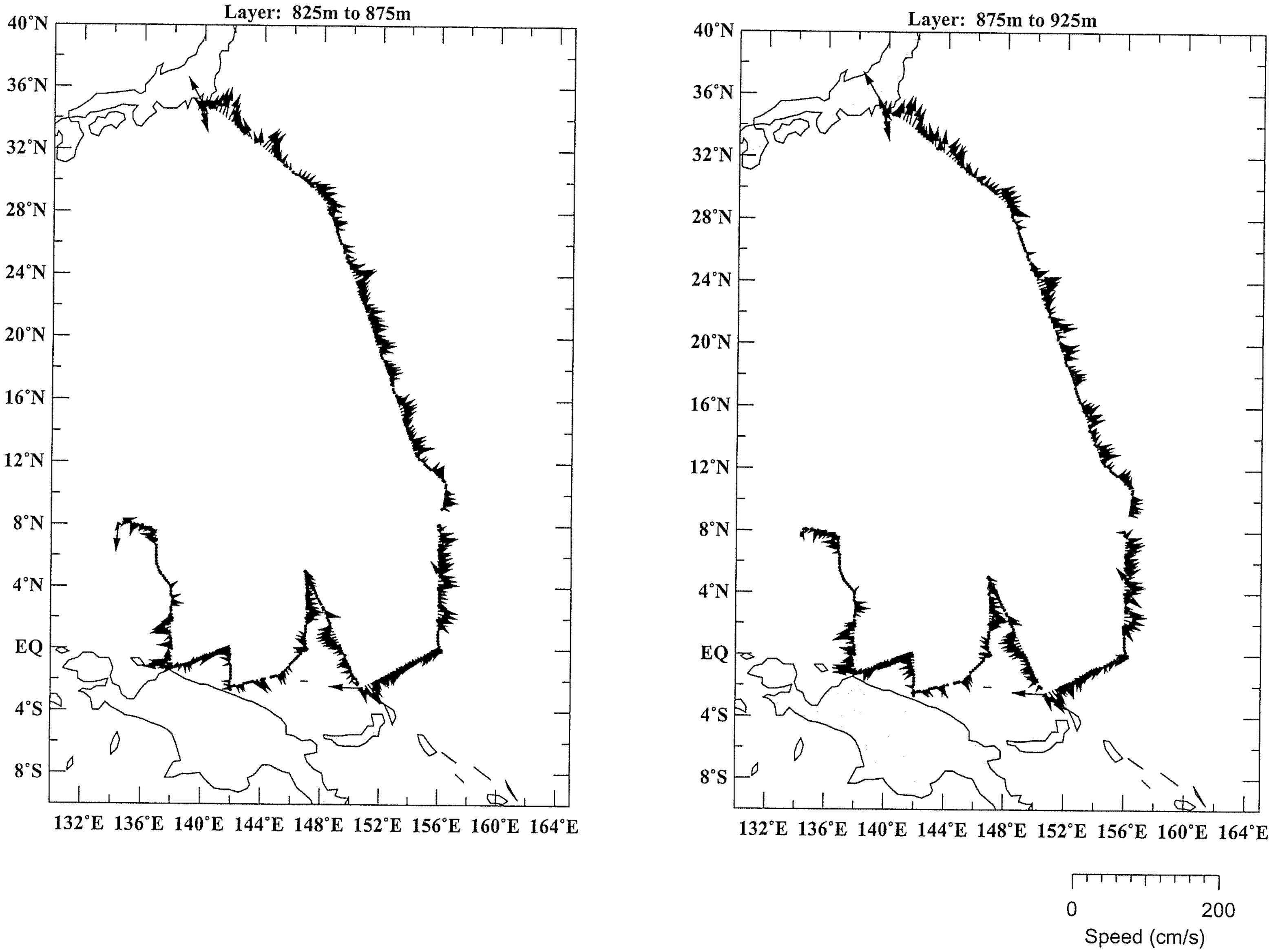
JAMSTEC

KY02-10 SHIPBOARD ADCP

30 September to 30 October, 2002 Yokosuka - Kevieng - Palau



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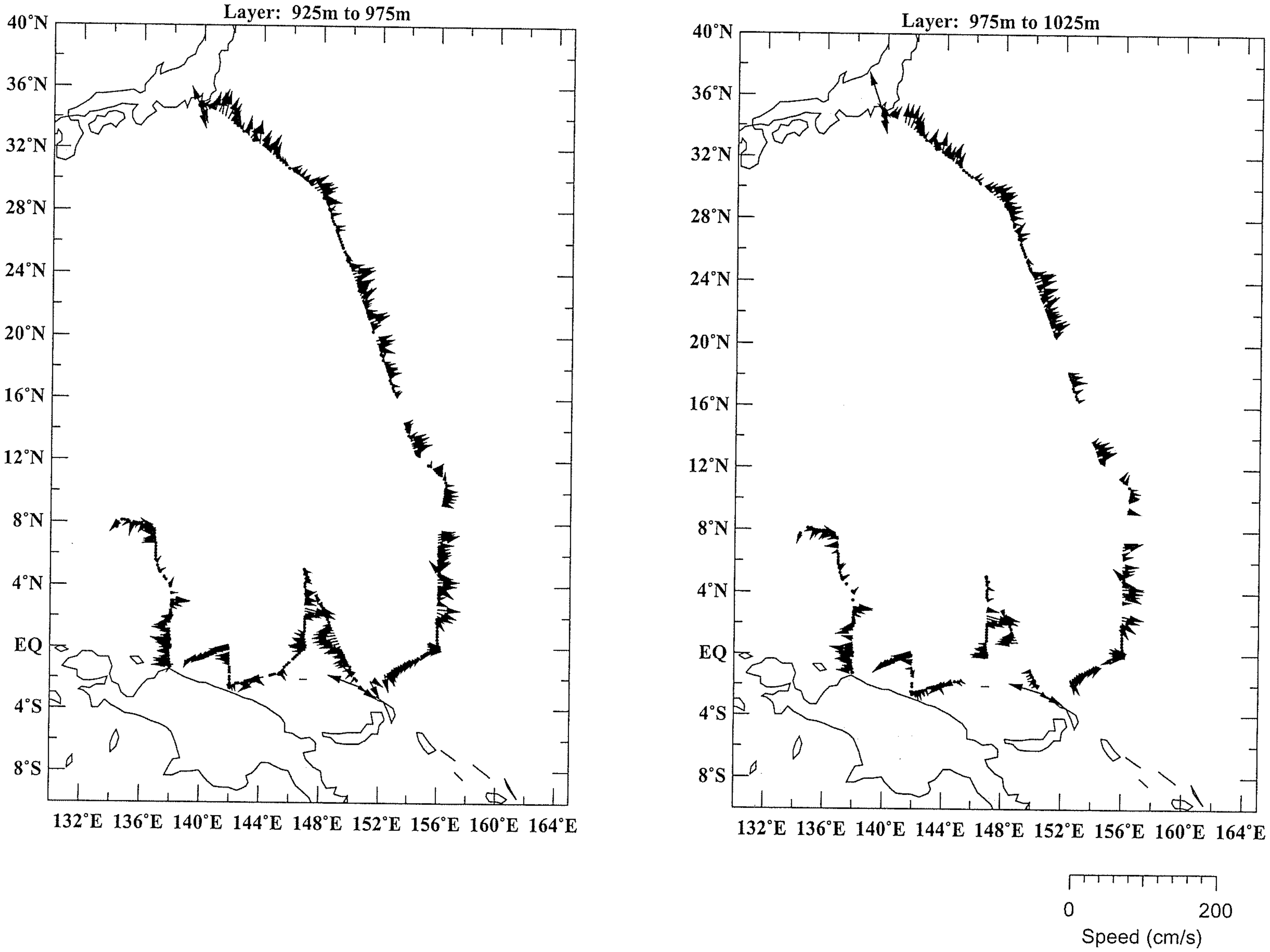
JAMSTEC

KY02-10 SHIPBOARD ADCP

30 September to 30 October, 2002 Yokosuka - Kevieng - Palau



7 . ADCP MOORING

(1) Objectives

The purpose is to get the knowledge of physical process in the western equatorial pacific. In this cruise (KY02-10), we recovered and deployed four subsurface ADCP moorings at (00-156E), (00-147E), (2.5S-142E), (00-138E) and recovered it at (2N-138E) .

(2) Parameters

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

(3) Methods

The mooring consists of a top float , instruments , ropes which length is about 3000- 4000 m, some additional floats , two releasers and sinker. Two instruments are mounted in the top float for observation. One is ADCP (Acoustic Doppler Current Profiler) to observe current profiles upward. The another one is CTD to observe P, T, S. And Current Meter is fasten on recovered moorings (00-147E), (2.5S-142E), (00-138E) at 700m depth. There is a extra CTD on recovered mooring (2.5S-142E) at 700m depth. Details of the instruments are as follows.

1) ADCP

Self-Contained Broadband ADCP 150 kHz (RD Instruments)
Distance to first bin : 17m
Pings per ensemble : 16
Time per ping : 2.00s
Bin length : 8.00m
Sampling Interval : 3600s

Recovered

- Serial Number : 1220 (Mooring No.020307-00156E)
- Serial Number : 1221 (Mooring No.011218-00147E)
- Serial Number : 1224 (Mooring No.011222-25S142E)
- Serial Number : 1225 (Mooring No.011222-00138E)
- Serial Number : 1152 (Mooring No.011001-2N138E)

Deployed

- Serial Number : 1151 (Mooring No.021013-00156E)
- Serial Number : 1223 (Mooring No.021021-00147E)
- Serial Number : 1222 (Mooring No.021023-25S142E)
- Serial Number : (Mooring No.021026-00138E)

2) CTD

SBE-16 (Sea Bird Electronics Inc.)
Sampling Interval : 1800s

Recovered

- Serial Number : 1278 (Mooring No.020307-00156E)
- Serial Number : 1286 (Mooring No.011218-00147E)
- Serial Number : 1285 (Mooring No.011222-25S142E)
- Serial Number : 1284 (Mooring No.011222-00138E)
- Serial Number : 1283 (Mooring No.011001-2N138E)

Deployed

- Serial Number : 2611 (Mooring No.021013-00156E)
- Serial Number : 1280 (Mooring No.021021-00147E)
- Serial Number : 1282 (Mooring No.021023-25S142E)
- Serial Number : 1276 (Mooring No.021026-00138E)

SBE-37 (Sea Bird Electronics Inc.)
Sampling Interval : 1800s
Deployed

- Serial Number : 1685 (Mooring No.011222-25S142E)

3) Current Meter
RCM-8 (AANDERAA Instruments :These belong to Tokyo Univ.)
Recovered

- Serial Number : 5352 (Mooring No.011218-00147E)
- Serial Number : 3806 (Mooring No.011222-25S142E)
- Serial Number : 4008 (Mooring No.011222-00138E)

(4) Deployment

Four ADCP moorings were deployed at (00-156E), (00-147E), (2.5S-142E), (00-138E). The moorings were planed to make the ADCP buoy placed at about 300m.

After we dropped the anchor, we monitored depth of the acoustic releaser (Fig.7-1).
Each position of the mooring were showed below.

Results of calibration

- Mooring No.021013-00156E
  13-Oct. 2002 Lat: 00° 00.00.04S Long: 156° 08.52E Depth: 1956m
- Mooring No.021021-00147E
  21-Oct. 2002 Lat: 00° 00.40S Long: 147° 04.42E Depth: 4485m
- Mooring No.021023-25S142E
  23-Oct. 2002 Lat: 02° 28.83S Long: 141° 57.66E Depth: 3438m
- Mooring No.021026-0138E
  26-Oct. 2002 Lat: 00° 00.68S Long: 138° 01.82E Depth: 3945m

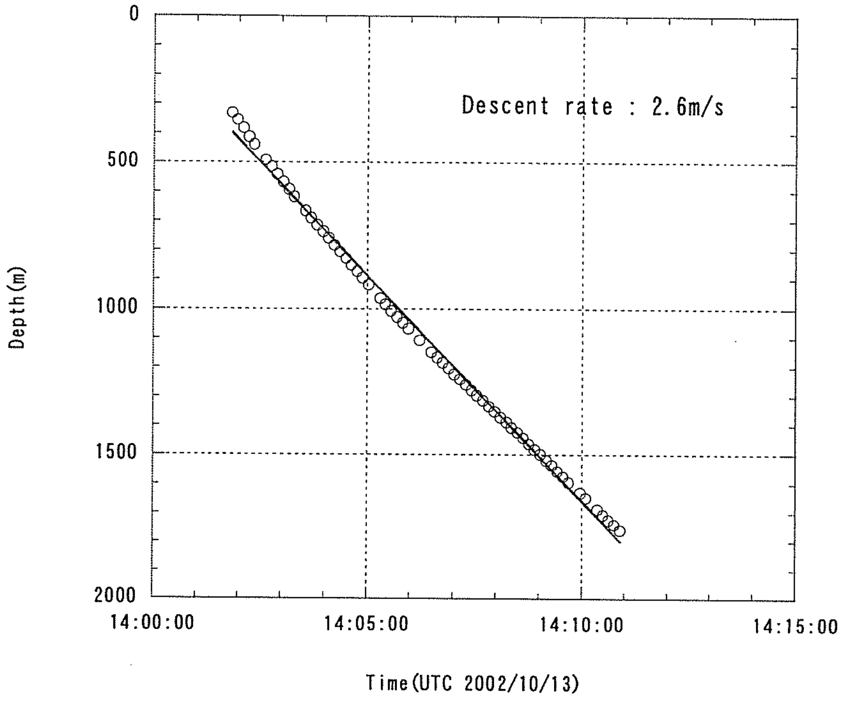
(5) Recovery

We recovered Five ADCP moorings which were deployed on Sep.2001 (MR01-K05), (KY01-11) and Mar.2002 (MR02-K02). We monitored depth of acoustic releaser after we released the anchor (Fig. 7-2).

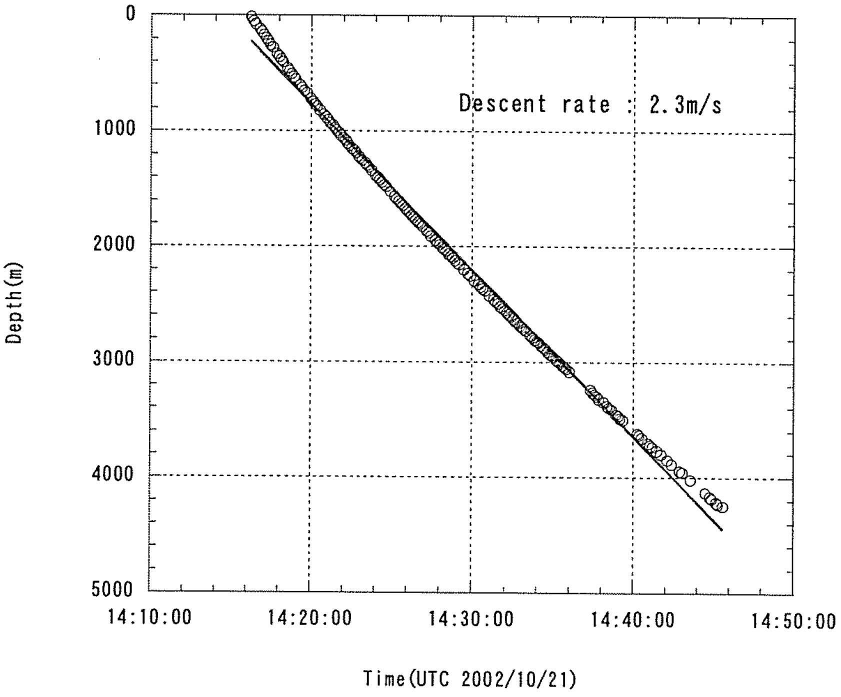
After the recovery, we uploaded ADCP and CTD data into a computer, then raw data were converted into ASCII code. Results were shown in the figures on following pages. Fig.7-3～7-7 shows CTD pressure, temperature ,salinity data. All CTD data were shown in recording SBE16 sensors at the top of mooring except for 2.5S 142E, because the data were not recorded through observation period. Instead, data of SBE37 sensor at the middle of the mooring were used. Fig.7-8～7-17 shows the velocity data (eastward and northward component) .

(6) Data archive

The velocity data will be reconstructed using CTD pressure data. The all data will be archived by the member of TOCS project at JAMSTEC. And, all data will be submitted to DMO at JAMSTEC within 3 years after each recovery.

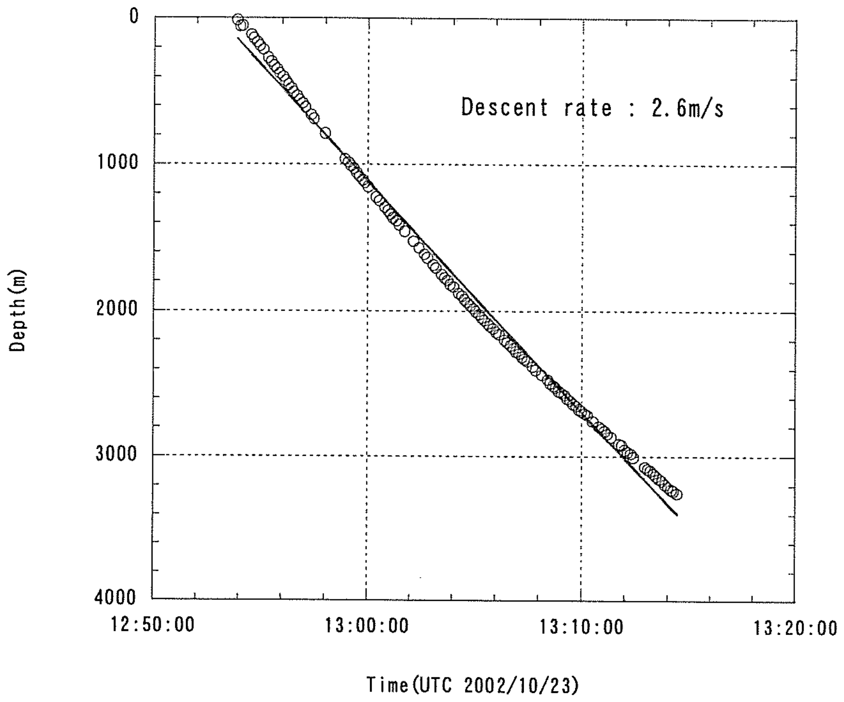


(a) EQ-156° E

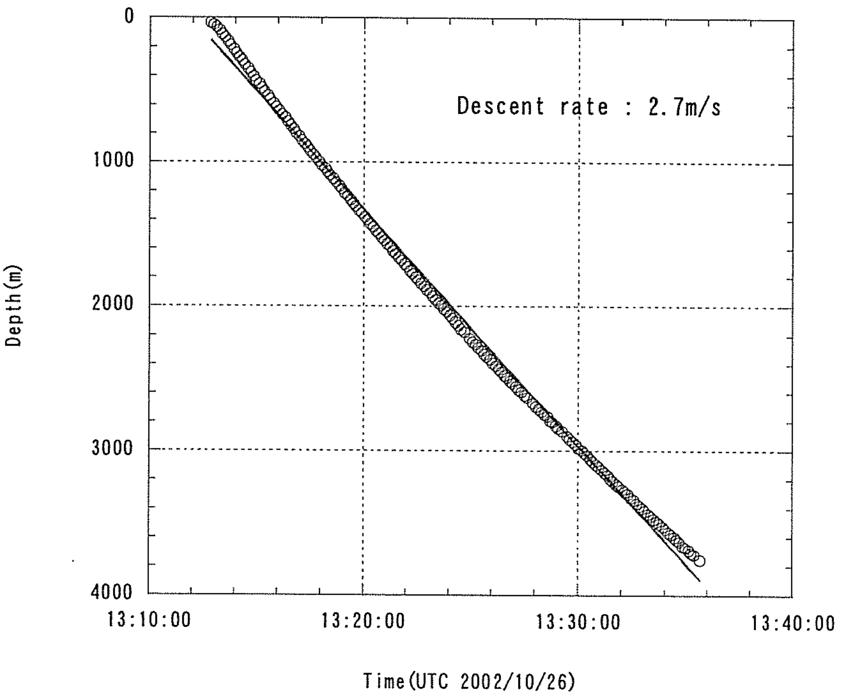


(b) EQ-147° E

Fig.7-1 Acoustic releaser depth monitor (Deploying).
(a) EQ-156E, (b) EQ-147E.

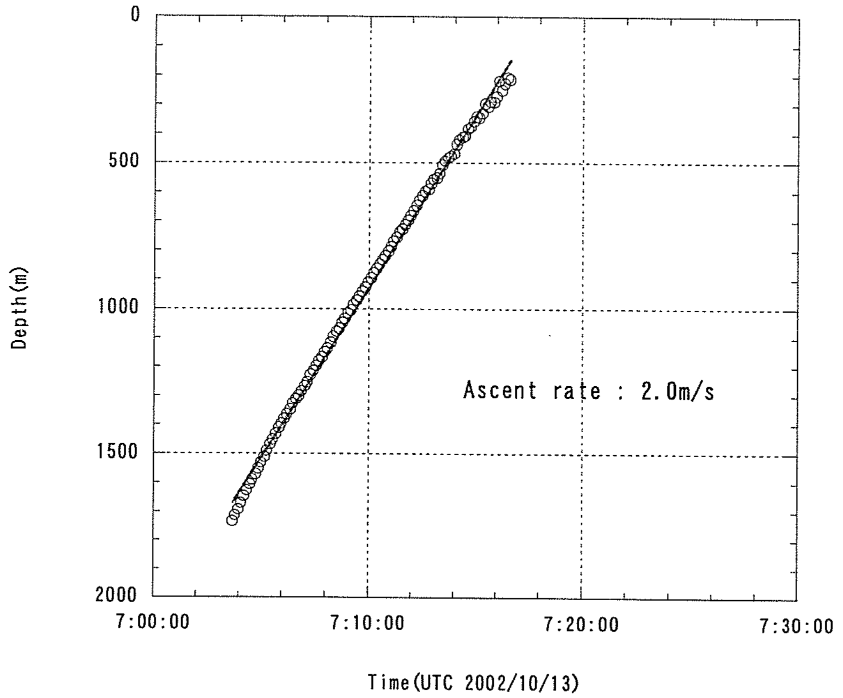


(c) 2.5° S-142° E

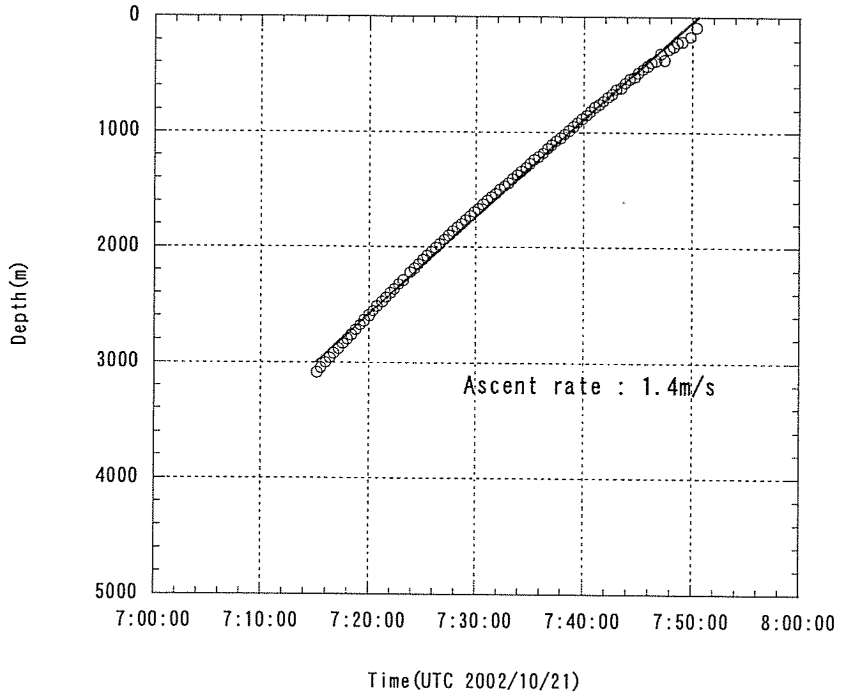


(b) EQ-138° E

Fig.7-1 Acoustic releaser depth monitor (Deploying).
(c) 2.5S-142E, (d) EQ-138E.

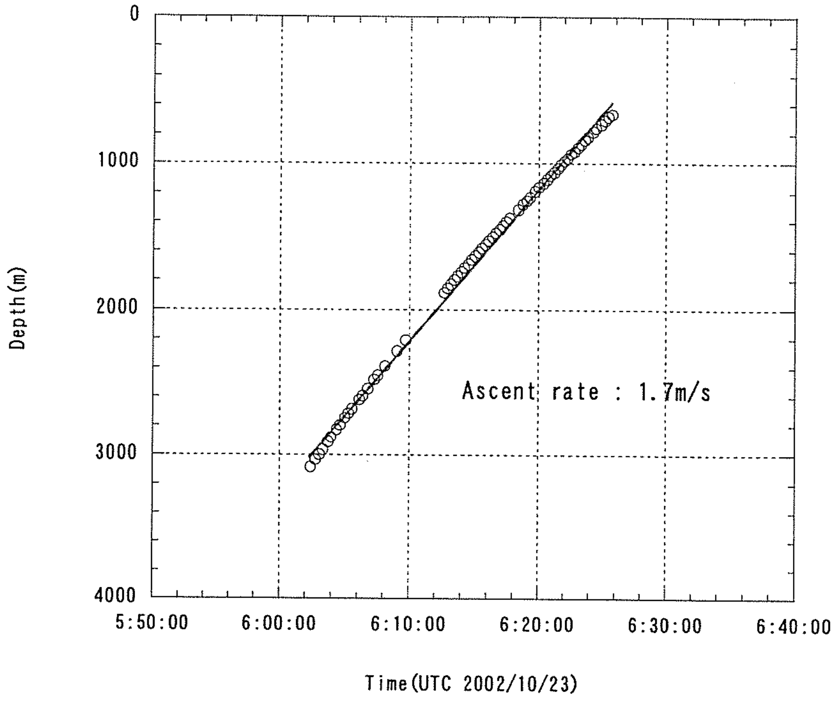


(a) EQ-156° E

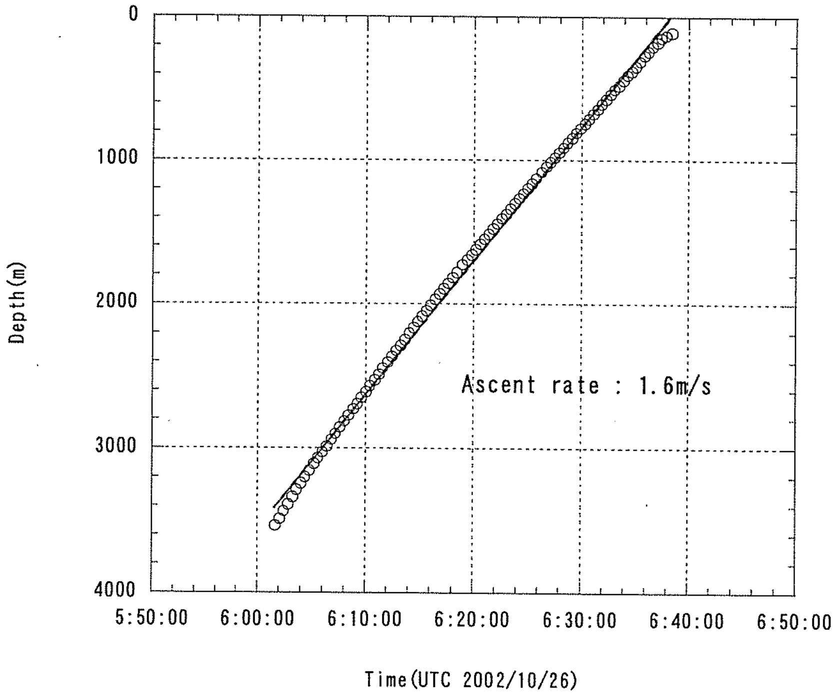


(b) EQ-147° E

Fig.7-2 Acoustic releaser depth monitor (Recovering).
(a) EQ-156E, (b) EQ-147E.

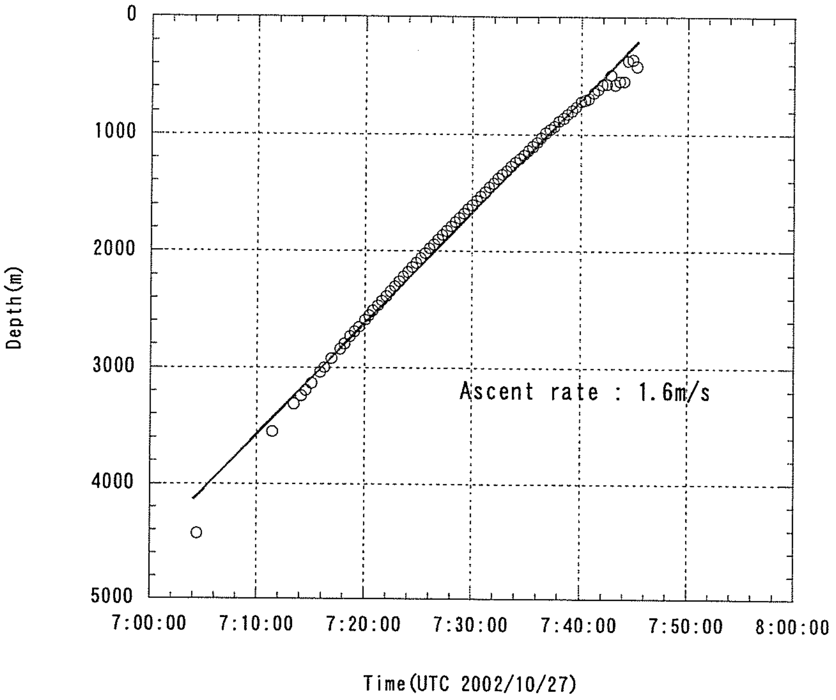


(c) 2.5° S-147° E



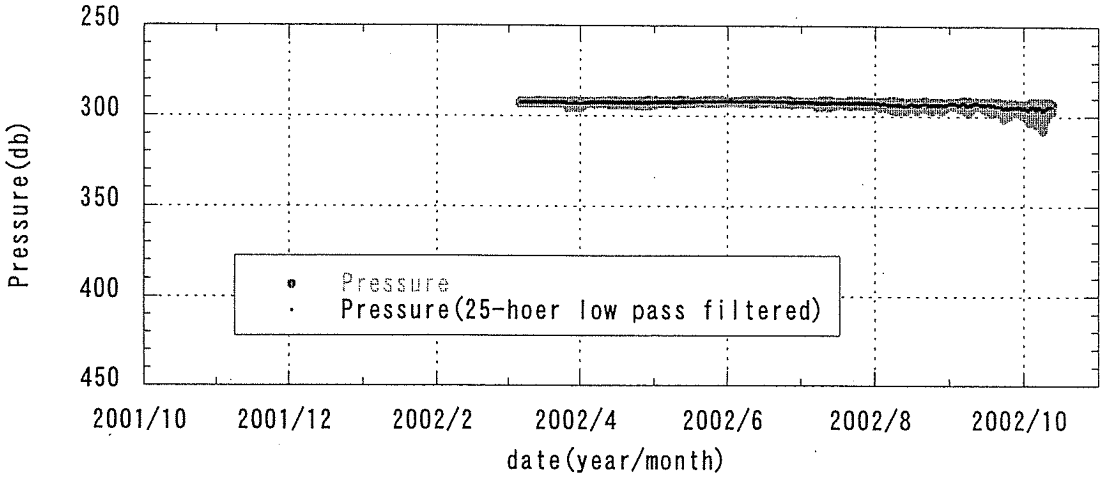
(d) EQ-138° E

Fig.7-2 Acoustic releaser depth monitor (Recovering).
(c) 2.5S-142E, (d) EQ-138E.

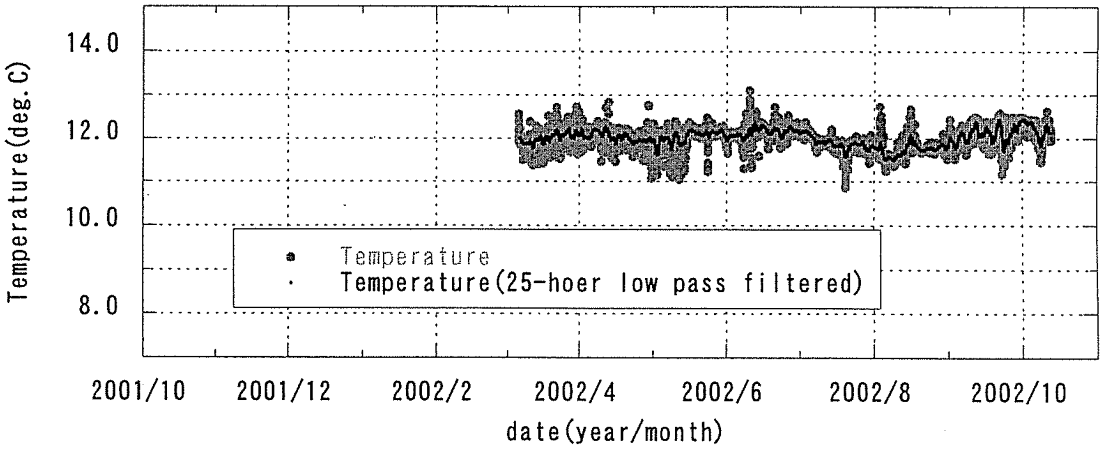


(e) 2° N-138° E

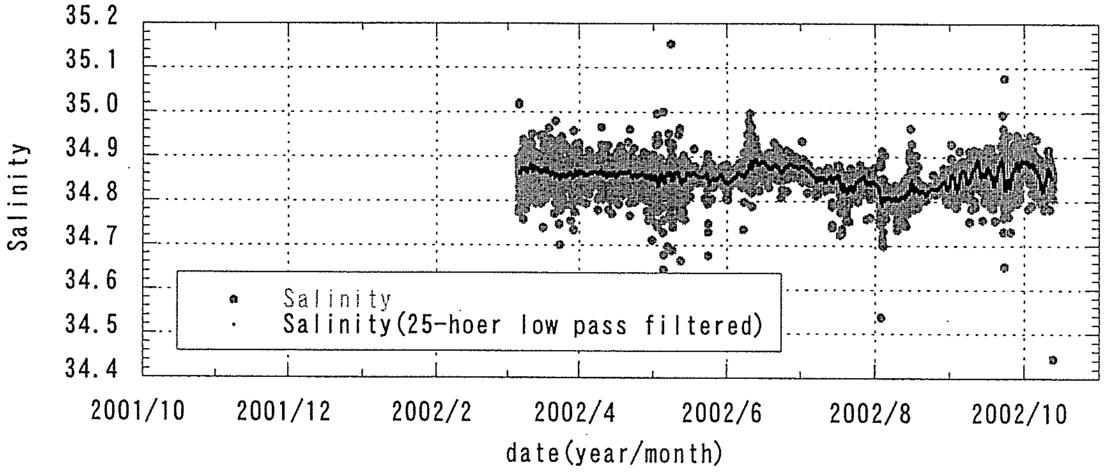
Fig.7-2 Acoustic releaser depth monitor (Recovering).
(e) 2N-138E



(a) Pressure

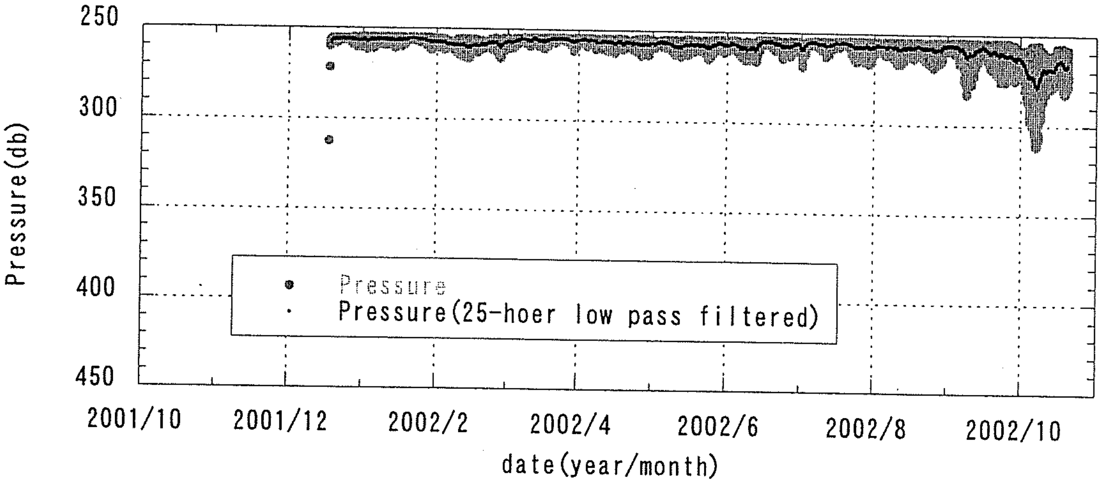


(b) Temperature

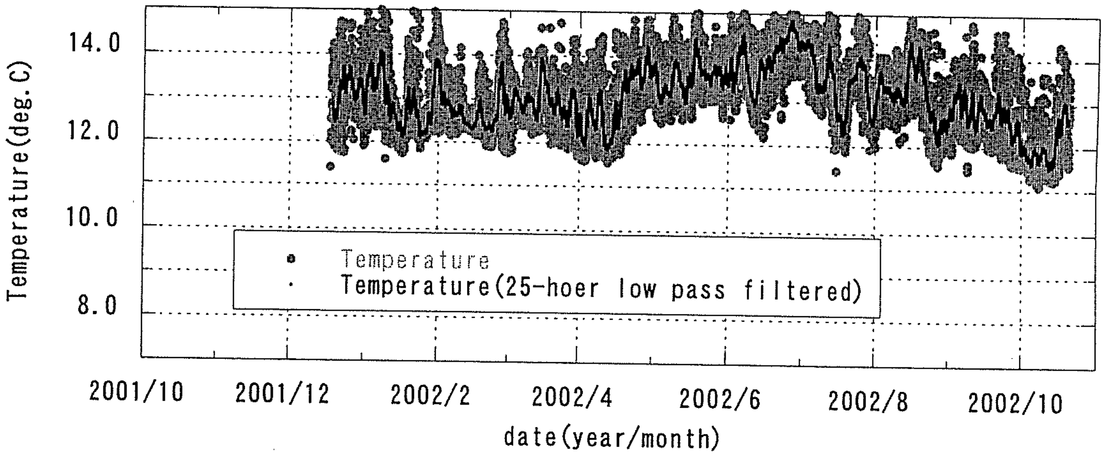


(c) Salinity

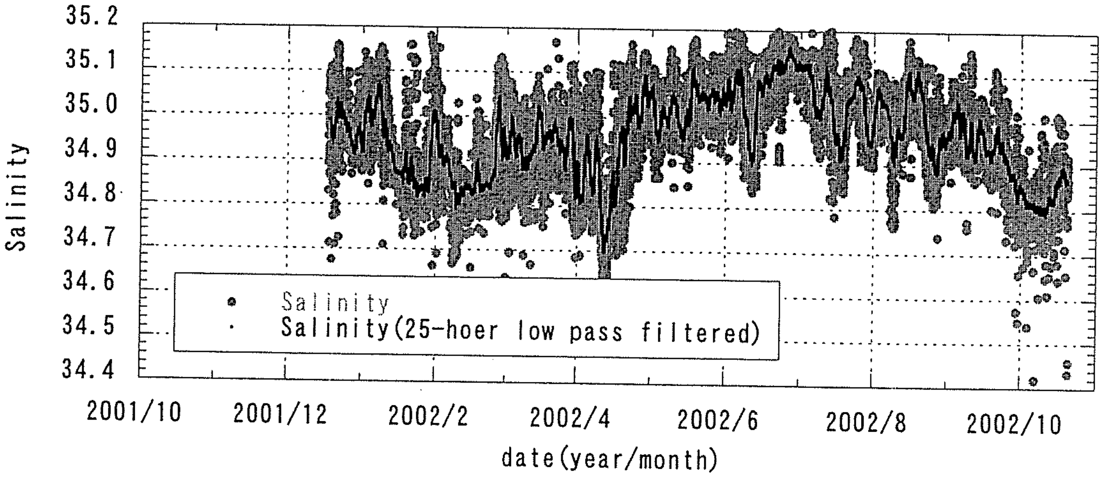
Fig.7-3 Time series of CTD data (EQ-156E, SBE-16).



(a) Pressure

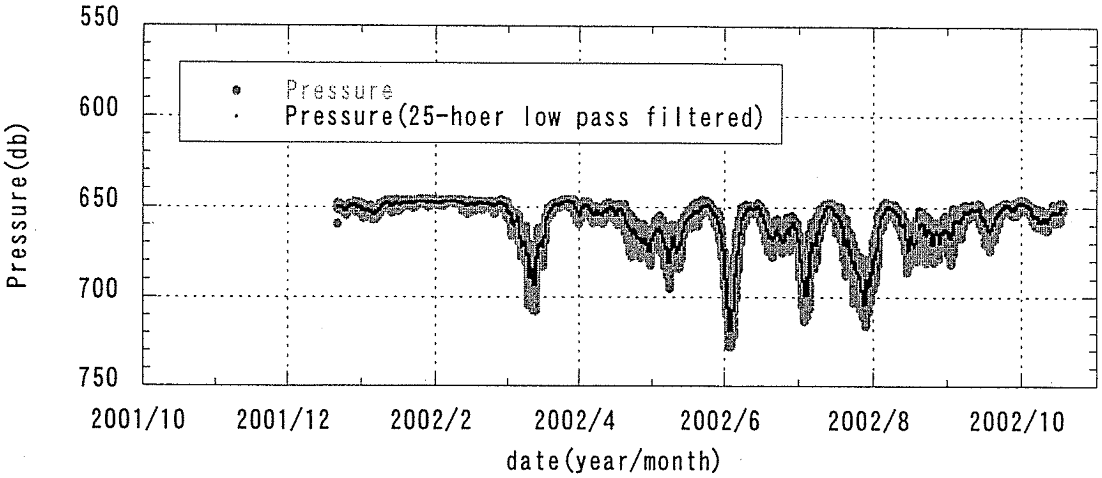


(b) Temperature

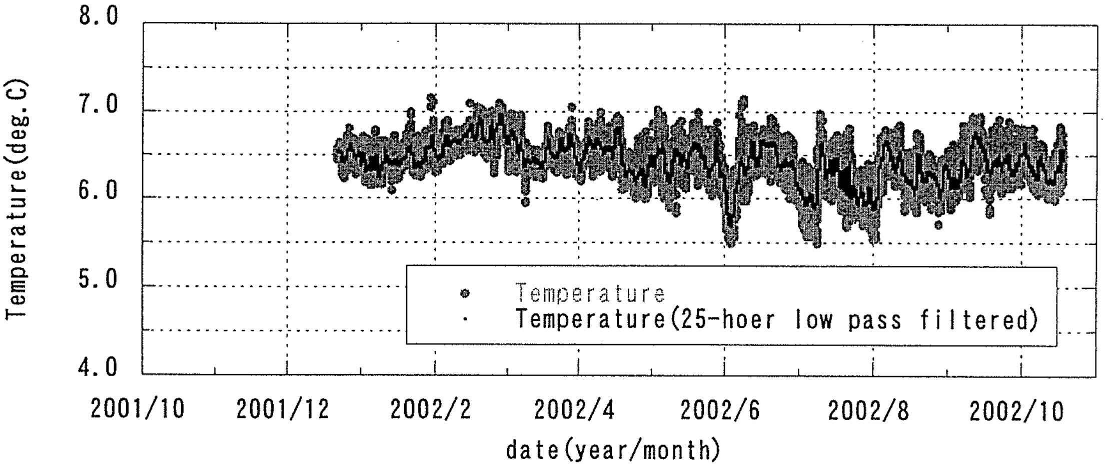


(c) Salinity

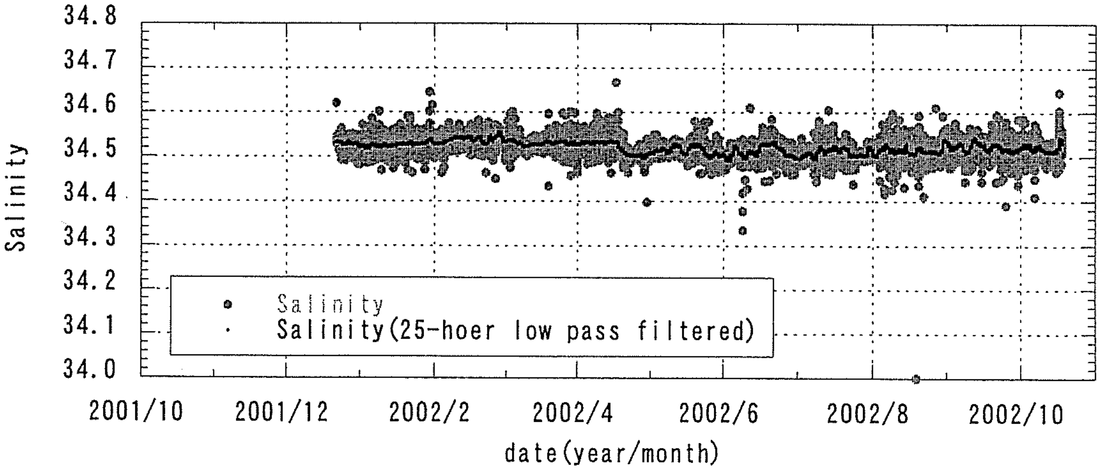
Fig.7-4 Time series of CTD data (EQ-147E, SBE-16).



(a) Pressure

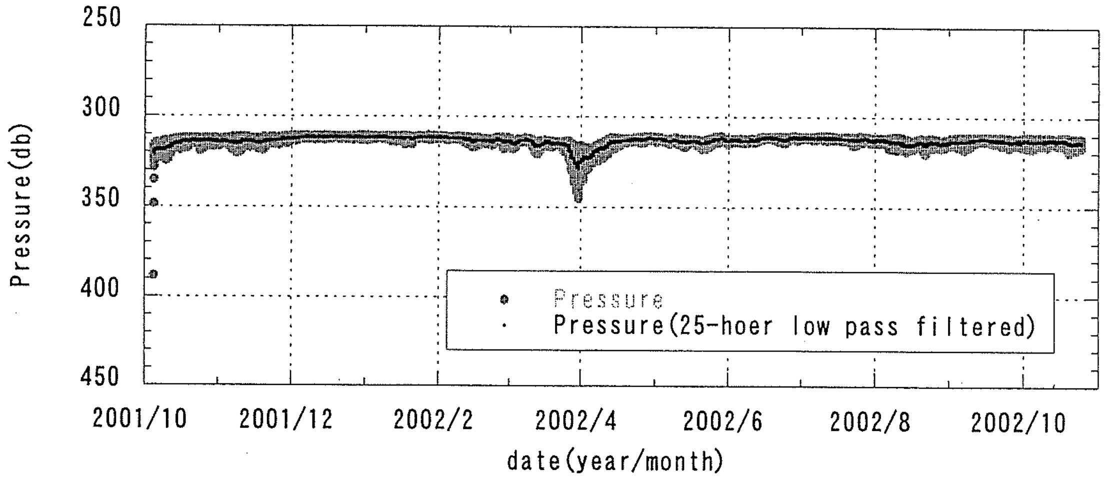


(b) Temperature

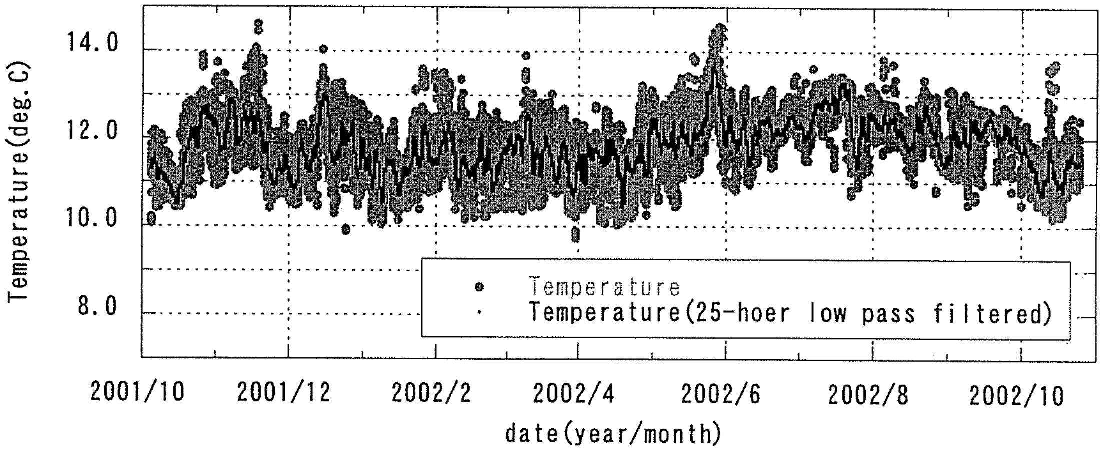


(c) Salinity

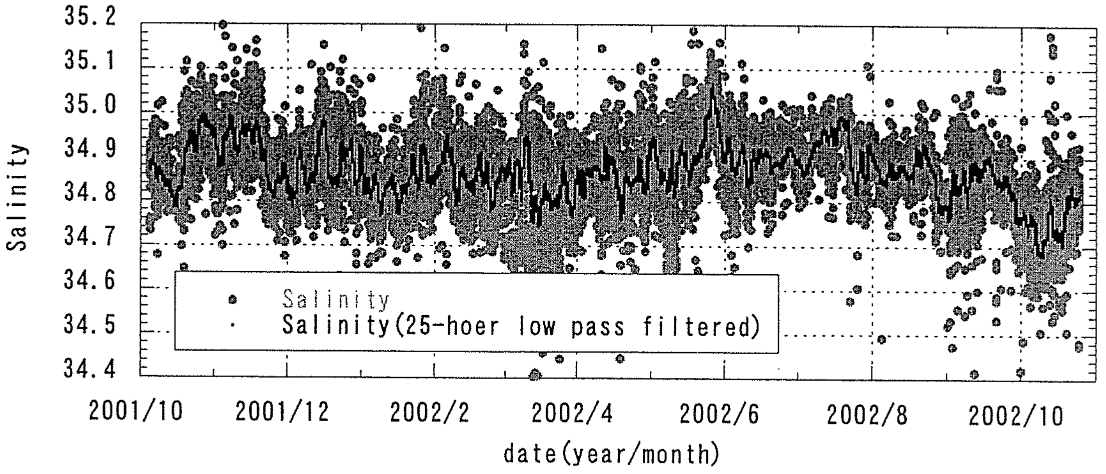
Fig.7-5 Time series of CTD data (2.5S-142E, SBE-37).



(a) Pressure

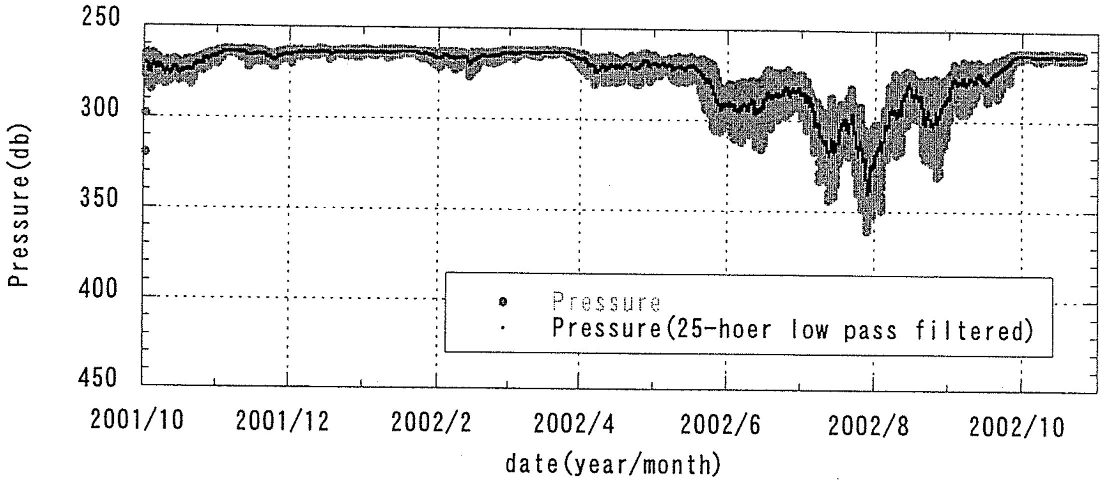


(b) Temperature

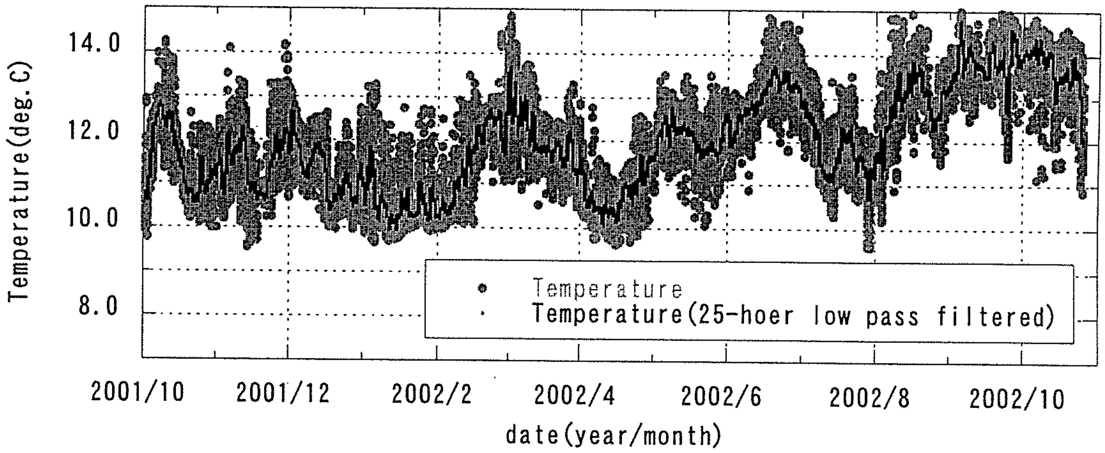


(c) Salinity

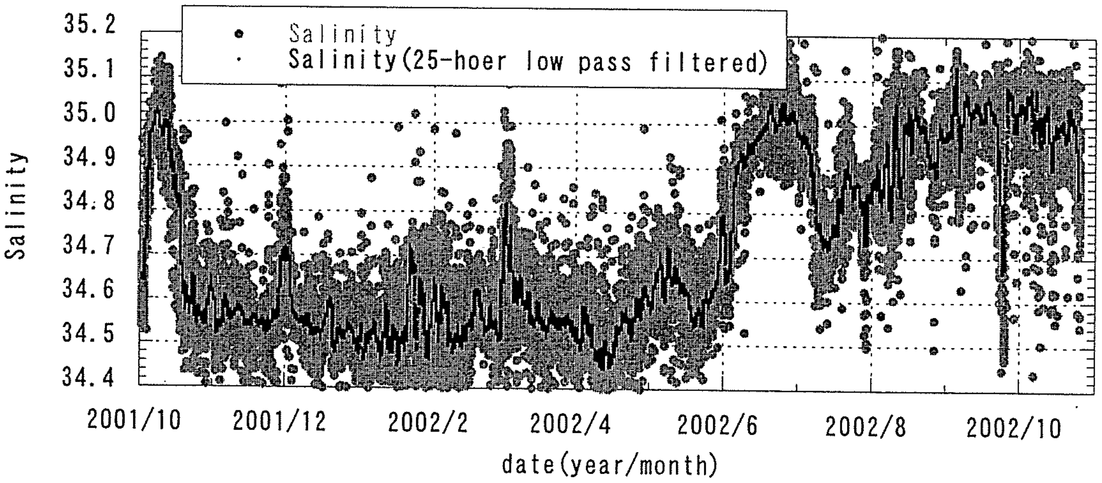
Fig.7-6 Time series of CTD data (EQ-138E, SBE-16).



(a) Pressure

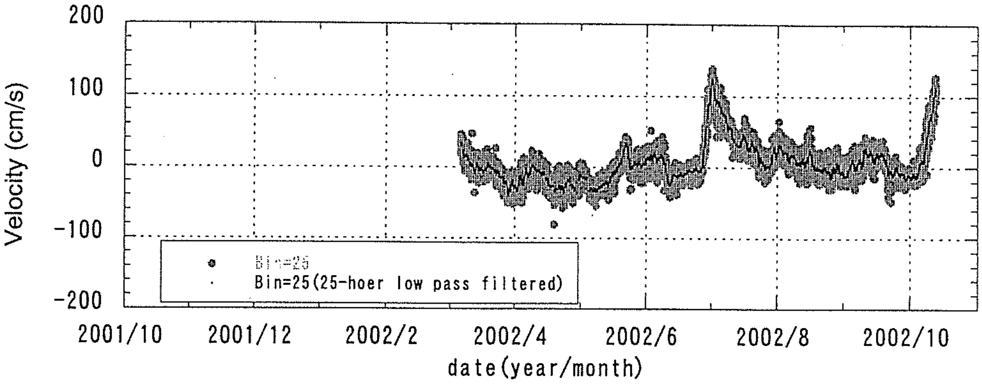


(b) Temperature

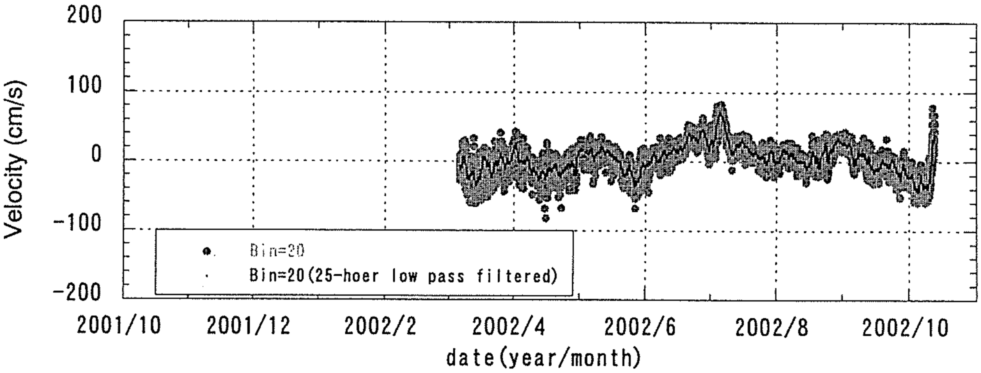


(c) Salinity

Fig.7-7 Time series of CTD data (2N-138E, SBE-16).



(a) Bin=25



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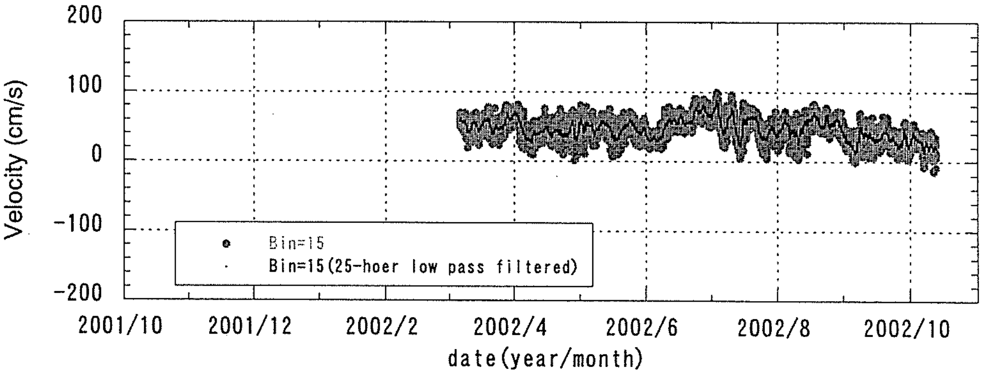
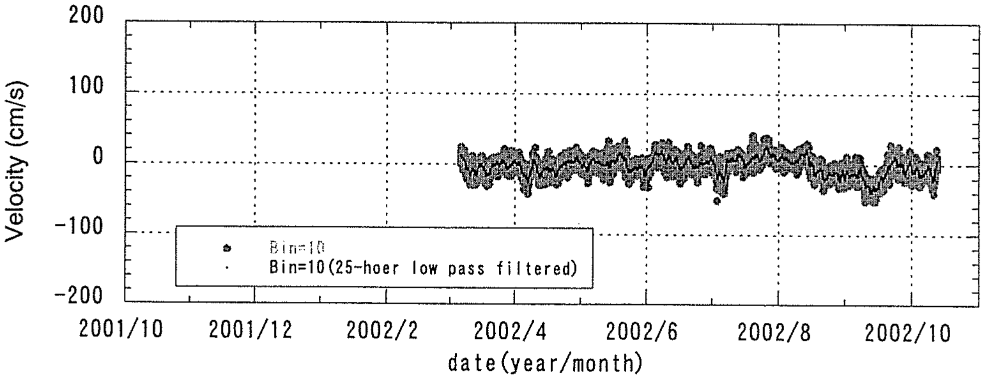
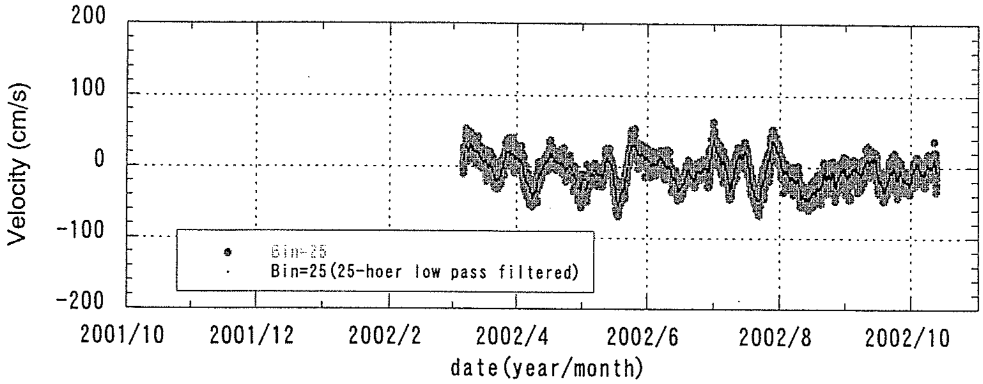


(c) Bin=15



(d) Bin=10

Fig.7-8-1 Time series of ADCP data (EQ-156E, Zonal component).



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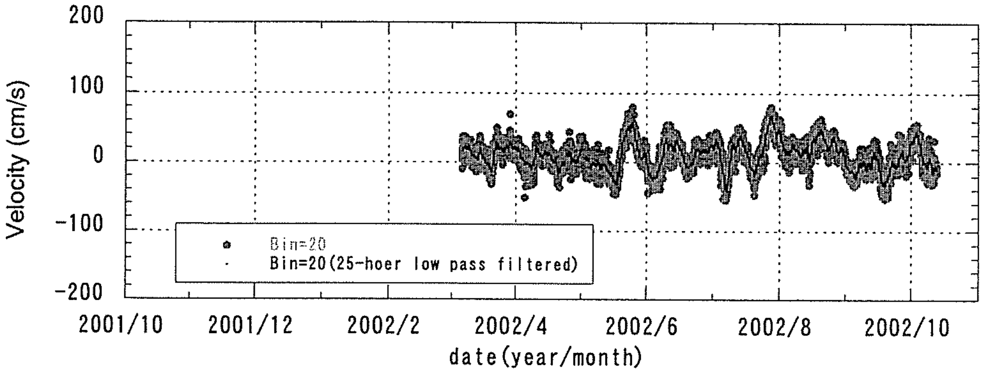

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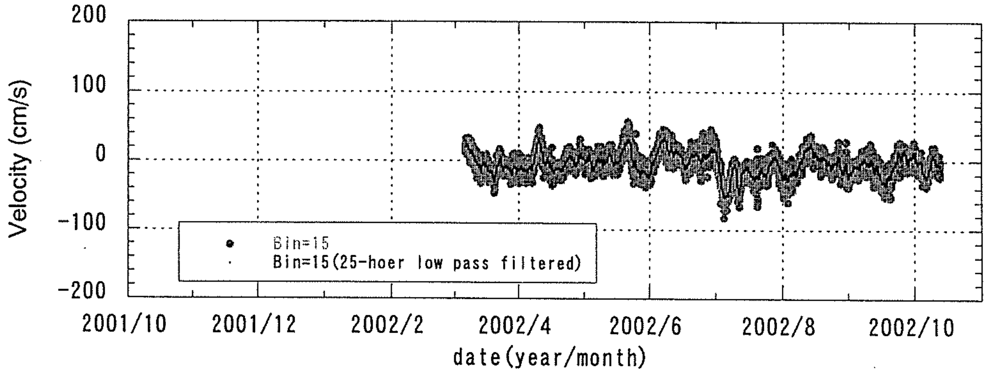
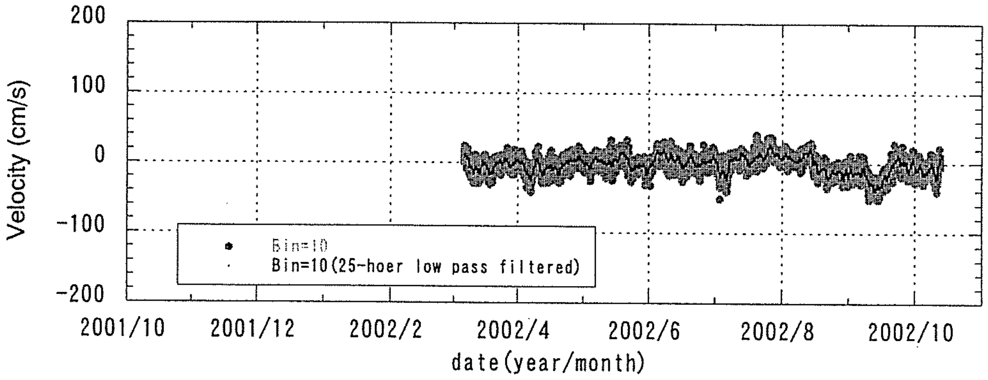
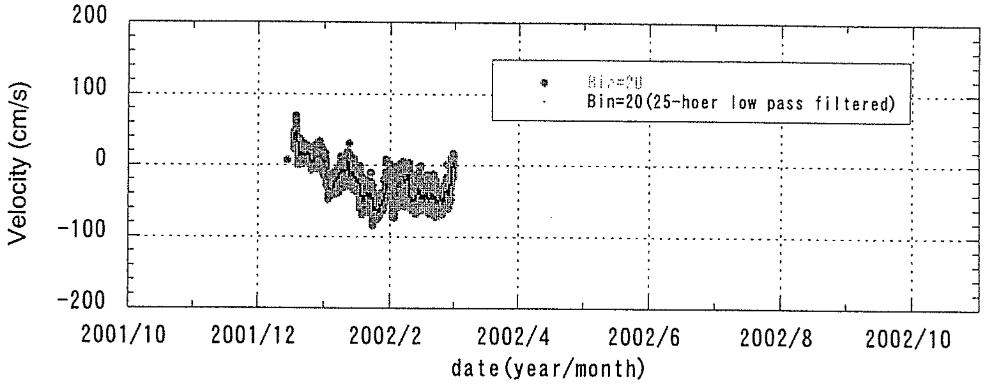


(c) Bin=15

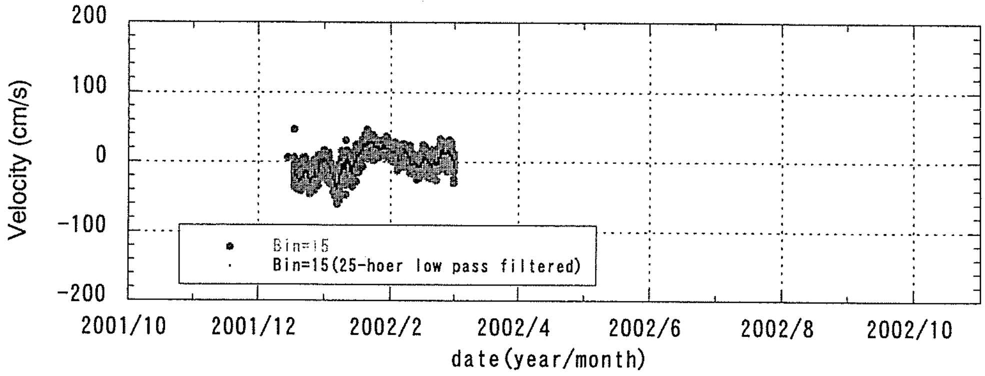


(d) Bin=10

Fig.7-8-2 Time series of ADCP data (EQ-156E, Meridional component).



(a) Bin=20



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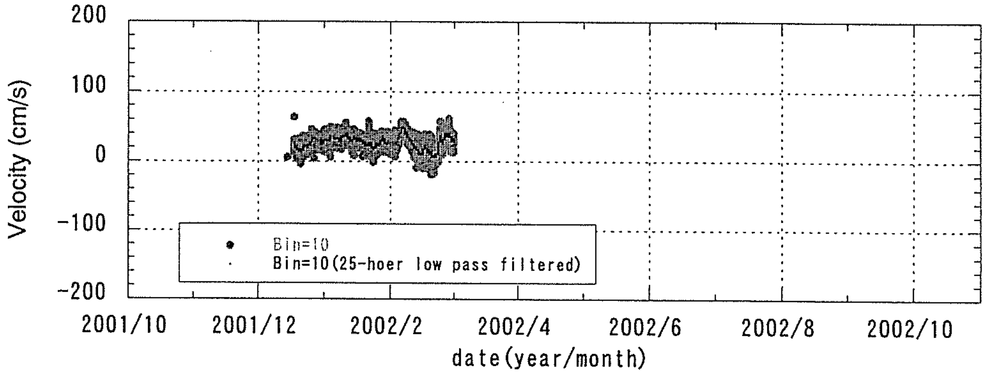

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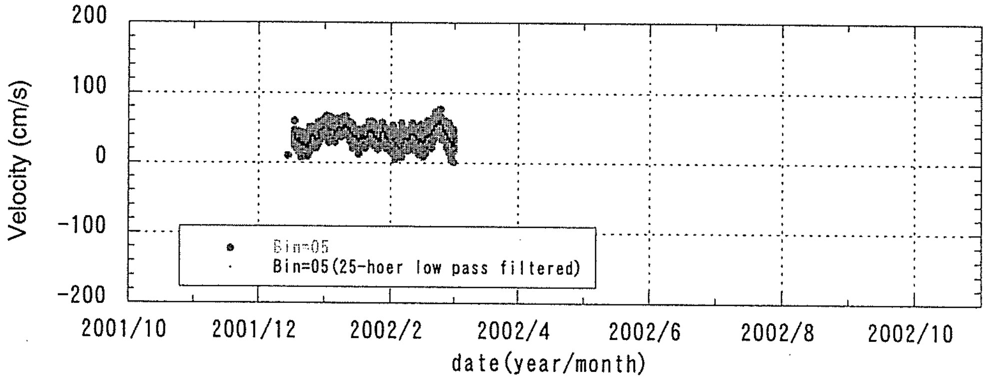
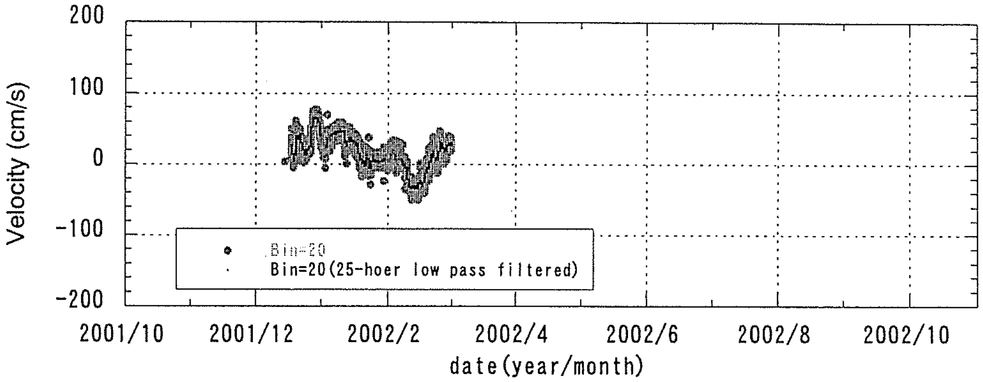


(d) Bin=05

Fig.7-9-1 Time series of ADCP data (EQ-147E, Zonal component).



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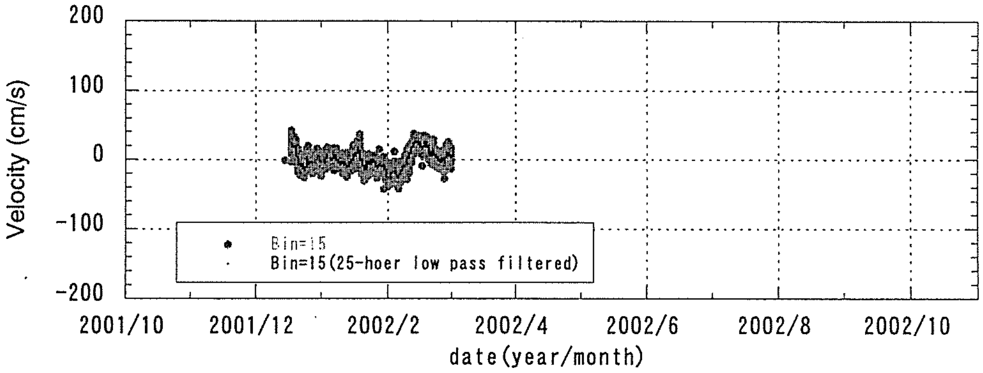

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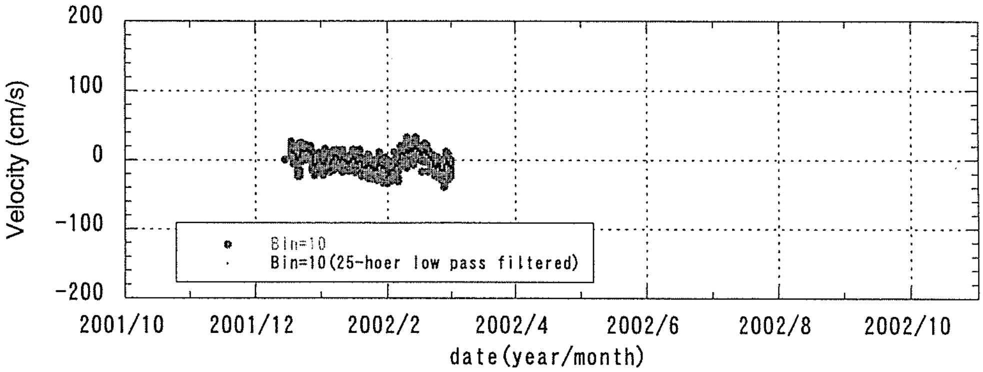

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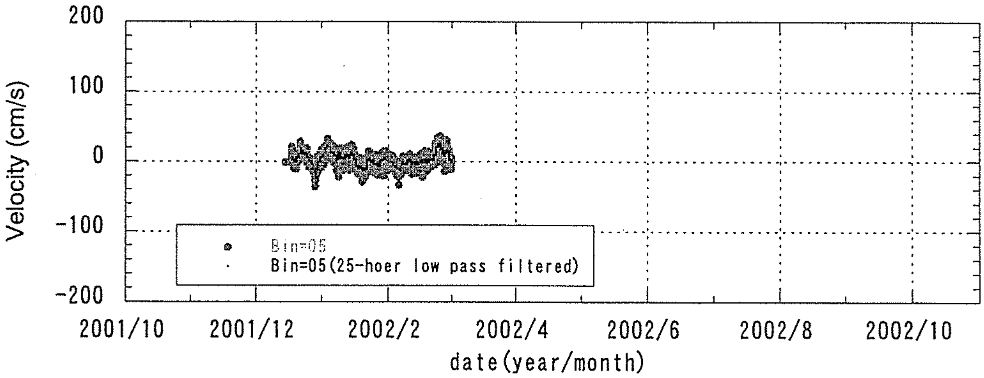

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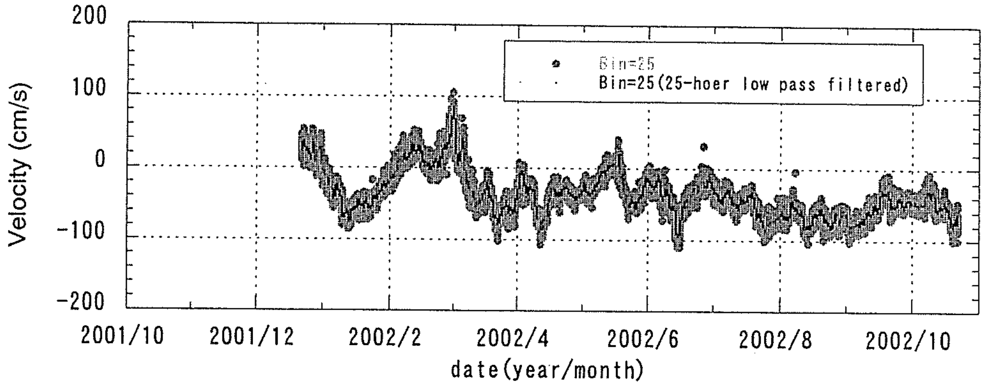
Fig.7-9-2 Time series of ADCP data (EQ-147E, Meridional component).



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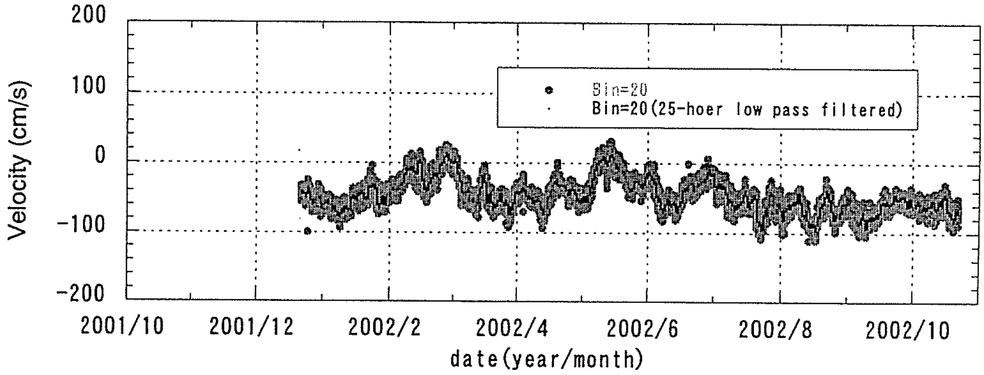

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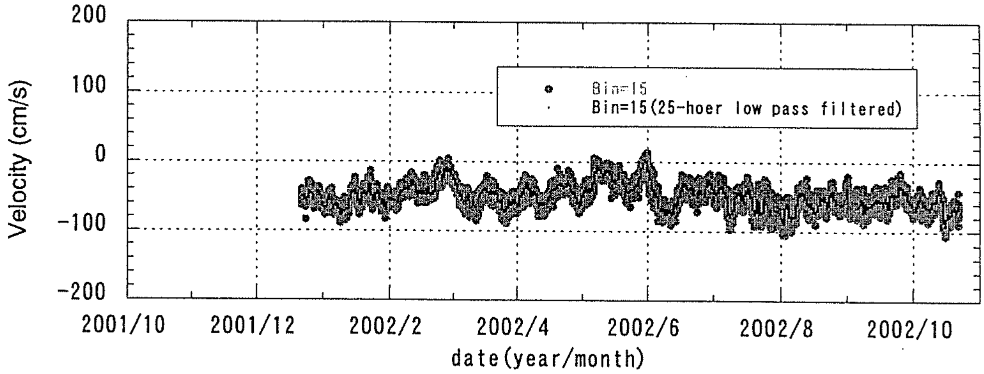

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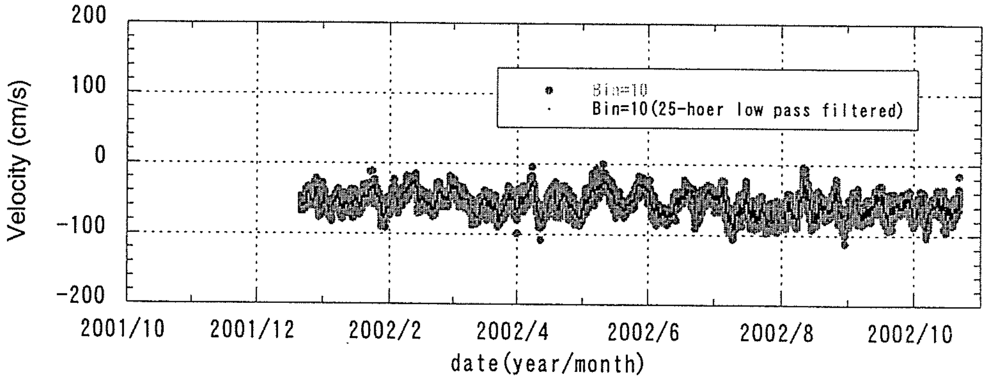

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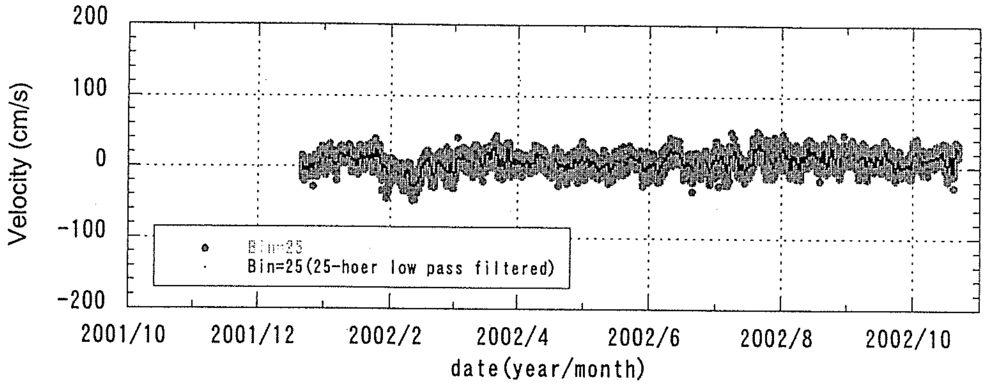
Fig.7-10-1 Time series of ADCP data (2.5S-142E, Zonal component).



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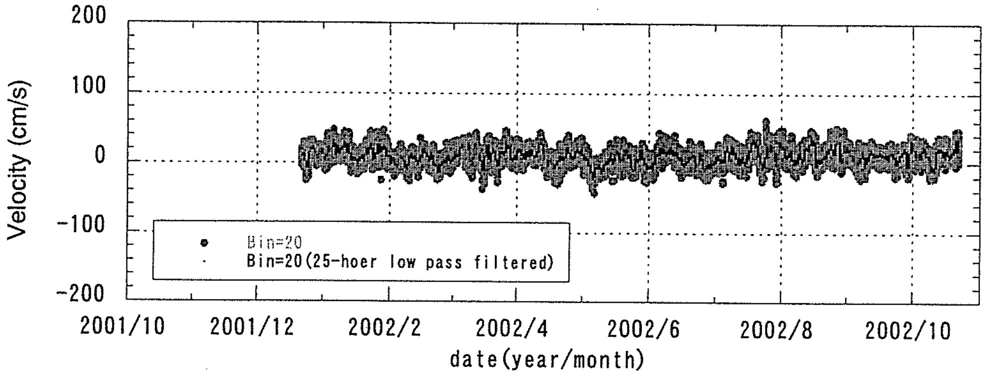

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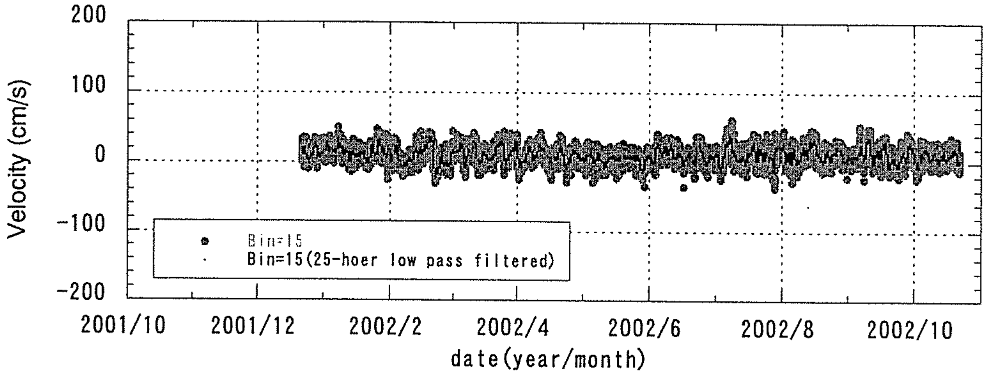

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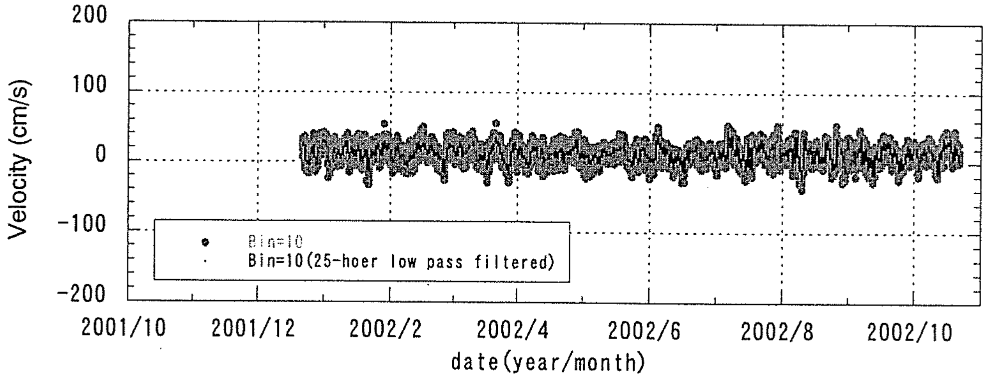

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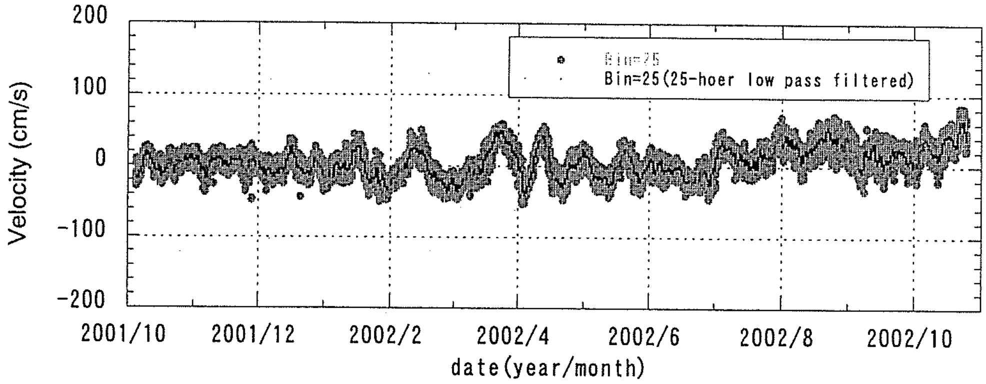
Fig.7-10-2 Time series of ADCP data (2.5S-142E, Meridional component).



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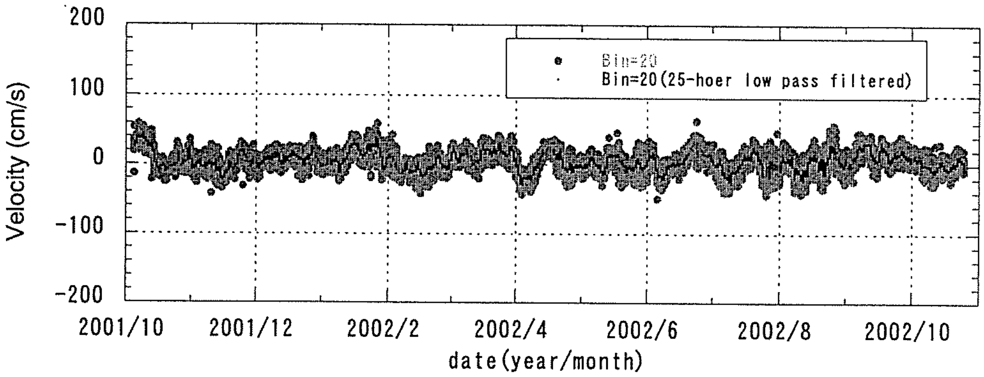

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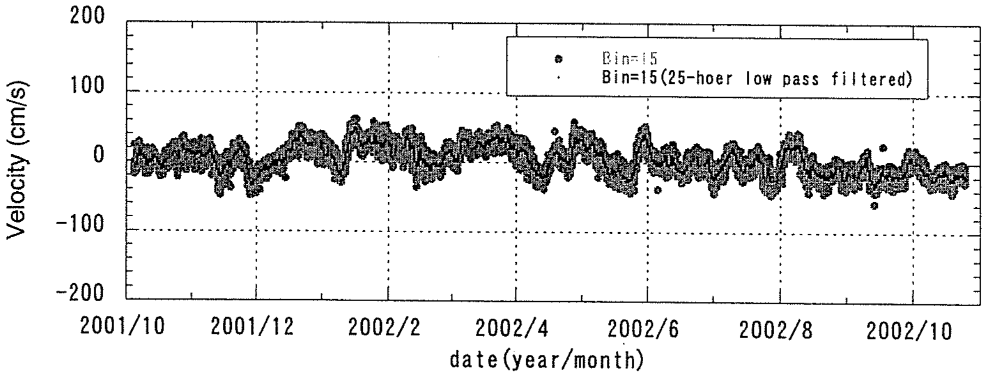

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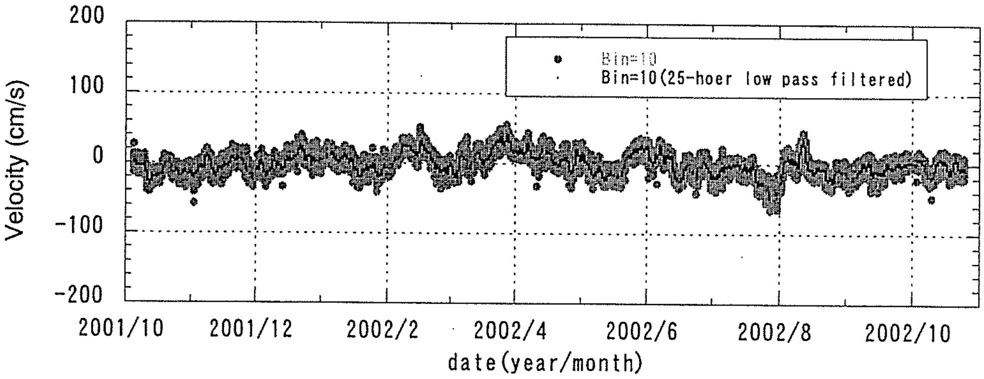

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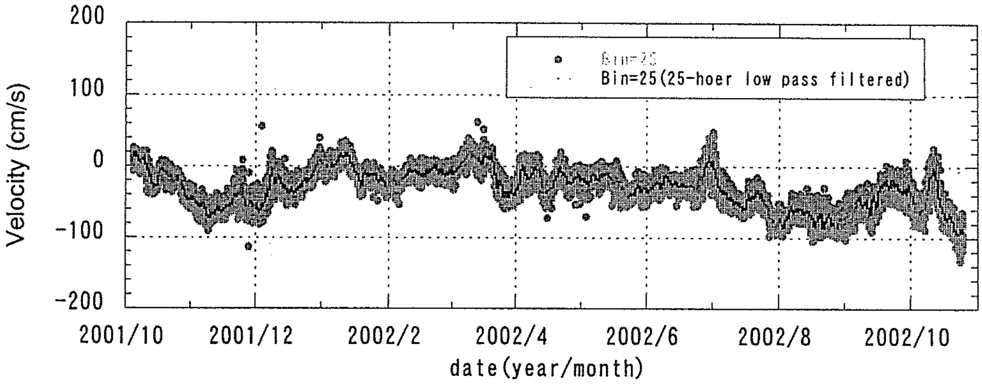
Fig.7-11-1 Time series of ADCP data (EQ-138E, Zonal component).



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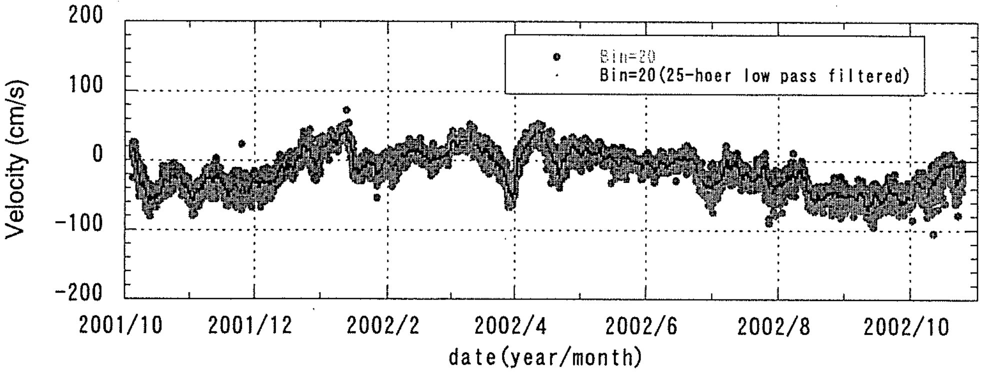

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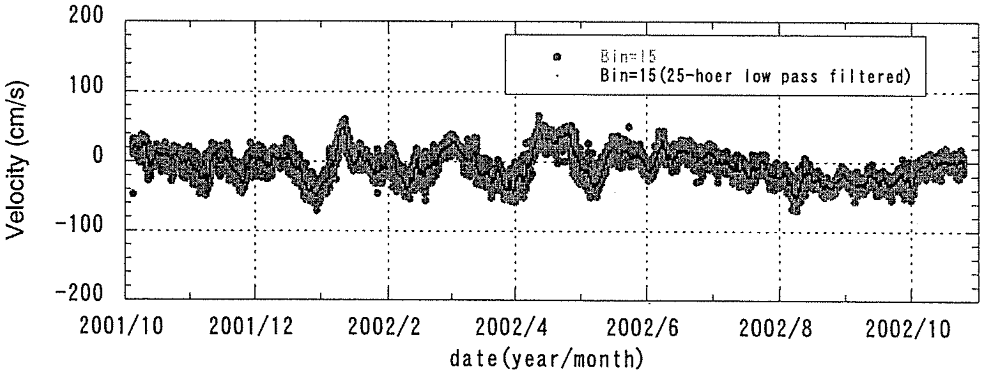

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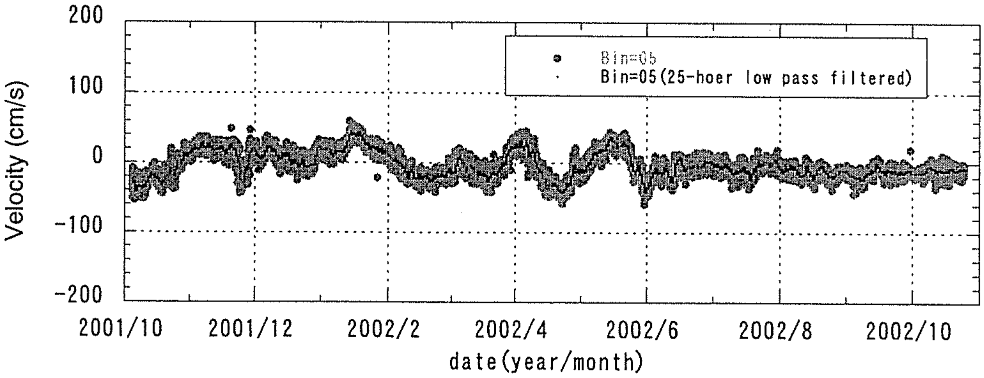

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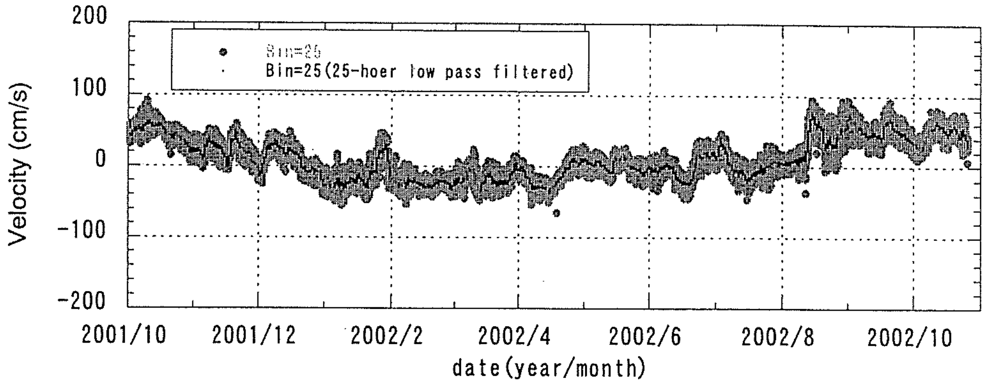
Fig.7-11-2 Time series of ADCP data (EQ-138E, Meridional component).



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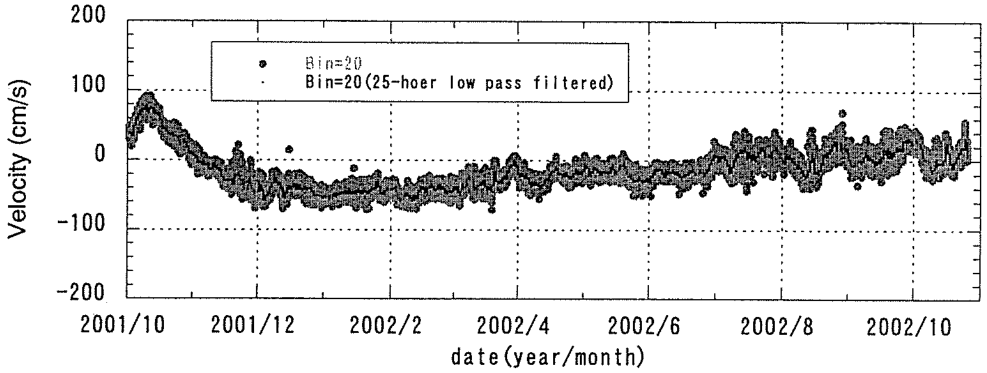

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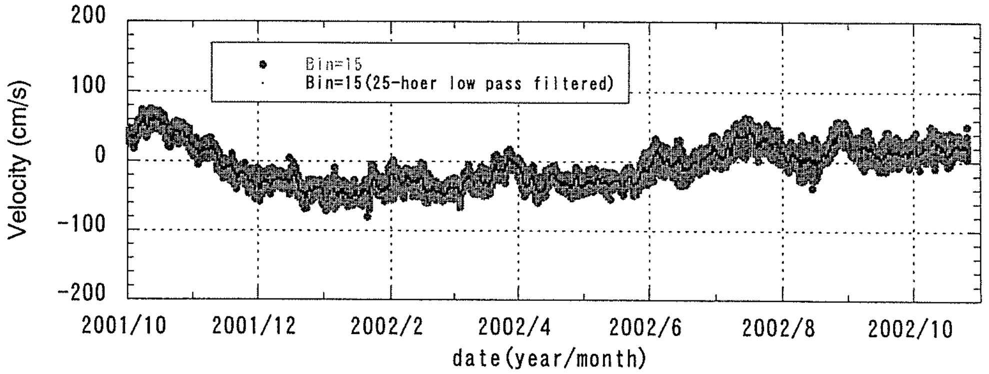

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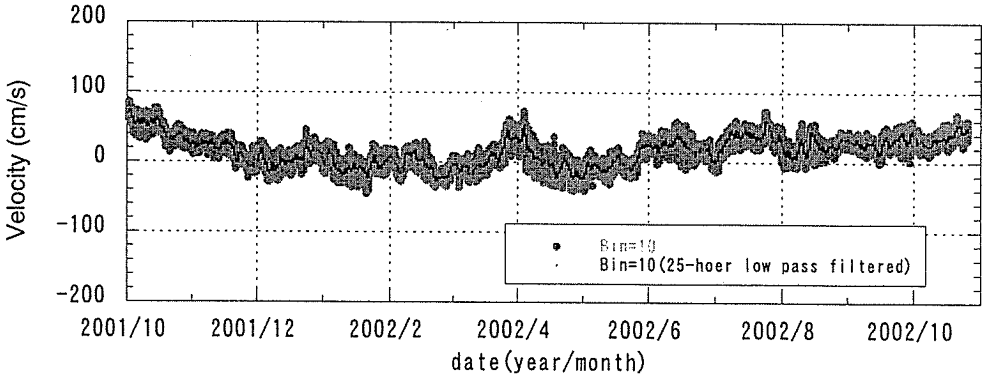
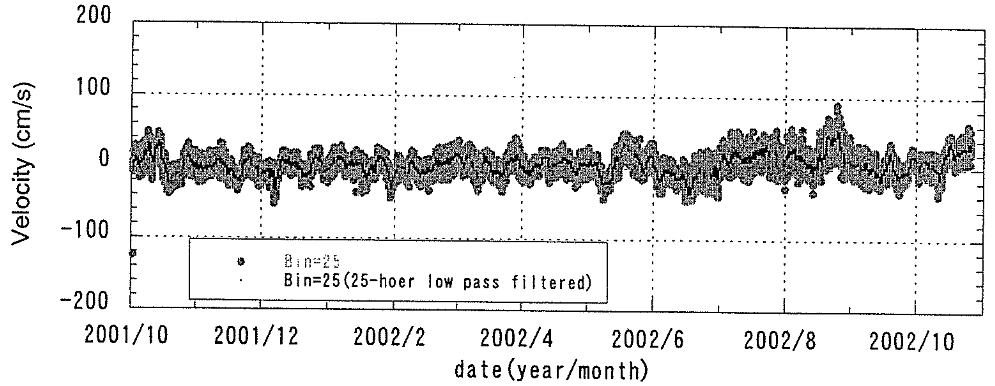


(d) Bin=10

Fig.7-12-1 Time series of ADCP data (2N-138E, Zonal component).



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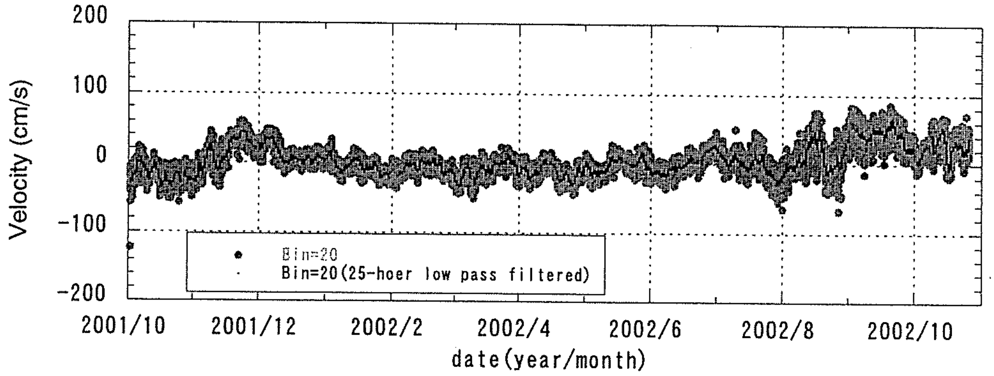

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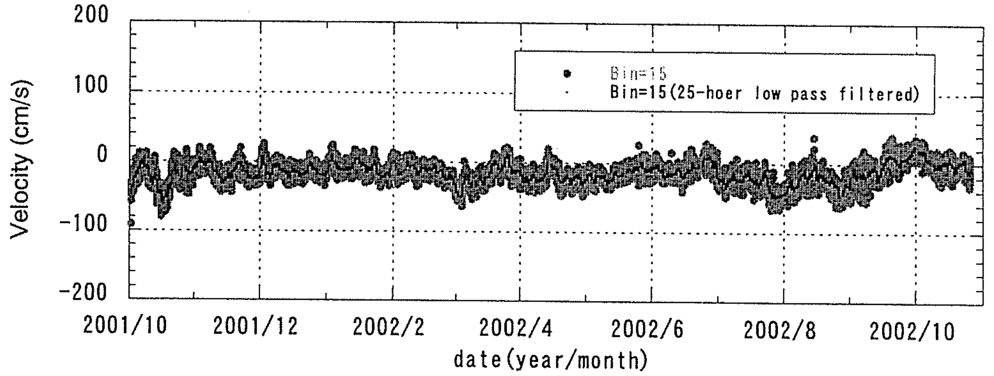
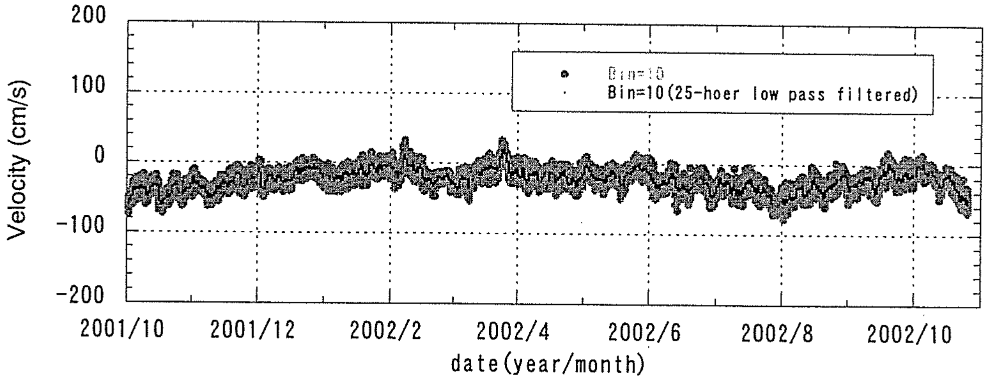
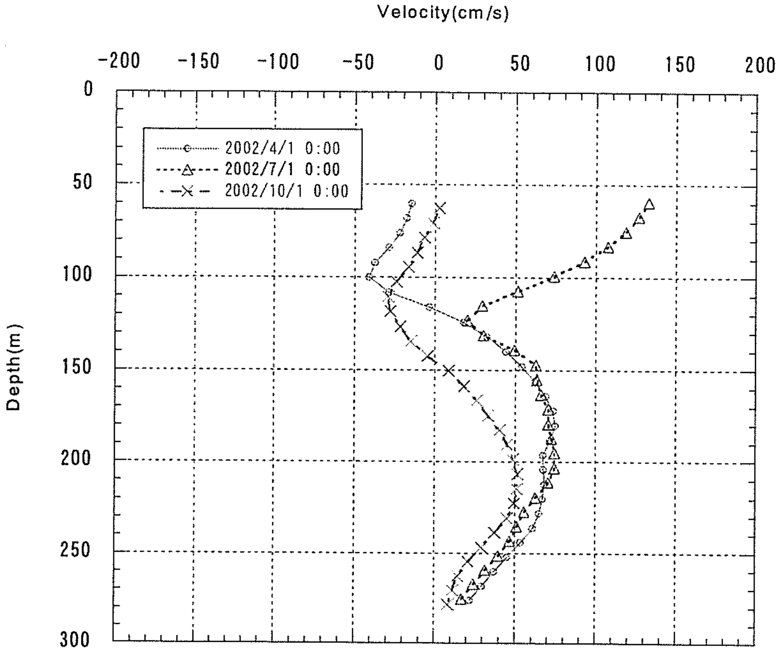


(c) Bin=15

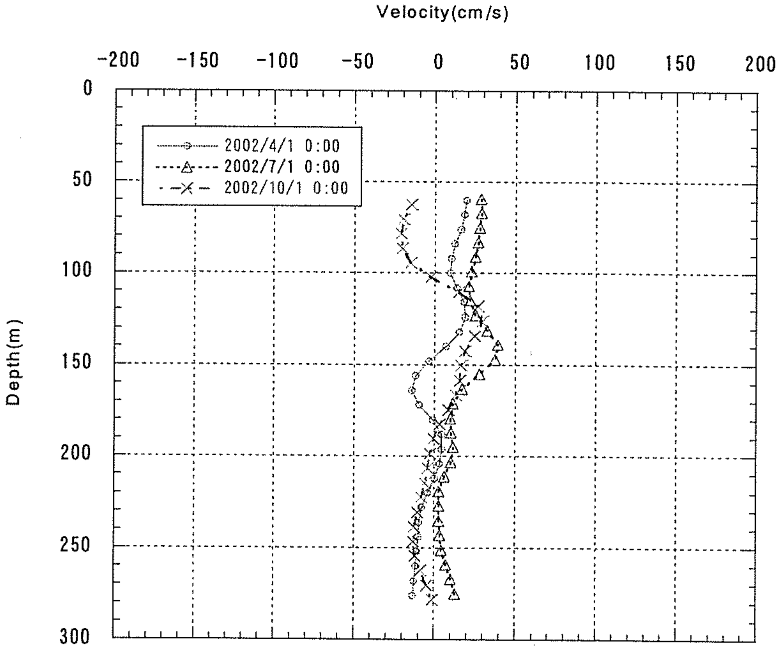


(d) Bin=10

Fig.7-12-2 Time series of ADCP data (2N-138E, Meridional component).

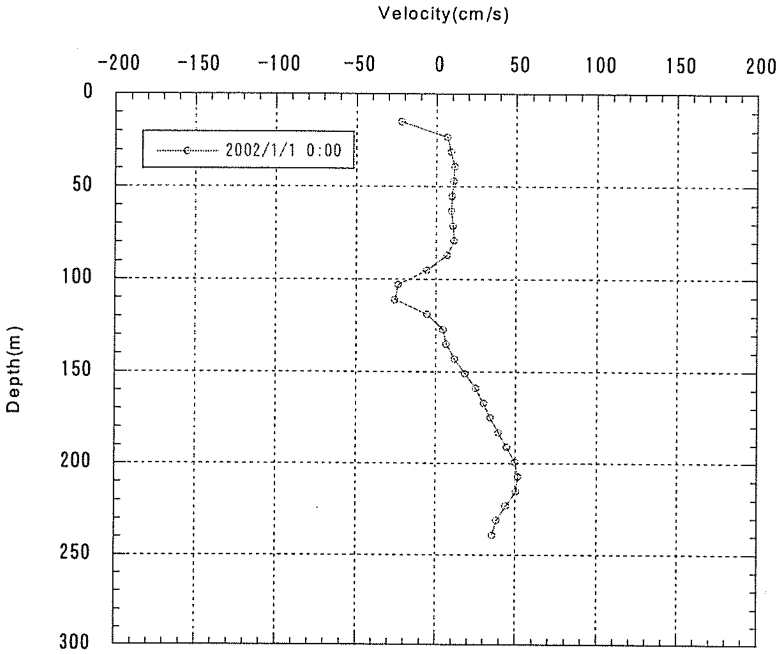


(a) Zonal component

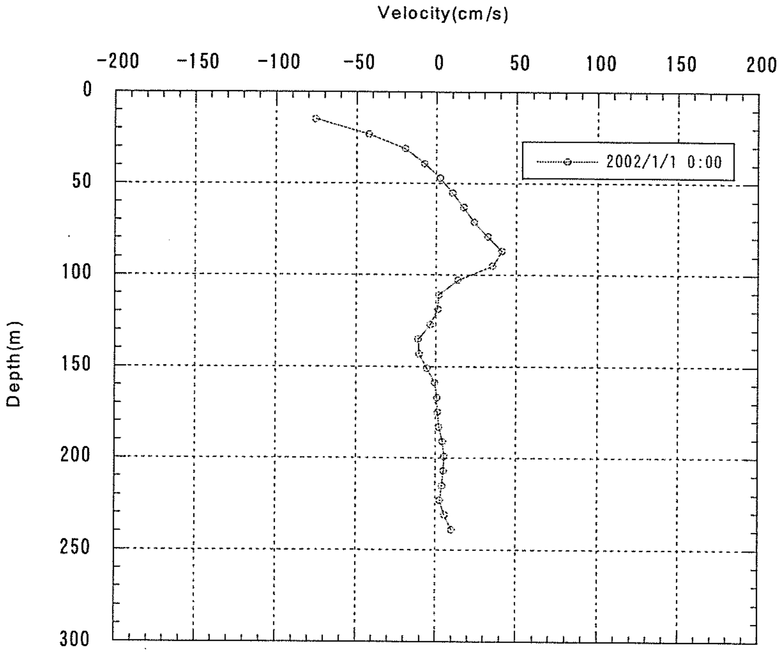


(b) Meridional component

Fig.7-13 Velocity profiles of ADCP data (EQ-156E).

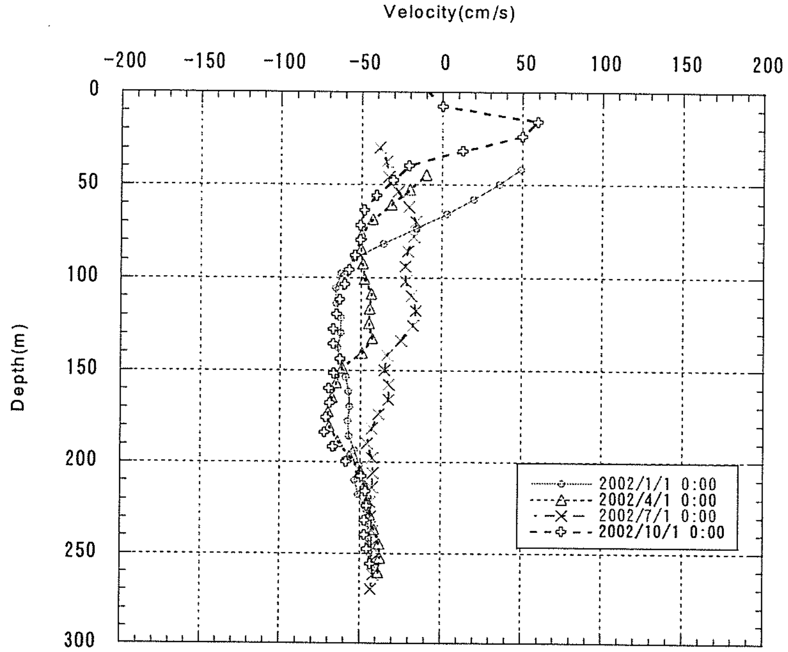


(a) Zonal component

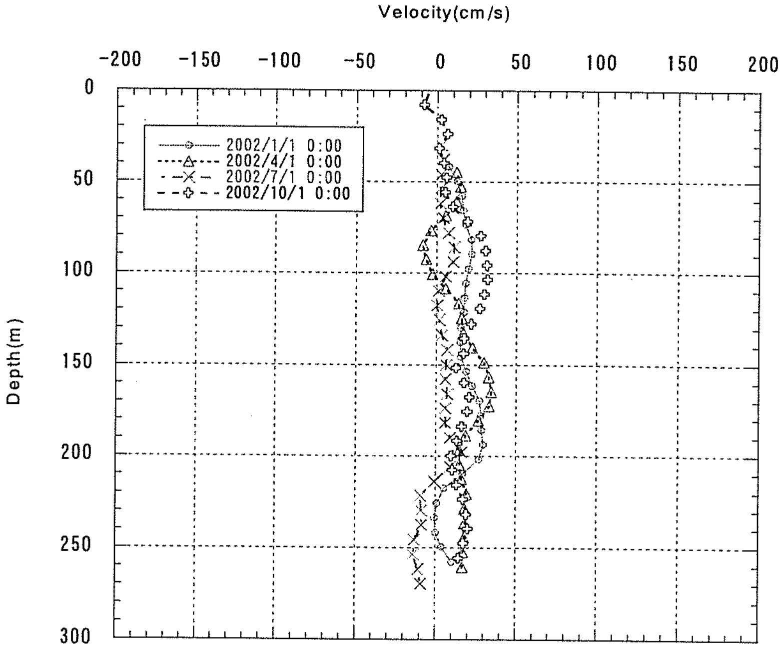


(b) Meridional component

Fig.7-14 Velocity profiles of ADCP data (EQ-147E).

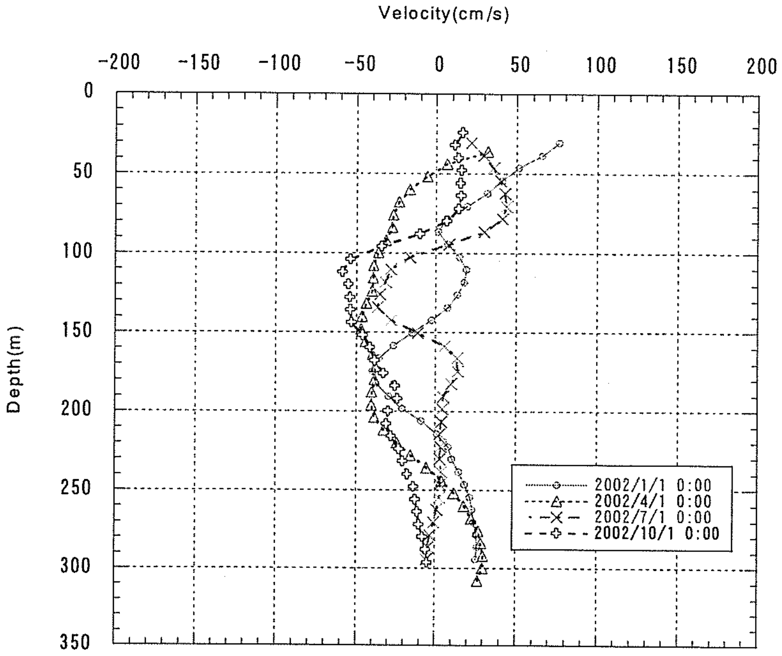


(a) Zonal component

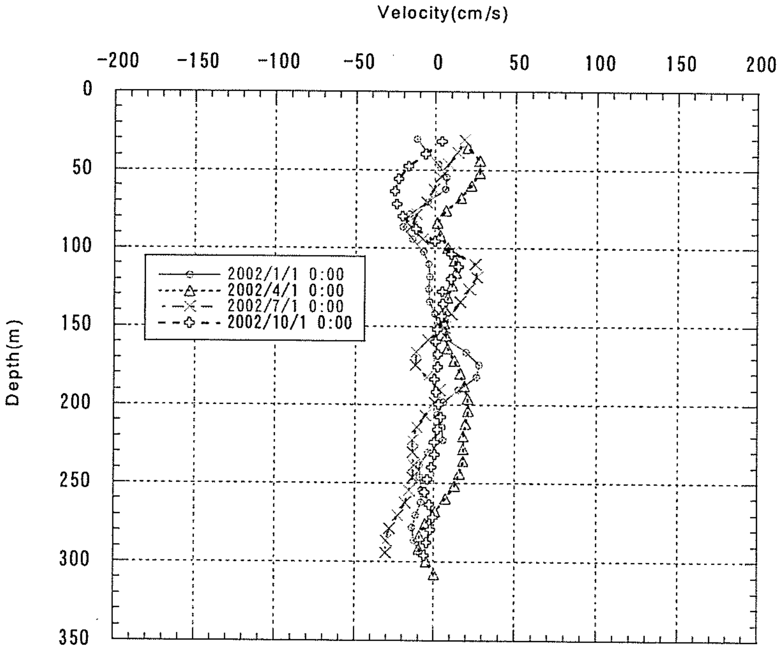


(b) Meridional component

Fig.7-15 Velocity profiles of ADCP data (2.5S-142E).

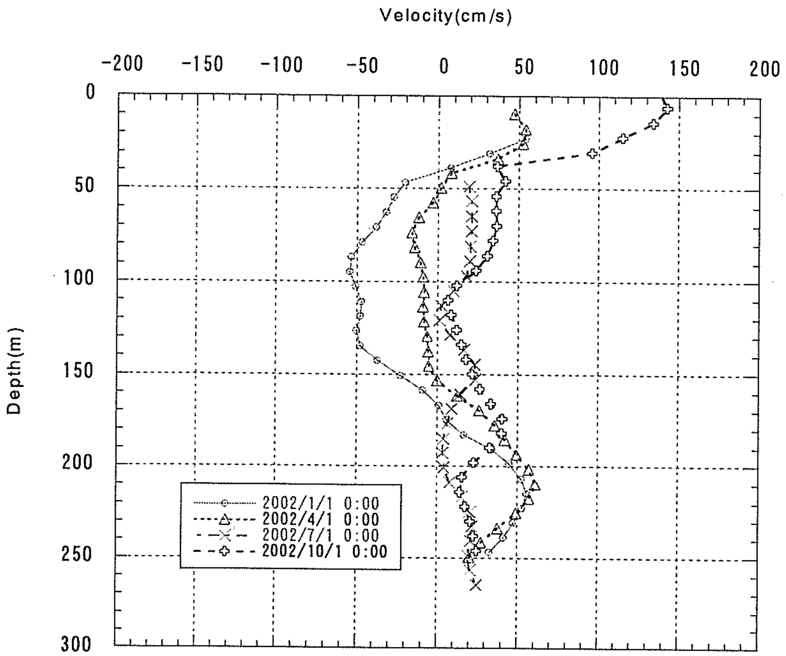


(a) Zonal component

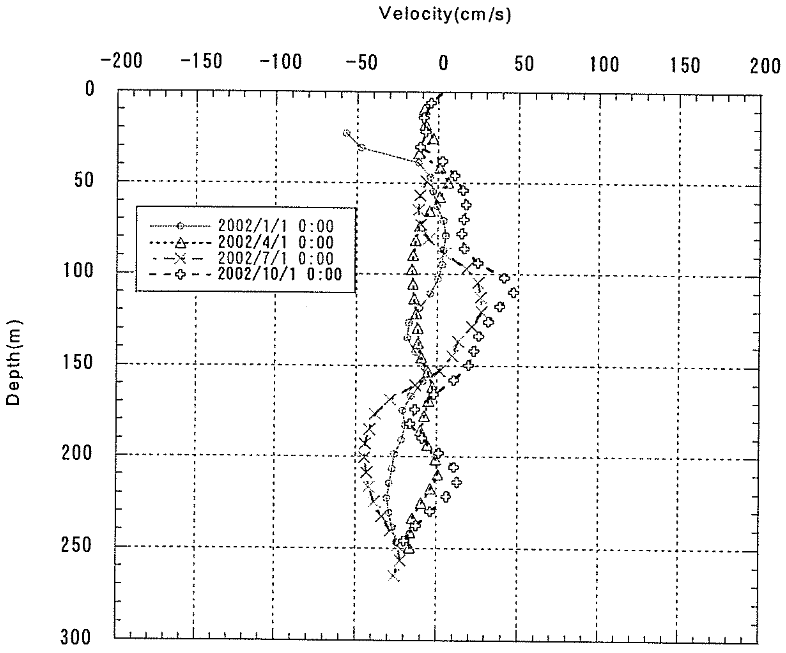


(b) Meridional component

Fig.7-16 Velocity profiles of ADCP data (EQ-138E).



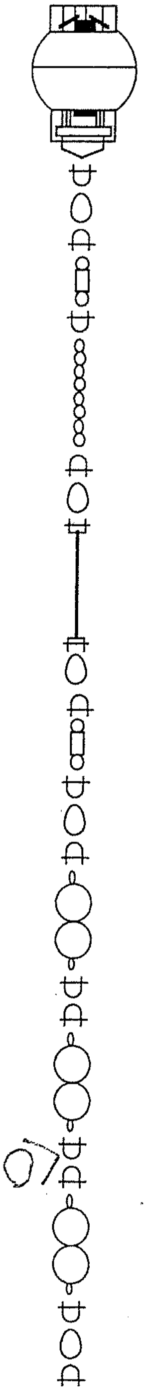
(a) Zonal component



(b) Meridional component

Fig.7-17 Velocity profiles of ADCP data (2N-138E).

00-156E MR02-K02 Deployment (0[illegible]3/06)



FLOAT(F-01)
ADCP S/N 1220
CTD SBE16 S/N 1278

SHACKLE 7/8
RING 19mm
SHACKLE 5/8

SWIVEL AB102

SHACKLE 5/8

CHAIN
13mm x 3.0m

SHACKLE 5/8
RING 19mm

WIRE
10mm x 50m

RING 19mm
SHACKLE 5/8

SWIVEL AB102

SHACKLE 5/8
RING 19mm
SHACKLE 7/8

ABS BUOY CT608B
NYLON 2.2m

SHACKLE 7/8(used)
SHACKLE 7/8(used)

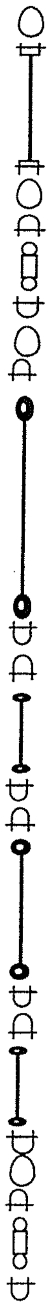
ABS BUOY CT608B
NYLON 2.2m

07

SHACKLE 7/8(used)
SHACKLE 7/8(used)

ABS BUOY CT608B
NYLON 2.2m

SHACKLE 7/8
RING 19mm
SHACKLE 5/8



RING 19mm

WIRE
10mm x 200m

RING 19mm
SHACKLE 5/8

SWIVEL AB102(used)

SHACKLE 5/8
RING 19mm
SHACKLE 5/8

KEVLER(K10-10 1/2)
12mm x 676m

SHACKLE 5/8(used)

SHACKLE 5/8(used)

KEVLER(K10-10 2/2)
12mm x 225m

SHACKLE 5/8(used)
SHACKLE 5/8(used)

KEVLER(K2-06)
12mm x 174 m

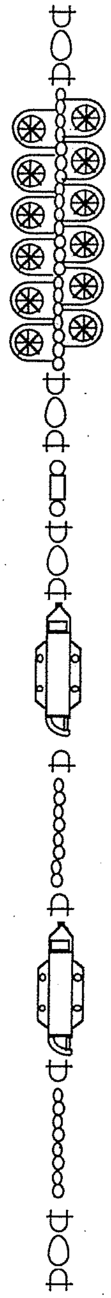
SHACKLE 5/8(used)
SHACKLE 5/8(used)

KEVLER(K10-03B)
12mm x 132m

SHACKLE 5/8(used)
RING 19mm(used)
SHACKLE 5/8(used)

SWIVEL AB102(used)

SHACKLE 5/8(used)



SHACKLE 5/8(used)
RING 19mm(used)
SHACKLE 5/8(used)

BENTHOS
GLASS BALL
2040-17V x 12ps.

CHAIN
13mm x 8.0m

SHACKLE 5/8
RING 19mm
SHACKLE 5/8

SWIVEL BS103

SHACKLE 5/8
RING 19mm
SHACKLE 5/8

BENTHOS A.R.
S/N 963 E.C.=A
14.5/11.0 R.C.=D

SHACKLE 5/8

CHAIN
13mm x 5.0m

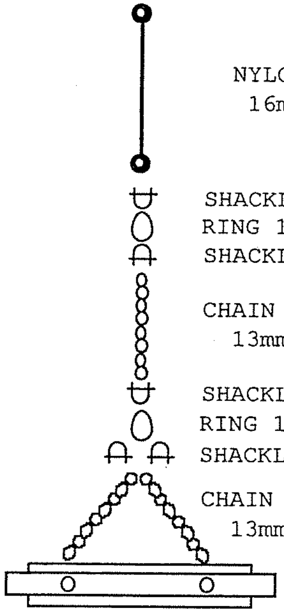
SHACKLE 5/8

BENTHOS A.R.
S/N 717 E.C.=D
14.0/13.0 R.C.=C

SHACKLE 5/8

CHAIN
13mm x 2.0m

SHACKLE 5/8
RING 19mm
SHACKLE 5/8



NYLON
16mm x ~~120m~~ 110m

SHACKLE 5/8
RING 19mm
SHACKLE 5/8

CHAIN
13mm x 5.0m

SHACKLE 5/8
RING 19mm
SHACKLE 5/8 x 2

CHAIN
13mm x 2.5m x 2

SHACKLE 5/8 x 2

ANCHOR 1.8t

0°N, 156°E
水深:1,956 m
索長:~~1,621.3m~~ /61
ADCP: 310.7m
(計算後)

DEPLOYMENT & RECOVERY

MOORING No. 020307-00156E

PROJECT TOCS

AREA Western Pacific

POSITION 0-156E

DEPTH 1955m

TIME UTC

RECORDER (D) : M. Hirano

RECORDER (R) :

PERIOD 07 ~~10~~ Mar 2002~13 Oct 2002 NAVIGATION SYSTEM : WGS 84

No. of DAYS

LENGTH : m DEPTH of BUOY : m BUOYANCY : ~~1000~~ kg

ACOUSTIC RELEASERS

TYPE	Benthos (Upper)	TYPE	Benthos (Lower)
S/N	963	S/N	717
RECEIVE F.	11.0 kHz	RECEIVE F.	13.0 kHz
TRANSMIT F.	14.5 kHz	TRANSMIT F.	14.0 kHz
ENABLE C.	A	ENABLE C.	D
RELEASE C.	D	RELEASE C.	C
BATTERY	2year	BATTERY	2year
TEST on DECK	26. Feb. 02	TEST on DECK	26. Feb. 02

DEPLOYMENT

DATE 2002. Mar 07 SHIP MIRAI CRUISE No. MR02-K02

WATHER C CONDITIONS 1.3m DIR. of WIND 115 VEL. of WIND 2.5 m/s

DEPTH 1955 m DEPTH of A.R. 1776 m DESCEND. RATE ~~2.7~~ 3.0 m/s BUOY 00 : 33

POS. of START 0°00.42S 156°09.85E HOR. RANGE m

POS. of DEP. 0°00.19N 156°07.85E ANCHOR 01 : 23 DISAPPEAR :

POS. of MOORING 0°00.1765N 156°07.9271E LANDING 01 : 36

ナイロンロープ110m

Time	Depth (m)
1:27	530
1:29	1000
1:32	1500
1:36	1776

Time	Depth (m)
22:07	1400m
22:10	1000m
22:14	500m

RECOVERY

DATE 13 Oct. 2002 SHIP KAIYO CRUISE No. KY02-10

WATHER bc CONDITIONS 0.9m DIR. of WIND NW VEL. of WIND 5.3 m/s

START of RELEASE 22 : 03 SENDING E.C. 22 : 03

SENDING R.C. 22 : 04

FINISH of RELEASE 22 : 04

DISTANCE from A.R. unknown m DISCOVERY ADCP 22 : 10

TIME RECORD

MOORING NO. 020307 − 00156E

	DEPLOYMENT	RECOVERY (Date : 13 Oct. 2002)
	START : 00:33	START : 23:18 (Top buoy 水切り)
	FINISH : 01:36	FINISH : 00:55 (Lower A.R. on deck)

ITEM	S/N etc.	TIME	MEMO	TIME (on deck)	MEMO
ADCP	ADCP 1220 CTD 1278	00:33		23:29	
WIRE	φ10mm×50m	00:33~37		23:29~23:47	
ABS BUOY	2	00:37		23:47	
ABS BUOY	2	00:37		23:48	
ABS BUOY	2	00:37		23:48	
WIRE	φ10mm×200m	00:37~00:41		23:48~00:02	
KEVLER	K10-10 1/2 12mm×676m	00:41~00:50		00:02~00:18	
KEVLER	K10-10 2/2 12mm×225m	00:50~00:52		00:18~00:31	
KEVLER	K2-06 12mm×174m	00:52~00:55		00:31~00:39	
KEVLER	K10-03B 12mm×132m	00:55~00:59		00:39~00:50	
GLASS BALL	12PS	01:02		00:51	
BENTHOS A.R.	963	01:02		00:52	
BENTHOS A.R.	717	01:02		00:55	
NYLON	φ16mm×110	01:02~01:~~08~~13	ストッパー用ロープがリングにからまり一旦船上取る [illegible]ナイロンロープを外した。再度 [illegible]		
ANCHOR	1.8t	01:23			

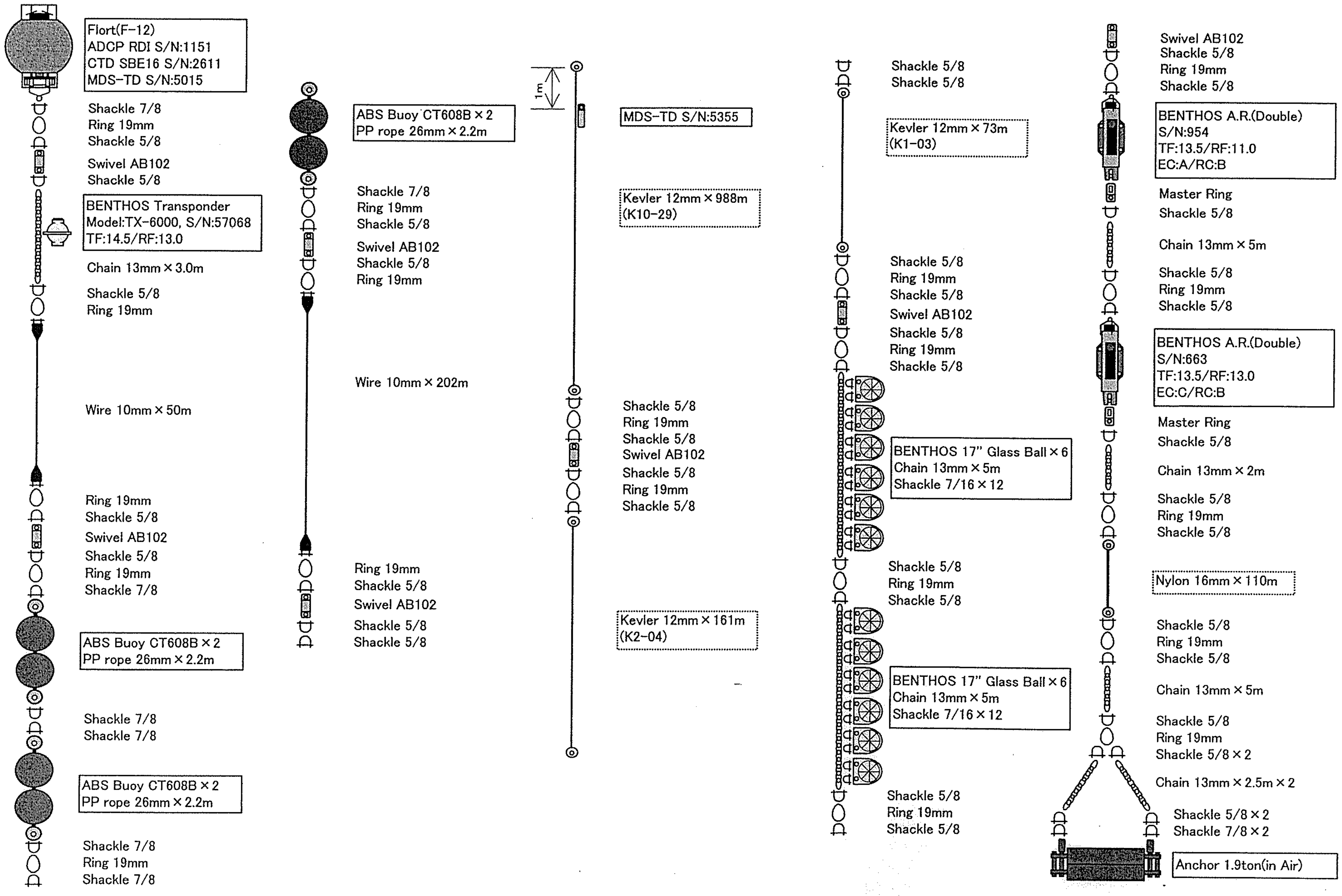
00:33 start
水深調整用ナイロンロープ110mに変更

設置ポイントまで10分航走
11kHz Upperも受信(着底後に確認)
1:27 530m
1:29 1000m
1:32 1500m
1:36 1776m(着底)

22:20 ガラス玉浮上
22:32 作業艇着水
22:58 引き寄せ索取付
23:04 作業艇揚収
23:19~23:22 ワイヤーがペラの下に滑り込み作業中断
00:50 下段リリーサ水切り

00-156E [KY02-10]Deployment

<Water Depth: 1956m, ADCP Depth: 305m>



DEPLOYMENT & RECOVERY

MOORING No.

PROJECT	TOCS	TIME	UTC
AREA	Western Pacific	RECORDER (D) :	Masaki. Tag
POSITION	0 - 156E	RECORDER (R) :	

DEPTH

PERIOD NAVIGATION SYSTEM : WGS 84

No. of DAYS

LENGTH : m DEPTH of BUOY : m BUOYANCY : kg

ACOUSTIC RELEASERS

TYPE	BENTHOS Double (Upper)	TYPE	BENTHOS Double (Lower)
S/N	954	S/N	663
RECEIVE F.	11.0 kHz	RECEIVE F.	13.0 kHz
TRANSMIT F.	13.5 kHz	TRANSMIT F.	13.5 kHz
ENABLE C.	A	ENABLE C.	C
RELEASE C.	B	RELEASE C.	B
BATTERY	2 year	BATTERY	2 year
TEST on DECK		TEST on DECK	

DEPLOYMENT

DATE 13 Oct. 2002 SHIP KAIYO CRUISE No. KY02-10

WATHER 0 CONDITIONS 1.0 m DIR. of WIND WNW VEL. of WIND 7.3 m/s

DEPTH m DEPTH of A.R. 1806 m DESCEND. RATE m/s BUOY 03:35

POS. of START 00 ° 00.41N 156 ° 07.04E HOR. RANGE m

POS. of DEP. 00 ° 00.09N 156 ° 08.40E ANCHOR 05:01 DISAPPEAR :

POS. of MOORING 00 ° 00.04N 156 ° 08.52E LANDING 05 : 12

Time	Depth(m) by Lower
05:03	400
05:07	1000
05:09	1400
05:12	着底

	S/N
ADCP	1150
CTD	2611
RCM-9	none
RCM-9	none
MDS-TD	5015
MDS-TD	5355

RECOVERY

DATE SHIP CRUISE No.

WATHER CONDITIONS DIR. of WIND VEL. of WIND

START of RELEASE : SENDING E.C. :

SENDING R.C. :

FINISH of RELEASE :

DISTANCE from A.R. m DISCOVERY ADCP :

TIME RECORD

MOORING NO. 021013 - 00156E

DEPLOYMENT 13 Oct. 2002
START : 03:35
FINISH :

RECOVERY (Date :)
START :
FINISH :

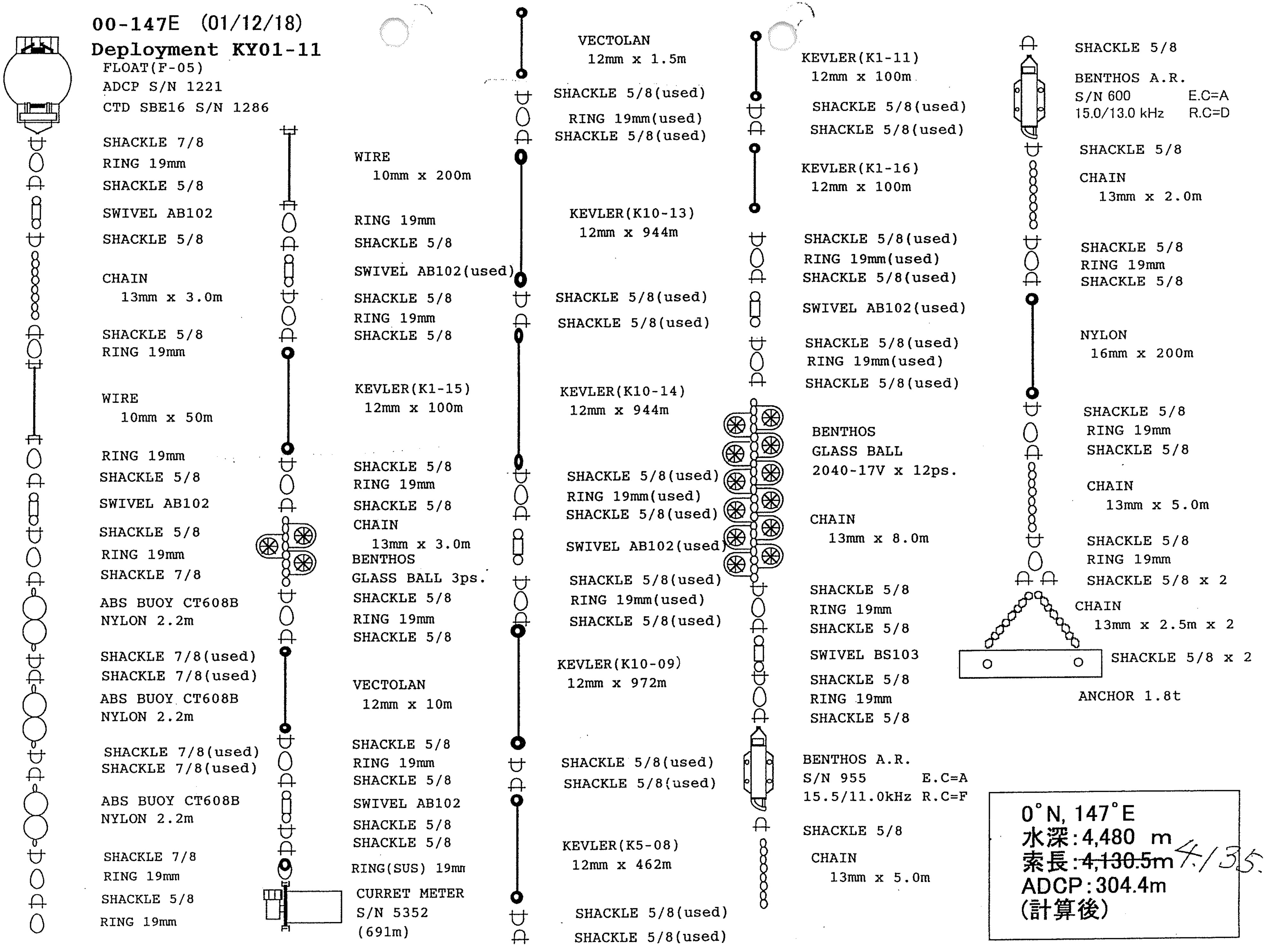
ITEM	S/N etc.	TIME	MEMO	TIME	MEMO
ADCP MDS+TD S/N 5015	ADCP:1150 CTD:2611	03 : 40			
Transponder	RF13.0, TF14.5 57068	03 : 40			
WIRE	ø10mm×50m	03:40~03:49			
ABS BUOY	2ps	03:49			
ABS BUOY	2ps	03:49			
ABS BUOY	2ps	03:49			
WIRE	ø10mm×200m	03:49~03:55			
KEVLER	ø12mm×988m K10-29	03:55~04:12			
MDS-TD	988mケブラーの残部 5355	03:55			
KEVLER	ø12mm×761m K2-04 0	04:12 ~ 04:18			
〃	ø12mm×78m K1-03 9	04:18 ~ 04:42			
GLASS BALL	12ps	04:43			
A.R.	T13.5, R11.0 EC A, RC B S/N 9584	04:44			
A.R.	T13.5, R13.0 EC C, RC B S/N 663	04:44			
NYLON	ø16mm×110m	04:44~05:00			
ANCHOR	1.9t	05:01			

MDS+TD S/N:5355は KEVLER988mの残部1mに取付

04:32 つり上げ、振り出したガラス玉を水に着くまえに一度揚収
作業後 04:38 再投入開始

Time	Depth(m)
05:03	400m
05:07	1000m
05:09	1400m
05:12	着底

00-147E (01/12/18)
Deployment KY01-11



0°N, 147°E
水深:4,480 m
索長:~~4,130.5m~~ 4,135.5
ADCP:304.4m
(計算後)

DEPLOYMENT & RECOVERY

MOORING No. 01/12/18-00147E

PROJECT	TOCS「かいよう」	TIME	UTC
AREA	熱帯赤道域	RECORDER (D) :	Hirano
POSITION	0-147E	RECORDER (R) :	

DEPTH 4506 m

PERIOD NAVIGATION SYSTEM : WGS 84

No. of DAYS

LENGTH : 4130.5 m DEPTH of BUOY : m BUOYANCY : kg

ACOUSTIC RELEASERS

TYPE	BENTHOS (Upper)	TYPE	BENTHOS (Lower)
S/N	955	S/N	600
RECEIVE F.	11.0 kHz	RECEIVE F.	13.0 kHz
TRANSMIT F.	15.5 kHz	TRANSMIT F.	15.0 kHz
ENABLE C.	A	ENABLE C.	A
RELEASE C.	F	RELEASE C.	D
BATTERY	2years	BATTERY	2 years
TEST on DECK	Ok	TEST on DECK	ok

DEPLOYMENT

DATE 2001. 12. 18 SHIP KAIYO CRUISE No. KY01-11

WATHER O CONDITIONS 2-0 DIR. of WIND WNW VEL. of WIND 8.2 m/s

DEPTH 4480 m DEPTH of A.R. 4202 m DESCEND. RATE 2.~~37~~32 m/s BUOY 3:12

POS. of START 00°00.2S 147°06.4E HOR. RANGE m

POS. of DEP. 00°00.45 147°04.1E ANCHOR 05:18 DISAPPEAR :

POS. of MOORING 0°00.3982'S 147°04.2602'E LANDING 05:50

o 流速計(東大海洋研)

S/N 5352

2001.12.17

00:00:00

スイッチ ON

RECOVERY

DATE 2002. 10. 20 SHIP KAIYO CRUISE No. KY02-10

WATHER bc CONDITIONS 0.2m- DIR. of WIND WNW VEL. of WIND 2.6 m/s

START of RELEASE 22:03 SENDING E.C. 22:04

SENDING R.C. 22:05

FINISH of RELEASE 22:05

DISTANCE from A.R. m DISCOVERY ADCP :

Time	depth
22:10	3500 m
22:14	3000 m
22:20	2500 m
22:25	2000 m
22:31	1500 m
22:37	1000 m

TIME RECORD

MOORING NO. 011218-0147E

	DEPLOYMENT 01.12.18 START : 03:08 FINISH :		RECOVERY (Date 20.Oct.2002) START : 23:01 (水切り) FINISH : 01:21 (on deck)	
ITEM	S/N etc.	TIME	MEMO	TIME	MEMO

ITEM	S/N etc.	TIME	MEMO	TIME	MEMO
ADCP CTD SBE16	1221 1286	03:12	着水	23:09	on deck
WIRE	10mm×50m	03:08~03:16		23:09~23:23	〃
ABS BUOY	2×3	03:16		23:23	〃
WIRE	10mm×200m	03:16~03:25		23:23~23:39	〃
KEVLER	K1-15 12mm×100m	03:25~03:33		23:39~23:46	〃
GLASS BALL	3	03:33		23:46	〃
VECTOLAN	12mm×10m	03:35		23:46~23:52	〃
CURRENTMETER	5352	03:35	着水	23:52	〃
VECTOLAN	12mm×1.5m	03:35		23:52	〃
KEVLER	K10-13 12mm×944m	03:35~03:50		23:52~00:21	〃
KEVLER	K10-14 12mm×944m	03:50~04:10		00:21~00:40	〃
KEVLER	K10-09 12mm×972m	04:10~04:37		00:40~01:00	〃
KEVLER	K5-08 12mm×462m	04:37~04:47		01:00~01:08	〃
KEVLER	K1-11 12mm×100m	04:47~04:51		01:08~01:12	〃
KEVLER	K1-16 12mm×100m	0451~05:00		01:12~01:21	〃
GLASS BALL	12	05:01		01:21	〃
BENTHOS A.R.	955	05:02		01:20	水切り
BENTHOS A.R.	600	05:02		01:20	水切り
NYLON	200m	05:03~05:12			
ANCHOR		05:18			

水深調整のためナイロンロープを195mから200mに変更
作業開始 03:00
上側 955 R11.0 T15.5 E:A R:F
下側 600 R:13.0 T:16.0 E:A R:D
ブイが見えなくなる 3:40
15:17
00- 00.3749
147 04.0987E

切離装置取付 22:45
巻込み開始 22:45
作業現場撤収 22:50

HR	DEPTH	Time
322	472	05:22
387	668	05:23
413	742	05:24:00
418	813	05:24:25
416	906	05:24:55
423	997	05:25:30
432	1017	05:25:45
445	1198	05:26:45
429	1306	05:27:20
392	1416	05:28:05
371	1503	05:28:30
376	1592	05:29:25
397	1699	05:29:45

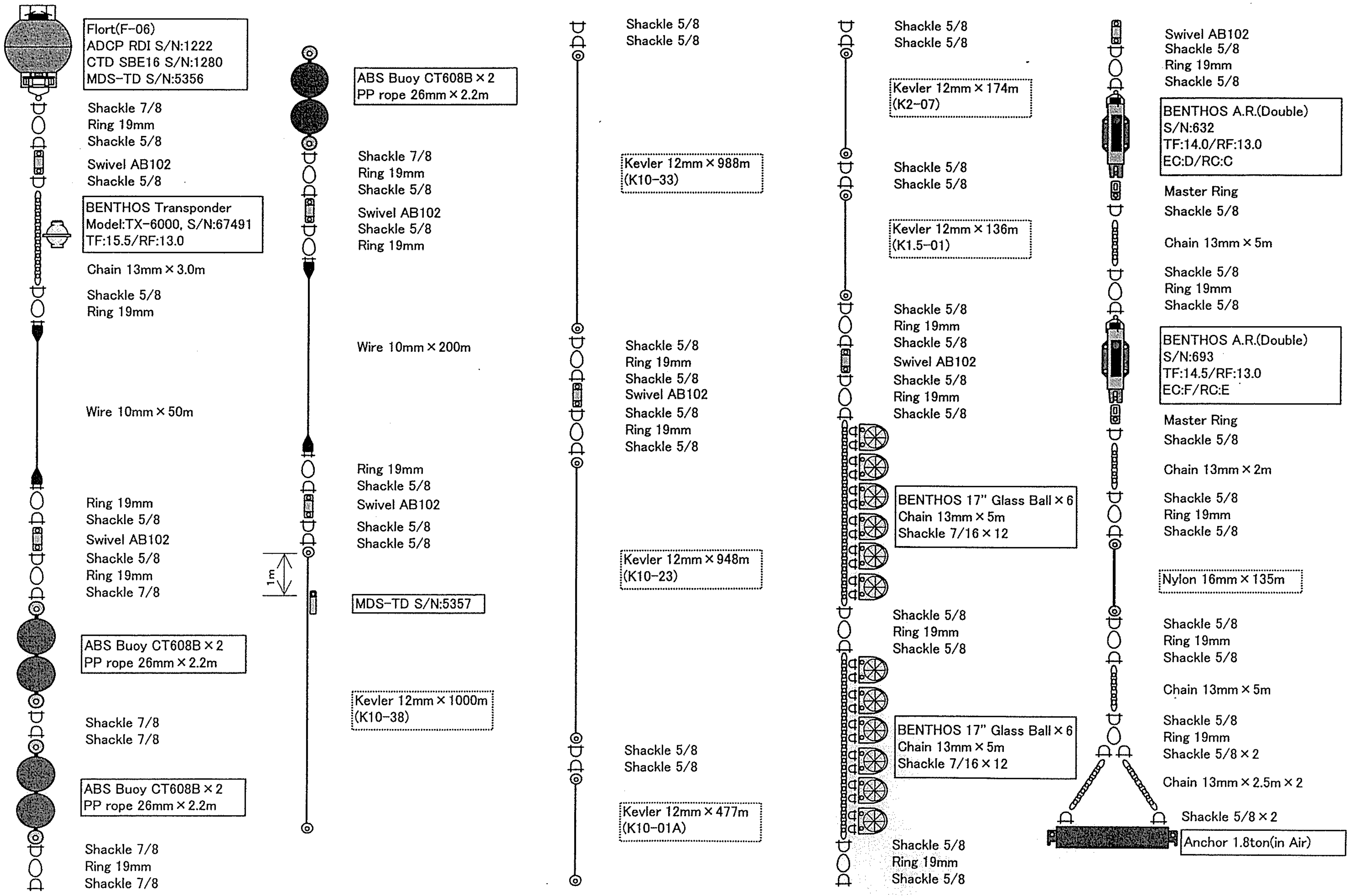
4480m

463	1805	05:30:20
550	1911	05:31:00
640	2012	05:31:45
844	2192	05:32:00
890	2309	05:33:00
1061	2440	05:33:30
1118	2508	05:34:00

3009 05:38
3509 05:42
4057 05:47
~~4136 05:50~~ 着底
~~4190~~ 05:48
4200 0-04268S
147 02701 4202m 11.1 十 付位置

00-147E [KY02-10]Deployment

<Water Depth: 4485m, ADCP Depth: 304m>



DEPLOYMENT & RECOVERY

MOORING No.

PROJECT	TOCS	TIME	UTC
AREA	Western Pacific	RECORDER (D) :	masaki · Tag.
POSITION	0-147E	RECORDER (R) :	

DEPTH

PERIOD NAVIGATION SYSTEM : WGS 84

No. of DAYS

LENGTH : m DEPTH of BUOY : m BUOYANCY : kg

ACOUSTIC RELEASERS

TYPE	BENTOHS Double (Upper)	TYPE	BENTOHS Double (Lower)
S/N	~~667~~ → 632	S/N	693
RECEIVE F.	~~11.0~~ → 13.0 kHz	RECEIVE F.	13.0 kHz
TRANSMIT F.	~~13.5~~ → 14.0 kHz	TRANSMIT F.	14.5 kHz
ENABLE C.	~~A~~ → D	ENABLE C.	F
RELEASE C.	~~G~~ → C	RELEASE C.	E
BATTERY	2year	BATTERY	2year
TEST on DECK		TEST on DECK	

DEPLOYMENT

DATE 2002.10.21 SHIP KAIYO CRUISE No. KY02-10

WATHER bc CONDITIONS 0.4m DIR. of WIND WNW VEL. of WIND 3.8m/s

DEPTH m DEPTH of A.R. 4275 m DESCEND. RATE m/s BUOY :

POS. of START 00-00.29~~N~~S 147-06.33E HOR. RANGE m

POS. of DEP. 00-°00.38S 147°-04.33E ANCHOR : DISAPPEAR :

POS. of MOORING 00-°00.40S 147-°04.42E LANDING 05:47

上側リリーサ-S/N667→S/N632に変更(理由:デッキテストでの反応悪し)

	S/N
ADCP	1220
CTD	1280
RCM-9	none
RCM-9	none
MDS-TA	5357(ボトム)
MDS-TD	5356(TOP)

RECOVERY

DATE SHIP CRUISE No.

WATHER CONDITIONS DIR. of WIND VEL. of WIND

START of RELEASE : SENDING E.C. :

SENDING R.C. :

FINISH of RELEASE :

DISTANCE from A.R. m DISCOVERY ADCP :

TIME RECORD

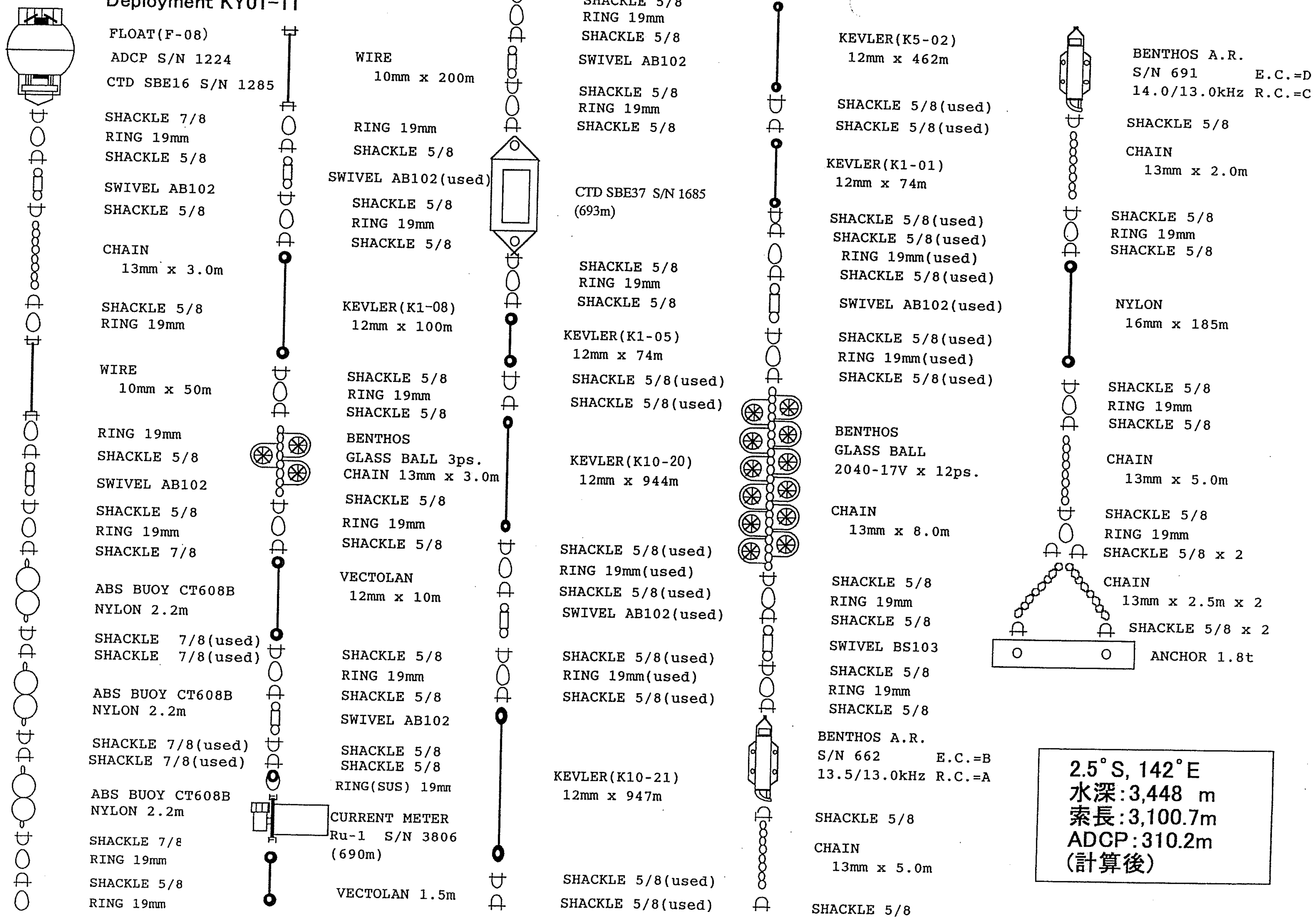
MOORING NO. 021029-00147E

	DEPLOYMENT 2/ Oct. 2002	RECOVERY (Date :)
	START : 03:40 (振り出し)	START :
	FINISH : 05:16	FINISH :

ITEM	S/N etc.	TIME	MEMO	TIME	MEMO
ADCP RDI SBE16 (MDS-7D 5356)	1220 1280	03:42	着水		
Transponder TF15.5 RF13.0	67491	03:43	〃		
WIRE	ø10mm×50m	03:43~03:52	着水~着水		
ABS BUOY	2ps.	03:52	着水		
ABS BUOY	2ps.	03:52	〃		
ABS BUOY	2ps.	03:53	〃		
WIRE	ø10mm×200m	03:53~03:57	着水~着水		
KEVLER	ø12mm×1000m K10-37	03:57~04:14	〃		
MDS-7D	5357	03:57	上1000mケブラー 上部1mに取付		
KEVLER	ø12mm×988m K10-33	04:14~04:29	着水~着水		
KEVLER	ø12mm×948m K10-23	04:29~04:42	〃		
KEVLER	ø12mm×479m K10-04½	04:42~04:48	〃		
KEVLER	ø12mm×174m K2-07	04:48~04:52	〃		
KEVLER	ø12mm×136m K1.5-01	04:52~05:01	〃		
GLASS BALL	6p.s	05:01	着水		
GLASS BALL	6p.s	05:02	〃		
A.R.	TF14.0, RF13.0 EC:D, RC:C S/N 632	05:02	〃		
A.R.	TF14.5, RF13.0 EC:F, RC:E S/N 693	05:03	〃		
NYLON	ø16mm ×135m	05:03~05:15	着水~着水		
ANCHOR	1.8t	05:16	レッコ		

Time	Depth(m)
05:19	500
05:22	1000
05:26	1500
05:29	2000
05:36	3000
05:44	4000
05:47	4275 (着底)

2.5S-142E (01/12/22)
Deployment KY01-11



2.5°S, 142°E
水深:3,448 m
索長:3,100.7m
ADCP:310.2m
(計算後)

DEPLOYMENT & RECOVERY

MOORING No. 011222 -2.5S/142E

PROJECT	TOCS	TIME	UTC
AREA	Western Pacific	RECORDER (D) :	M. Hirano
POSITION	2.5S 142°E	RECORDER (R) :	

DEPTH 3443 m

PERIOD NAVIGATION SYSTEM : WGS 84

No. of DAYS

LENGTH : m DEPTH of BUOY : m BUOYANCY : kg

ACOUSTIC RELEASERS

TYPE	Benthos (Upper)	TYPE	Benthos (lower)
S/N	662	S/N	691
RECEIVE F.	13.0 kHz	RECEIVE F.	13.0 kHz
TRANSMIT F.	13.5 kHz	TRANSMIT F.	14.0 kHz
ENABLE C.	B	ENABLE C.	D
RELEASE C.	A	RELEASE C.	C
BATTERY	2years	BATTERY	2years
TEST on DECK	OK	TEST on DECK	OK

DEPLOYMENT

DATE 2001. Dec. 22 SHIP KAIYO CRUISE No. KY01-11

WATHER 0 CONDITIONS 1.2 m DIR. of WIND 305°(NW) VEL. of WIND 9.9 m/sec

DEPTH 3443 m DEPTH of A.R. 3177.5 m DESCEND. RATE 2.48 m/s BUOY 03 : 31

POS. of START 02°29.4S 141°59.4E HOR. RANGE m

POS. of DEP. 02°28.8S 141°57.6E ANCHOR 05 : 16 DISAPPEAR :

POS. of MOORING 02°28.7974S 141°57.7325E LANDING 05 : 39

AANDERAA S/N3806
スイッチ ON
2001. 12. 17
00:00:00 (UTC)

RECOVERY

DATE 2002. Oct. 22 SHIP KAIYO CRUISE No. KY02-10

WATHER 0 CONDITIONS 0.2 m DIR. of WIND WNW VEL. of WIND 5.1 m/s

START of RELEASE 21 : 00 SENDING E.C. 21 : 01

SENDING R.C. 21 : 02

FINISH of RELEASE 21 : 02

DISTANCE from A.R. 3200 m DISCOVERY ADCP :

Time	Depth(m)
21:12	2000
21:17	1500
21:22	1000
21:28	500

TIME RECORD

MOORING NO. 011222-2.5S142E

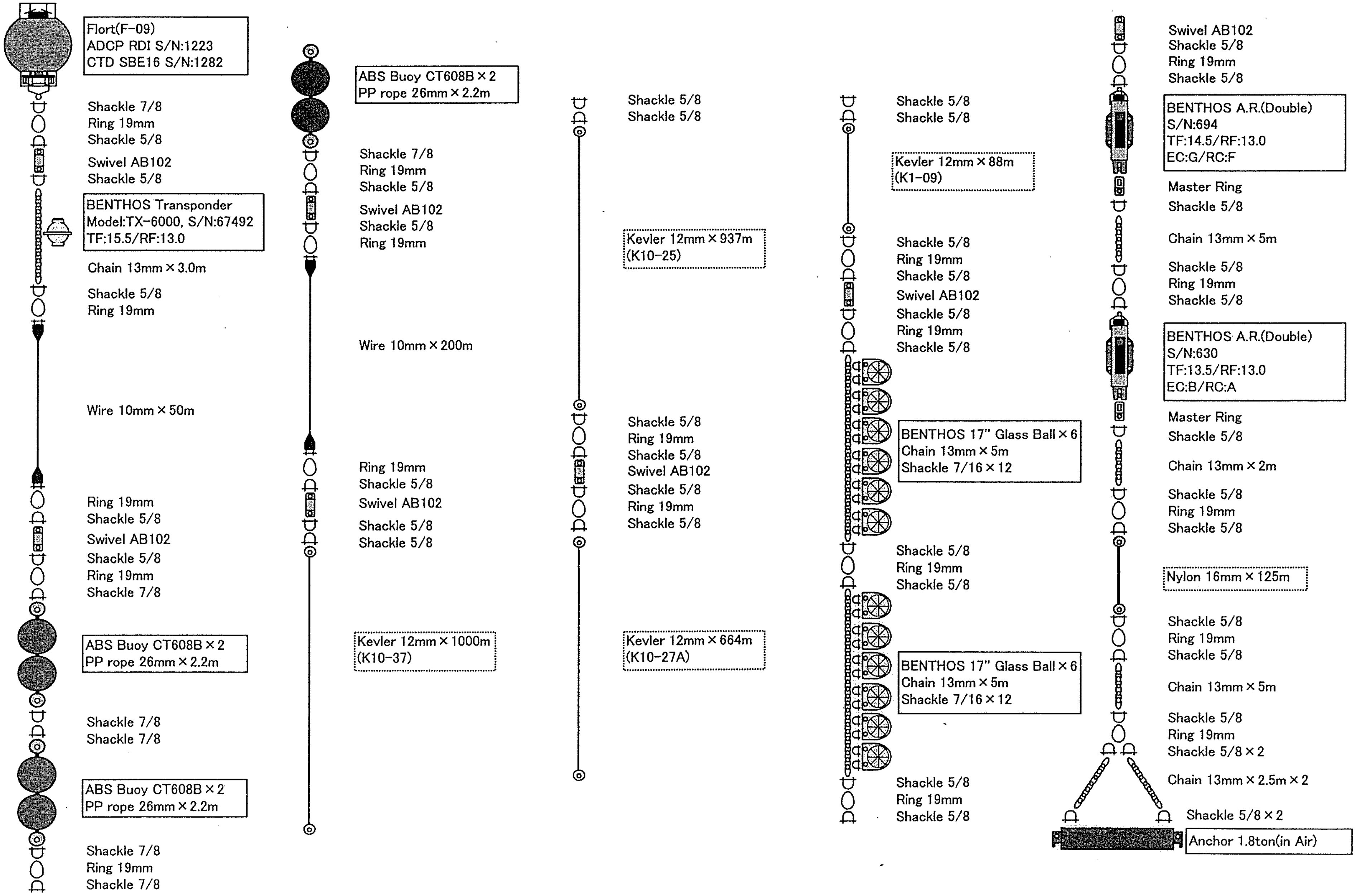
		DEPLOYMENT		RECOVERY (Date : 22 Oct. 2002)	
		START : 03:28 FINISH : 05:16		START : 21:49 (切離) FINISH : 23:32 (on deck)	
ITEM	S/N etc.	TIME	MEMO	TIME	MEMO
ADCP ADCP CTD	1224 1285	03:31	着水	21:54	on deck
WIRE	50m	03:28~34		21:54 ~ 22:06	〃
ABS BUOY	2×3	03:34		22:06	〃
WIRE	200m	03:34~03:46		22:06 ~ 22:18	〃
KEVLER(K1-08)	100m	03:46~03:54		22:18 ~ 22:23	〃
GLASS BALL	3ps	03:55		22:23	〃
AANDERAA	3806	03:55		22:27	〃
CTD SBE37	1685	03:55		22:27	〃
KEVLER(K1-05)	74m	03:55 ~03:58		22:27 ~ 22:33	〃
KEVLER(K10-20)	944m	03:58~04:20		22:33 ~ 22:57	〃
KEVLER(K10-21)	947m	04:20~04:43		22:57 ~ 23:14	〃
KEVLER (K5-02)	462m	04:43~04:54		23:14 ~ 23:23	〃
KEVLER(K1-01)	74m	04:54~05:03		23:23 ~ 23:32	〃
GLASS BALL	12ps	05:05		23:32	〃
BENTHOS A.R.	662	05:06		23:28.	水切り
BENTHOS A.R.	691	05:06		23:28	〃
NYLON	185m	05:06~05:13			
ANCHOR		05:16			

AANDERAA S/N 3806
スイッチON 2001.12.17
00:00:00 (UTC)

21:26 作業艇着水
21:33 引寄索取付
21:33 巻込開始

2.5S-142E [KY02-10]Deployment

<Water Depth: 3438m, ADCP Depth: 304m>



DEPLOYMENT & RECOVERY

MOORING No.

PROJECT	TOCS	TIME	UTC
AREA	Westem Pacific	RECORDER (D) :	masaki. Tag.
POSITION	2.5S-142E	RECORDER (R) :	

DEPTH

PERIOD NAVIGATION SYSTEM : WGS 84

No. of DAYS

LENGTH : m DEPTH of BUOY : m BUOYANCY : kg

ACOUSTIC RELEASERS

TYPE	BENTOHS Double (Upper)	TYPE	BENTOHS Double (Lower)
S/N	694	S/N	630
RECEIVE F.	13.0 kHz	RECEIVE F.	13.0 kHz
TRANSMIT F.	14.5 kHz	TRANSMIT F.	13.5 kHz
ENABLE C.	G	ENABLE C.	B
RELEASE C.	F	RELEASE C.	A
BATTERY	2 year.	BATTERY	2 year.
TEST on DECK		TEST on DECK	

DEPLOYMENT

DATE 23 Oct. 2002 SHIP KAIYO CRUISE No. KY02-10

WATHER 0 CONDITIONS 0.3 m DIR. of WIND WNW VEL. of WIND 4.3 m/s

DEPTH m DEPTH of A.R. 3280 m DESCEND. RATE m/s BUOY :

POS. of START 02°-28.60~~S~~S 141-56.10E HOR. RANGE m

POS. of DEP. 02°-28.81S 141-57.77E ANCHOR 04 : 53 DISAPPEAR :

POS. of MOORING 02°-28.83S 141°-57.66E LANDING 05 : 41

Time	Depth(m)
04:55	~~800~~
04:57	600
05:02	1800
05:04	2000
05:08	2800
05:12	3000
05:14	3261 (着底)

	S/N
ADCP	1123
CTD	1282
RCM-9	none
RCM-9	none
Trapon	07492

RECOVERY

DATE SHIP CRUISE No.

WATHER CONDITIONS DIR. of WIND VEL. of WIND

START of RELEASE : SENDING E.C. :

SENDING R.C. :

FINISH of RELEASE :

DISTANCE from A.R. m DISCOVERY ADCP :

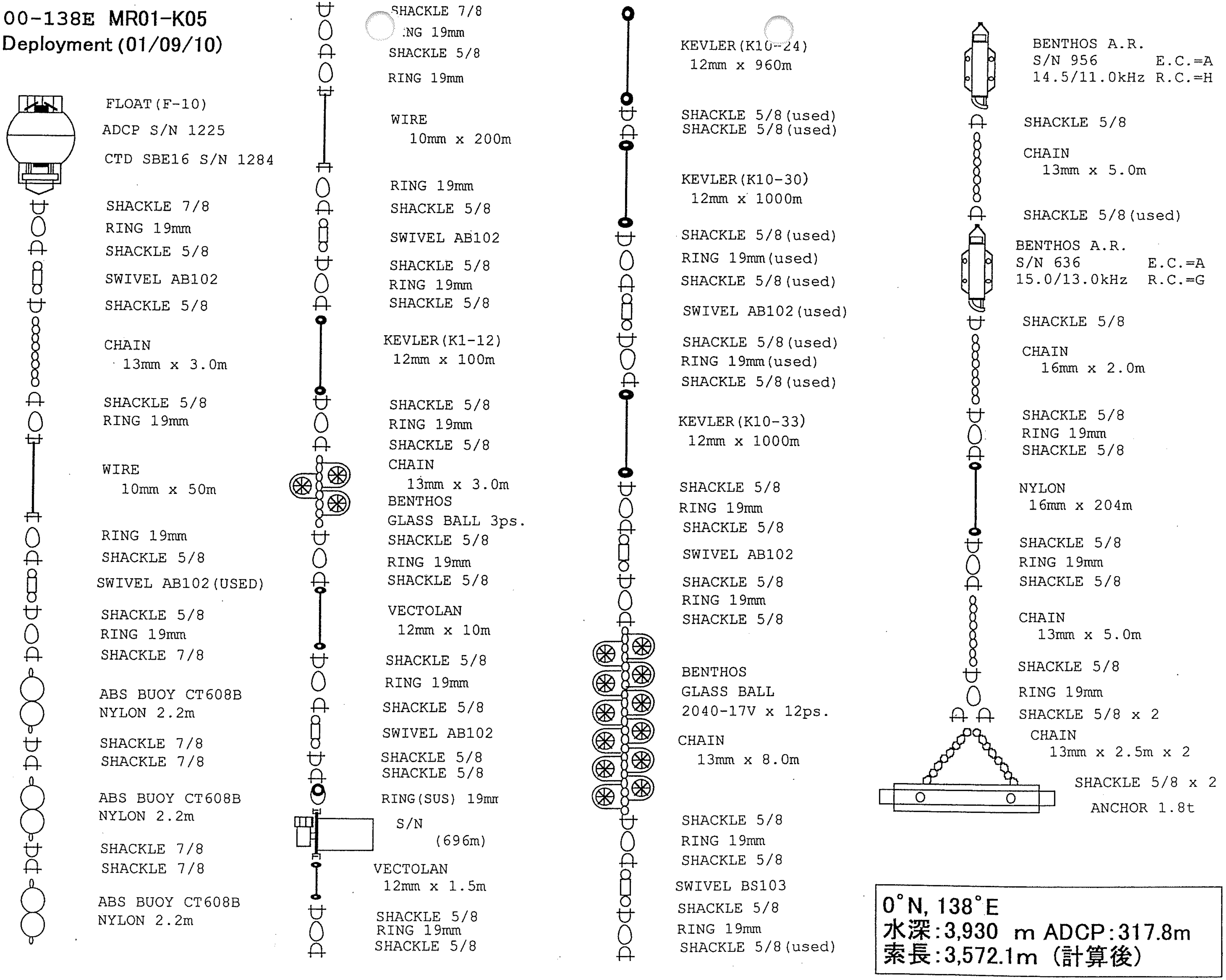
TIME RECORD

MOORING NO. 021023 – 25S/142E

		DEPLOYMENT 23 Oct. 2002 START : 03:29 (ブリッジ) FINISH : 04:53		RECOVERY (Date :) START : FINISH :	
ITEM	S/N etc.	TIME	MEMO	TIME	MEMO
ADCP CTD	1123 1282	03:33	着水		
Transponder	67492 TF:14.5RF:13.0	03:32	〃		
WIRE	ø10mm ×50m	03:33 ~ 03:43	〃		
ABS BUOY	2p.s.	03:42	〃		
ABS BUOY	2p.s.	03:43	〃		
ABS BUOY	2p.s.	03:43	〃		
WIRE	ø10mm ×200m	03:43 ~ 03:48	〃		
KEVLER	ø12mm×1000 K10-38	03:48 ~ 04:03	〃		
KEVLER	ø12mm×937m K10-25	04:03 ~ 04:14	〃		
KEVLER	ø12mm×664m K10-27-A	04:14 ~ 04:23	〃		
KEVLER	ø12mm×88m K01-09	04:23 ~ 04:32	〃		
GLASS BALL	6p.s.	04:32	〃		
GLASS BALL	6p.s.	04:33	〃		
A.R.	TF:14.5RF:13.0 EC:G RC:F 694	04:33	〃		
A.R.	TF:13.5RF:13.0 EC:B RC:A 630	04:33	〃		
NYLON	ø16mm ×125m	04:33 ~ 04:53	〃		
ANCHR	1.8t	04:53	Vァフ		

Time	Depth(m)
04:55	300
04:57	600
05:02	1500
05:04	2000
05:08	2500
05:12	3000
05:14	3261 (着底)

00-138E MR01-K05
Deployment (01/09/10)



0°N, 138°E
水深:3,930 m ADCP:317.8m
索長:3,572.1m (計算後)

DEPLOYMENT & RECOVERY

MOORING No. 011005 · 00138E

PROJECT	TOCS	TIME	UTC
AREA	Pacific Ocean	RECORDER (D) :	M. Hirano
POSITION	0-138E	RECORDER (R) :	Takeo Matsumoto

DEPTH 3946 m

PERIOD NAVIGATION SYSTEM : WGS 84

No. of DAYS

LENGTH : m DEPTH of BUOY : m BUOYANCY : kg

ACOUSTIC RELEASERS

TYPE	BENTHOS (Upper)	TYPE	BENTHOS (Lower)
S/N	956	S/N	636
RECEIVE F.	11.0 kHz	RECEIVE F.	13.0 kHz
TRANSMIT F.	14.5 kHz	TRANSMIT F.	15.0 kHz
ENABLE C.	A	ENABLE C.	A
RELEASE C.	H	RELEASE C.	G
BATTERY	2year	BATTERY	2year
TEST on DECK	2001.10.5 (ok)	TEST on DECK	2001.10.5 (ok)

DEPLOYMENT

DATE 2001.10.5 SHIP MIRAI CRUISE No. MR01-K05

WATHER bc CONDITIONS 1.2 m/s DIR. of WIND WSW VEL. of WIND 5.0 m/s

DEPTH 3946 m DEPTH of A.R. 3651 m DESCEND. RATE 3.0 m/s BUOY 03 : 26

POS. of START 0°01.58S 137°59.17E HOR. RANGE ~~3.0~~ m

POS. of DEP. 0°00.55S 138°01.89E ANCHOR 04 : 37 DISAPPEAR :

POS. of MOORING 0°00.59S 13801.80E LANDING 04 : 56

ナイロンロープ マーキング 204m.
切らずに使用.

500	
1000	13:40
1500	:42
2000	:45
2500	:47
3000	:51
3500	:55

3946m 3651 :57 着底

RECOVERY

DATE 25 Oct. 2002 SHIP KAIYO CRUISE No. KY02-10

WATHER bc CONDITIONS 0.6m DIR. of WIND WSW VEL. of WIND 7.1 m/s

START of RELEASE 21 ~~07~~ : 00 SENDING E.C. 21 ~~07~~ : 00

SENDING R.C. 21 ~~07~~ : 02

FINISH of RELEASE 21 ~~07~~ :02

DISTANCE from A.R. 3719 m DISCOVERY ADCP :

Time	Depth
21 ~~07~~ :09	2600
21 ~~07~~ :15	2000
21 ~~07~~ :21	1500
21 ~~07~~ :26	1000
21 :33	500

TIME RECORD

MOORING NO. 011005 - 00138E

DEPLOYMENT
START: 03:26 01.10.05
FINISH: 04:33

RECOVERY(Date: 25 Oct. 2002)
START: 22:14 (水切り)
FINISH: 00:12 (on deck)

ITEM	S/N etc.	TIME	MEMO	TIME	MEMO
ADCP/CTD	1225/1284	03:26 ~ 03:28		22:21	on deck
WIRE	50m	03:28 ~ 03:31		22:21 ~ 22:31	〃
ABS BUOY	2	03:31		22:31	〃
〃	2	03:29 ~ 03:31		22:30	〃
〃	2	03:32		22:30	〃
WIRE	200m	03:32 ~ 03:37		22:31 ~ 22:40	〃
KEVLER(K1-12)	100m	03:37 ~ 03:41		22:40 ~ 22:48	〃
GLASS BALL	3 ps	03:40 ~ 03:41		22:48	〃
~~AANDERAA~~ VECTOLAN RCM5	S/N 4008 10m	03:41 ~ 03:4~~4~~3 03:43 ~ 03:44		22:52	〃
KEVLER (K10-24)	960 m	03:44 ~ 03:55		22:52 ~ 23:20	途中 ブロックローラのローラからケブラーが外れていた
KEVLER (K10-30)	1000 m	03:55 ~ 04:06		23:20 ~ 23:43	on deck
KEVLER(K10-33)	1000m	04:06 ~ 04:22		23:43 ~	〃
GLASS BALL	12 ps	04:19 ~ 04:22		00:11	〃
BENTHOS A.R	S/N 956	04:19 ~ 04:23		00:12	〃
〃	S/N 636	04:21 ~ 04:23		00:08	水切り
NYLON	204 m	04:23 ~ 04:33			
ANCHOR	1.8t	04:31 ~ 04:33			
ANCHOR 深度 500m		04:37			

04:29 ~ 04:31 ANCHOR chain と NYLON シャックル接続部に 誘導用ロープがはさまり 取れなくなる → 少し巻き戻し (1m ほど) キズ の ホツレ

ANCHOR; 500m深 04:37, 1,000m深 04:39, 1,500m深 04:41, 2,000m 04:44, 2,500m 04:47
3,000m深 04:50, 3,500m 04:54, 3,651m 着底 04:56

ワーク切離し 21:02
作業艇着水 21:33
引寄せ索取付 21:51
引寄せ索巻込 21:53

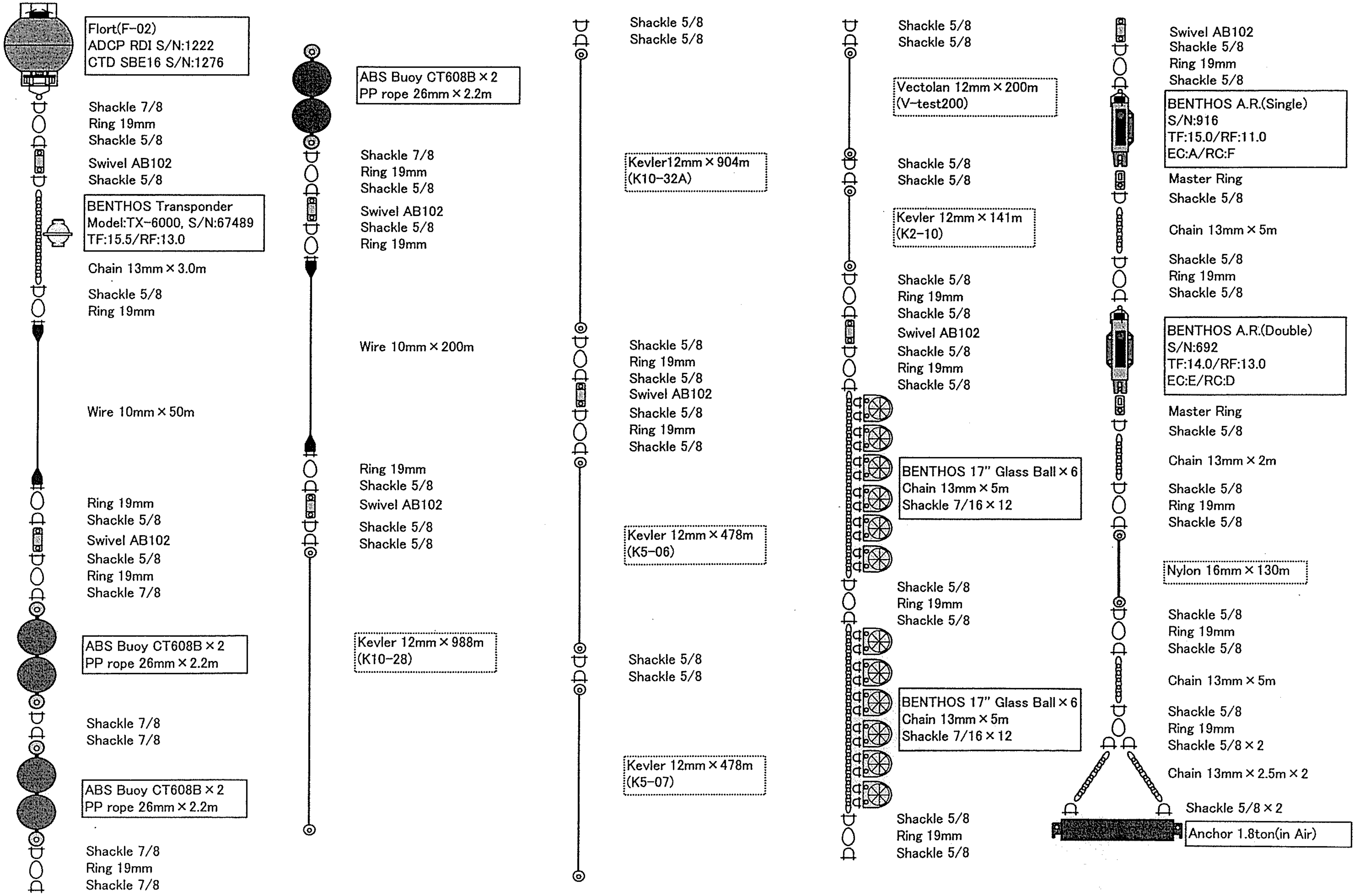
ミリアル 確認 → ワイヤー いりまし [illegible]

・巻きとし ・解系
・トラブル など
何を いつ 行ったか 記録

指揮室 にて 500m ごとの 深度 time
[illegible]

00-138E [KY02-10]Deployment

<Water Depth: 3945m, ADCP Depth: 303m>



DEPLOYMENT & RECOVERY

MOORING No.

PROJECT	TOCS	TIME	UTC
AREA	Western Pacific	RECORDER (D) :	Masaki Taguchi
POSITION	0-138E	RECORDER (R) :	

DEPTH

PERIOD NAVIGATION SYSTEM :

No. of DAYS

LENGTH : m DEPTH of BUOY : m BUOYANCY : kg

ACOUSTIC RELEASERS

TYPE	BENTOHS Single (Upper)	TYPE	BENTOHS Double (Lower)
S/N	916	S/N	692
RECEIVE F.	11.0 kHz	RECEIVE F.	13.0 kHz
TRANSMIT F.	15.0 kHz	TRANSMIT F.	14.0 kHz
ENABLE C.	A	ENABLE C.	E
RELEASE C.	F	RELEASE C.	D
BATTERY	~~2year~~ 1year	BATTERY	2year.
TEST on DECK		TEST on DECK	

DEPLOYMENT

DATE 26 Oct. 2002 SHIP KAIYO CRUISE No. KY02-10

WATHER bc CONDITIONS 0.5m DIR. of WIND WSW VEL. of WIND 6.1m/s

DEPTH m DEPTH of A.R. 3818 m DESCEND. RATE m/s BUOY :

POS. of START 00°-00.71S 138°-03.39E HOR. RANGE m

POS. of DEP. 00°-00.55S 138°-01.72E ANCHOR : DISAPPEAR :

POS. of MOORING 00°-00.68S 138°-01.82E LANDING 04 : 36

Time	Depth(m)
4:16	700
4:18	1000
4:21	1500
4:23	2000
4:26	2500
4:30	3000
4:33	3500
4:36	3750 (着底)

	S/N
ADCP	1222
CTD	1276
RCM-9	none
RCM-9	none
Trapon.	67489

RECOVERY

DATE SHIP CRUISE No.

WATHER CONDITIONS DIR. of WIND VEL. of WIND

START of RELEASE : SENDING E.C. :

SENDING R.C. :

FINISH of RELEASE :

DISTANCE from A.R. m DISCOVERY ADCP :

TIME RECORD

MOORING NO. 021025－00138E

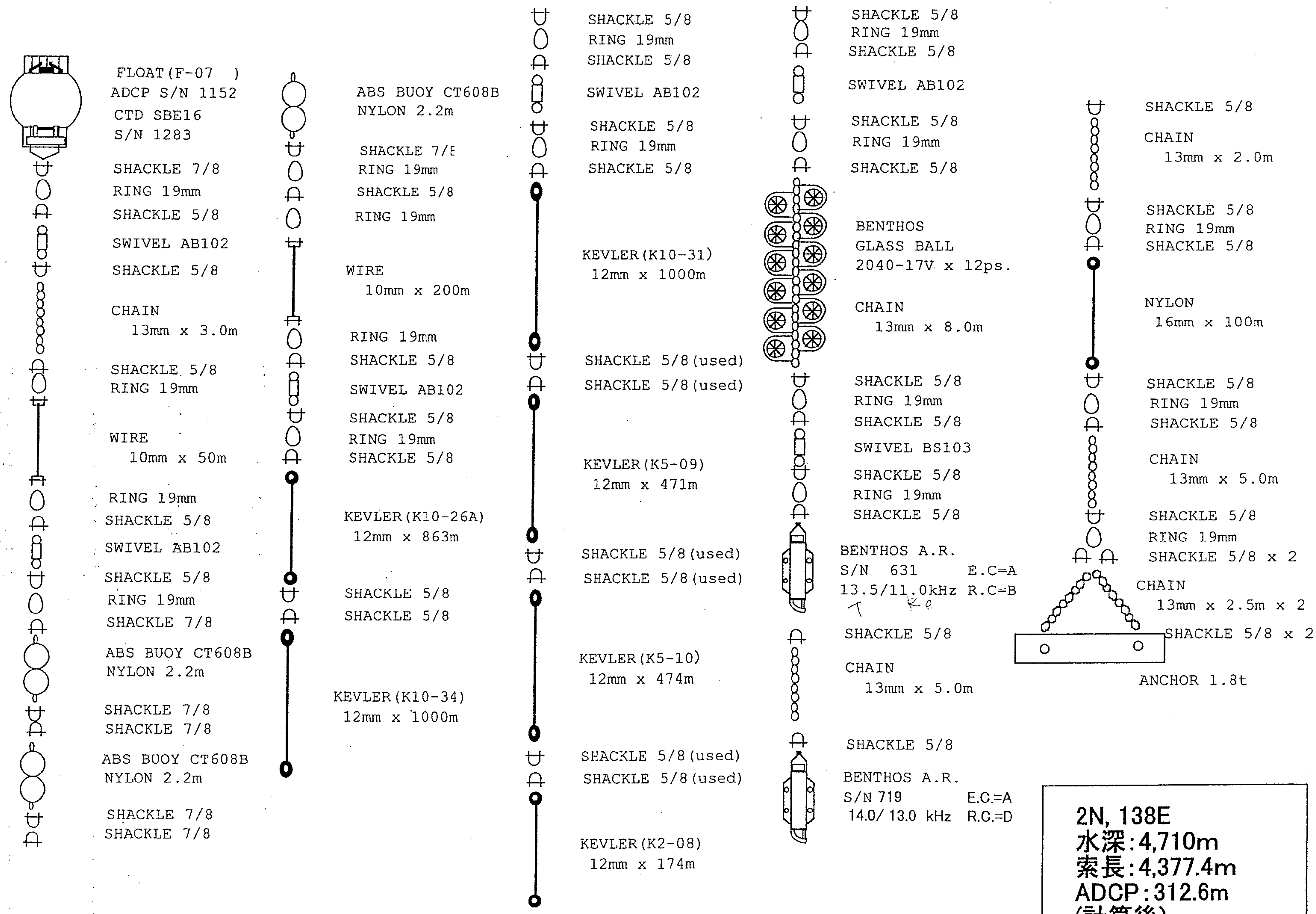
	DEPLOYMENT 26 Oct. 2002	RECOVERY (Date :)
	START : 02:57 (ブリエフ)	START :
	FINISH :	FINISH :

ITEM	S/N etc.	TIME	MEMO	TIME	MEMO
ADCP CTD	1222 1276	03:00	着水		
WIRE	ϕ10mm ×50m	03:00～03:05	〃		
ABS BUOY	2p.s.	03:05	〃		
ABS BUOY	2p.s.	03:06	〃		
ABS BUOY	2p.s.	03:06	〃		
WIRE	ϕ10mm ×200m	03:06～03:11	〃		
KEVLER	ϕ12mm×988m K10-28	03:11～03:18	〃		
KEVLER	ϕ12mm×904mm K10-32A	03:18～03:35	〃		
KEVLER	ϕ12mm×478m K5-06	03:35～03:40	〃		
KEVLER	ϕ12mm×478m K5-07	03:40～03:46	〃		
VECTOLAN	ϕ12mm×200m K2-01test V-test200	03:46～03:49	〃		
KEVLER	ϕ12mm×141m K2-10	03:49～03:58	〃		
GLASS BALL	6p.s.	03:58	〃		
GLASS BALL	6p.s.	03:58	〃		
A.R.	TF:15.0, RF:11.0 EC:A, RC:F 926	03:59	〃		
A.R.	TF:14.0, RF:13.0 EC:E, RC:D 692	03:59	〃		
NYLON	ϕ16mm ×130m	03:59～04:12	〃		
ANCHOR	1.8t	04:12	(レッコ)		

Transponder S/N 67489 TF:15.5, RF:13.0

Time	Depth(m)
4:16	500
4:18	1000
4:21	1500
4:23	2000
4:26	2500
4:30	3000
4:33	3500
4:36	3750(着底)

2N-138E MR01-K05 Deployment (/09/10)



2N, 138E
水深:4,710m
索長:4,377.4m
ADCP:312.6m
(計算後)

DEPLOYMENT & RECOVERY

MOORING No. 011001-2N138E

PROJECT	TOCS	TIME	UTC
AREA	Pacific Ocean	RECORDER (D) :	M. Hirano
POSITION	2N-138E	RECORDER (R) :	

DEPTH 4681m

PERIOD NAVIGATION SYSTEM : WGS 84

No. of DAYS

LENGTH : m DEPTH of BUOY : m. BUOYANCY : kg

ACOUSTIC RELEASERS

TYPE	BENTHOS (Upper)	TYPE	BENTHOS (Lower)
S/N	631	S/N	719
RECEIVE F.	11.0 kHz	RECEIVE F.	13.0 kHz
TRANSMIT F.	13.5 kHz	TRANSMIT F.	14.0 kHz
ENABLE C.	A	ENABLE C.	A
RELEASE C.	B	RELEASE C.	D
BATTERY	2year	BATTERY	2year
TEST on DECK	01.Oct.01	TEST on DECK	01.Oct.01

DEPLOYMENT

DATE 01.Oct.01 SHIP MIRAI CRUISE No. MR01-K05

WATHER bc CONDITIONS 0.7m DIR. of WIND 303° VEL. of WIND 1.3m/s

DEPTH 4681 m DEPTH of A.R. 4502 m DESCEND. RATE 2.52 m/s BUOY 23 : 05

POS. of START 01° 52.87N 138° 04.82E HOR. RANGE m

POS. of DEP. 01° 53.74N 138° 02.10E ANCHOR 00 : 33 DISAPPEAR :

POS. of MOORING 01° 53.74N 138° 02.27E LANDING 10 : 02

リリーサー上部のシャックルー
中古を使用。
新品シャックルでは径が
合わなかったため。

RECOVERY

DATE 26 Oct. 2002 SHIP KAIYO CRUISE No. KY02-10

WATHER bc CONDITIONS 0.4m DIR. of WIND S VEL. of WIND 3.2m/s

START of RELEASE 21 : 57 SENDING E.C. 21 : 58 (2回送信)

SENDING R.C. 21 : 58, 22:03 (2回送信)

FINISH of RELEASE 22 : 03

DISTANCE from A.R. 4547 m DISCOVERY ADCP :

トランスデューサがヒレに流れていた。その後アスタンをかけてもらい、R.C.再送信

Time	Depth(m)	
22:09	4000	途中受信できず
22:13	3300	
22:16	3000	
22:20	2500	
22:25	2000	

TIME RECORD

MOORING NO. 011001 -2N138E

		DEPLOYMENT 01.10.01		RECOVERY(Date: 02.10.26)	
		START: 23:04		START: 22:43 OK切り)	
		FINISH: 00:33		FINISH: 00:42 (on deck)	
ITEM	S/N etc.	TIME	MEMO	TIME	MEMO
ADCP	F07	23:05	目視 ~23:59	~~23~~22:51	on deck
WIRE 50m	50m	23:04~23:08		~~23~~22:51~23:01	〃
ABS	2×3	23:08		23:01	〃
WIRE	200m	23:08~23:13		23:01~23:11	〃
KEVLER (K10-26A)	863m	23:13~23:22		23:11~23:32	藻の付着多し ピンのデロデロ多し
KEVLER (K10-34)	1000m	23:22-23:32		23:32~23:52	on deck
KEVLER (K10-31)	1000m	23:32-23:42		23:52~00:13	〃
KEVLER (K5-09)	471m	23:42~23:47		00:13~00:23	〃
KEVLER (K5-10)	474m	23:47~23:53		00:23~00:32	〃
KEVLER (K2-08)	174m	23:53~00:00		00:32~00:37	〃
GLASS BALL	12	00:00	目視 ~00:33	00:42	〃
BENTHOS A.R	S/N 631	00:03	（海へ入れるとき	00:42	〃
〃	S/N 719	00:03	つり上げロープが引っかかる。	00:38	OK切り)
NYLON	100m	00:03~00:33			
ANCHOR	1.8t	00:33			
航走 00:07~00:30 着底				22:30 引寄索取付 22:30 〃 巻込 (22:35~38中断) 22:~~40~~39 〃 巻込再開	

1500m 00:41
2000 00:44
2500 00:47
3000 00:50
3500 00:54
4000 00:57
45~~00~~ 02 01:02.

8. TRITON moorings

8.1 TRITON Mooring Operation

(1) Personnel

Hideaki Hase	(JAMSTEC): on board Leg1
Shigeki Hosoda	(JAMSTEC): on board Leg1,2
Shinya Minato	(JAMSTEC): on board Leg2
Takeo Matsumoto	(MWJ): Technical staff

(2) Objectives

The air-sea interaction over the warmest sea surface temperature region in the western tropical Pacific Ocean called warm pool affects the global atmosphere and causes El Nino phenomena. The formation mechanism has not been well understood. Long term data sets of temperature, salinity, currents, so on are required at fixed locations. In particular, the oceanic change to the winds in the western tropical Pacific is important in that region of origin of El Nino and rain fall over the ocean is also important parameter to study El Nino and Asia-Australian Monsoon. The TRITON program aims to obtain the basic data to improve the predictions of El Nino and variations of Asia-Australian Monsoon system.

TRITON will be 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 in cooperation with France, Chinese Taipei and Japan. 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).

The 11 TRITON buoys have been successfully repaired during this R/V Kaiyo cruise (KY02-10)

(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.

There recovered buoys will be maintained at JAMSTEC Mutsu-Branch where is the mother port of R/V Mirai.

(4) Instrument

1) CTD and CT

SBE-37 IM MicroCAT

A/D cycles to average :	4
Sampling Interval :	600sec
Measurement range Temperature :	-5～+35
Measurement range Conductivity :	0～+7
Measurement range Pressure :	0～full scale range

2) CRN

SonTek Argonaut ADCM

Sensor frequency : 1500kHz
Sampling Interval : 1200sec
Average Interval : 120sec

3) Floating Sensor

SCTI ORG-115DX

Precipitation

PARPSCIENTIFIC. Inc. DIGIQUARTZ FLOATING BAROMETER 6000SERIES

Atmospheric pressure

Woods Hole Institution ASIMET

Relative humidity/air temperature

Shortwave radiation

Wind speed/direction

Sampling Interval : 60sec
Data analysis : 600sec averaged

(5) Locations of TRITON Buoys

11 TRITON buoys have been successfully deployed in the EEZs of Federated States of Micronesia,Indonesia and Papua New Guinea using R/V KAIYO.

TRITON repaired

Nominal location	8N, 156E
ID number at JAMSTEC	01005
Number on surface float	T01
ARGOS PTT number	11823
ARGOS backup PTT number	11584
Deployed date	28 Feb. 2002
Repaired date	09 Oct. 2002
Exact location	08-00.85N, 155 - 57.25E
Depth	4836 m

Nominal location	5N, 156E
ID number at JAMSTEC	02005
Number on surface float	T14
ARGOS PTT number	07962
ARGOS backup PTT number	07860
Deployed date	03 Mar. 2002
Repaired date	10 Oct. 2002
Exact location	04-58.47N, 156 - 02.23E
Depth	3602 m

Nominal location	2N, 156E
ID number at JAMSTEC	03006
Number on surface float	T15
ARGOS PTT number	09770
ARGOS backup PTT number	07861
Deployed date	05 Mar. 2002

Repaired date	11 Oct. 2002
Exact location	01-57.24N, 155 - 59.99E
Depth	2565 m

Nominal location	Eq, 156E
ID number at JAMSTEC	04006
Number on surface float	T16
ARGOS PTT number	09771
ARGOS backup PTT number	07864
Deployed date	08 Mar. 2002
Repaired date	13 Oct. 2002
Exact location	00-00.98S, 155 - 57.39E
Depth	1942 m

Nominal location	5N, 147E
ID number at JAMSTEC	07004
Number on surface float	T19
ARGOS PTT number	11827
ARGOS backup PTT number	07881
Deployed date	19 Mar. 2002
Repaired date	18 Oct. 2002
Exact location	05-02.55N, 146 - 56.98E
Depth	4247 m

Nominal location	2N, 147E
ID number at JAMSTEC	08003
Number on surface float	T20
ARGOS PTT number	09427
ARGOS backup PTT number	24238
Deployed date	17 Mar. 2002
Repaired date	18 Oct. 2002
Exact location	01-59.54N, 147 - 01.14E
Depth	4523 m

Nominal location	Eq, 147E
ID number at JAMSTEC	09004
Number on surface float	T02
ARGOS PTT number	09793
ARGOS backup PTT number	11592
Deployed date	19 Dec. 2001
Repaired date	21 Oct. 2002
Exact location	00-01.32S, 146-59.54E
Depth	4552 m

Nominal location	08N, 137E
ID number at JAMSTEC	10002

Number on surface float	T13
ARGOS PTT number	20275
ARGOS backup PTT number	24229
Deployed date	01 Jul. 2002
Repaired date	29 Oct. 2002
Exact location	07-39.69N, 136 - 41.59E
Depth	3144 m

Nominal location	5N, 137E
ID number at JAMSTEC	11002
Number on surface float	T21
ARGOS PTT number	20417
ARGOS backup PTT number	24230
Deployed date	04 Jul. 2002
Repaired date	27 Oct. 2002
Exact location	04-51.55N, 137 - 16.04E
Depth	4109 m

Nominal location	2N, 138E
ID number at JAMSTEC	12004
Number on surface float	T22
ARGOS PTT number	20374
ARGOS backup PTT number	24231
Deployed date	06 Jul. 2002
Repaired date	27 Oct. 2002
Exact location	02-00.06N, 138 - 06.16E
Depth	4317 m

Nominal location	Eq, 138E
ID number at JAMSTEC	13004
Number on surface float	T23
ARGOS PTT number	none
ARGOS backup PTT number	24232, 24233
Deployed date	07 Jul. 2002
Repaired date	25 Oct. 2002
Exact location	00-01.97N, 137 - 53.15E
Depth	4371 m

(7) Data archive

Those hourly averaged data transmitted through ARGOS satellite data transmission system in near real time. The real time data will be 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 JAMSTEC Mutsu Branch.

8.2 Intercomparison between shipboard CTD and TRITON data

(1) Personnel

Kentaro Ando	(JAMSTEC): not on board Principal Ivestigetor
Takeo Matsumoto	(MWJ): on board Leg1, 2
Tetsuya Nagahama	(MWJ): not on board

(2) Objectives

TRITON CTD data validation.

(3) Measured parameters

- Temperature
- Conductivity
- Pressure

(4) Methods

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

TRITON buoy data was sampled every 1 hour except for transmition to the ship. We compared CTD observation by R/V KAIYO 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 samevalue of temperature data. Then, we calculated difference of salinity and conductivity between CTD casting and TRITON buoy for each deployment and recovery.

(5) Results

Most of temperature, conductivity and salinity data from TRITON buoy showed good agreement with CTD cast data. See the figure 8.2-1
To evaluate the performance of the conductivity sensors on TRITON buoy, the data from deployed buoy and shipboard CTD data at the same location were analysed.

The estimation were calculated as been deployed buoy data minus shipboard CTD data. The salinity differences are from –0.100 to 0.094 psu for all depths. Below 300db, salinity differences are from –0.017 to 0.011 psu (See the figures8.2-2and table 8.2-1). The average of salinity differences was 0.010 psu with standard deviation of 0.025 psu.

(6) Data archive

All raw and processed CTD data files were copied on 3.5 inch magnetic optical disks and submitted to JAMSTEC Data Management Office. All original data will be stored at JAMSTEC Mutsu brunch. (See section 6.2.1)

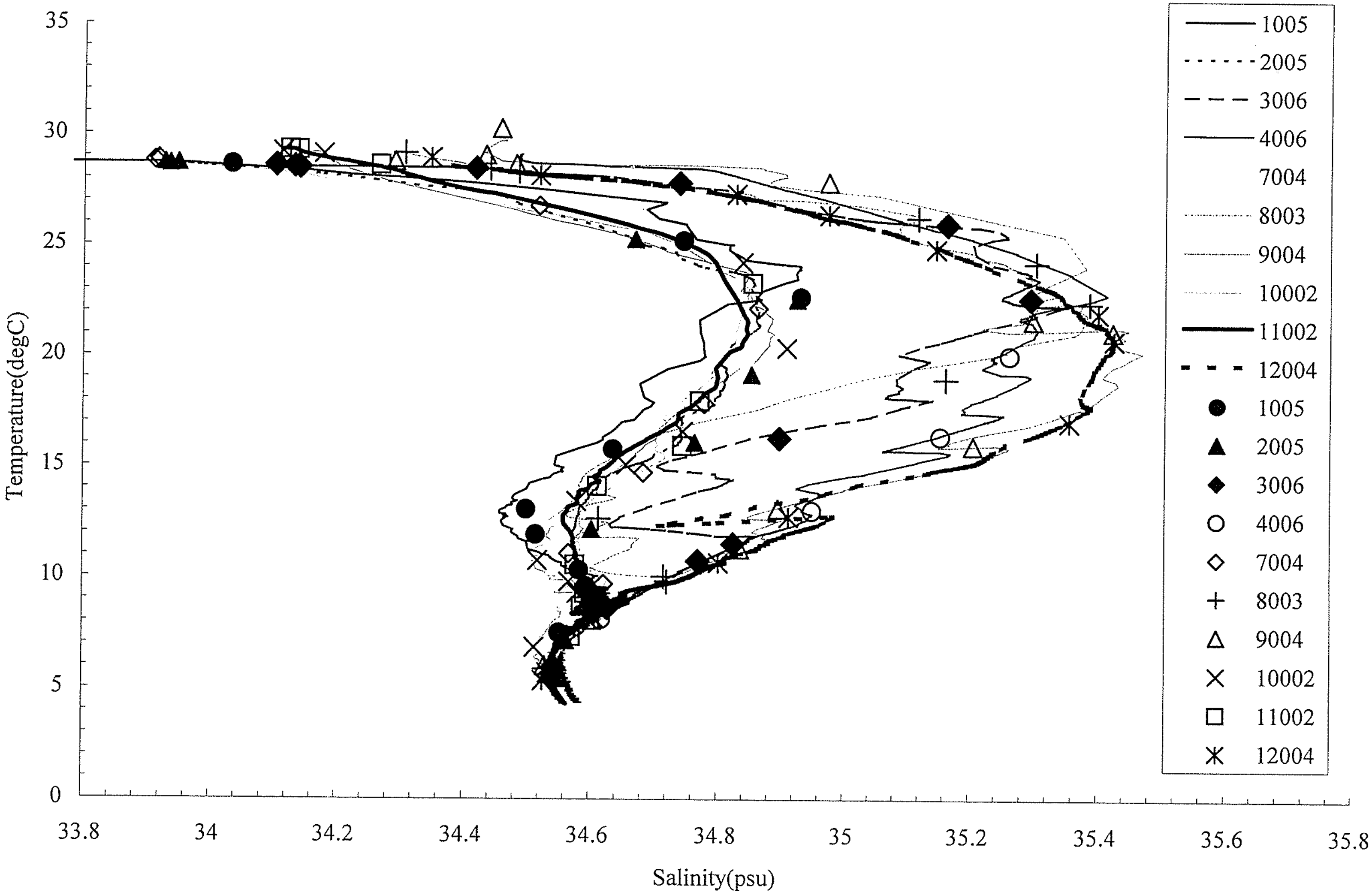


fig.8.2.-1 T-S diagram (TRITON buoys data and ship board CTD(9Plus) data)

Table 8.2.-1 Data differences between TRITON buoys data and ship board CTD(9Plus) data

Observation No.	Pressure (db)	Temperature (degC)	Conductivety (S/m)	Salinity (psu)
1005	1.5	0.00	0.000	0.000
1005	25	0.01	0.009	0.045
1005	50	-0.08	-0.006	-0.020
1005	75	-0.01	0.011	0.069
1005	100	-0.02	0.011	0.054
1005	125	0.03	0.009	0.041
1005	150	0.00	0.005	0.034
1005	200	0.01	0.004	0.002
1005	250	0.00	0.003	0.000
1005	300	0.00	0.001	-0.012
1005	500	0.00	0.000	-0.017
1005	750	0.01	0.000	-0.017
2005	1.5	0.00	0.000	0.005
2005	25	0.00	0.002	0.023
2005	50	0.00	-0.001	-0.006
2005	75	-0.08	-0.008	0.008
2005	100	0.04	0.012	0.064
2005	125	-0.03	0.001	0.038
2005	150	0.01	0.003	0.025
2005	200	0.06	0.008	0.028
2005	250	0.01	0.001	0.007
2005	300	0.00	0.001	0.007
2005	500	0.00	0.000	0.000
2005	750	0.00	0.001	0.011
3006	1.5	0.01	0.001	0.000
3006	25	0.00	0.004	0.030
3006	50	0.00	-0.016	-0.106
3006	75	0.01	0.000	0.000
3006	100	-0.07	0.000	0.051
3006	125	0.02	0.005	0.024
3006	150	-0.03	0.003	0.044
3006	200	0.03	0.008	0.048
3006	250	0.00	-0.001	-0.014
3006	300	-0.01	-0.002	-0.010
3006	500	0.00	0.000	-0.006
3006	750	0.00	0.000	0.009
4006	150	0.03	0.005	0.024
4006	200	0.01	0.001	0.006
4006	250	0.01	0.003	0.016
4006	500	0.01	0.002	0.000

Table 8.2.-1 Data differences between TRITON buoys data and ship board CTD(9Plus) data

Observation No.	Pressure (db)	Temperature (degC)	Conductivety (S/m)	Salinity (psu)
7004	1.5	0.01	0.002	0.010
7004	25	0.00	0.001	0.015
7004	50	0.00	0.002	0.015
7004	75	0.00	0.007	0.053
7004	100	0.00	0.002	0.021
7004	125	-0.01	0.003	0.039
7004	150	0.00	0.000	0.007
7004	200	0.00	-0.002	-0.018
7004	250	-0.01	-0.001	-0.002
7004	300	0.02	0.001	-0.006
7004	500	0.00	-0.001	0.000
7004	750	0.00	0.000	-0.003
8003	1.5	0.01	0.001	0.002
8003	25	-0.01	0.000	0.015
8003	50	-0.01	-0.004	-0.021
8003	75	0.01	0.000	0.002
8003	100	0.00	0.006	0.047
8003	125	-0.02	-0.001	0.012
8003	150	-0.02	0.014	0.132
8003	200	0.04	0.005	0.021
8003	250	0.00	0.000	-0.003
8003	300	0.00	0.000	-0.002
8003	500	0.00	0.000	-0.006
8003	750	0.00	0.000	-0.009
9004	1.5	0.56	0.057	-0.008
9004	25	0.00	-0.002	-0.007
9004	50	0.00	-0.026	-0.172
9004	75	0.00	-0.015	-0.100
9004	100	-0.03	0.010	0.094
9004	125	0.00	0.001	0.013
9004	150	0.00	0.000	-0.001
9004	200	0.00	-0.005	-0.040
9004	250	0.04	0.005	0.013
9004	300	0.03	0.001	-0.015
9004	500	0.00	0.000	-0.008
9004	750	0.00	-0.001	-0.011
10002	1.5	0.00	-0.002	-0.006
10002	25	-0.05	-0.005	0.007
10002	50	0.06	0.012	0.045
10002	75	-0.06	-0.004	0.030
10002	100	0.06	0.010	0.037
10002	125	0.03	0.004	0.006
10002	150	0.02	0.003	0.007
10002	200	0.00	0.002	0.007
10002	250	-0.01	-0.001	-0.012
10002	300	0.00	-0.001	-0.016

Table 8.2.-1 Data differences between TRITON buoys data and ship board CTD(9Plus) data

Observation No.	Pressure (db)	Temperature (degC)	Conductivety (S/m)	Salinity (psu)
10002	500	0.00	0.000	0.004
10002	750	0.00	0.001	0.007
11002	1.5	0.00	0.001	0.010
11002	25	0.00	0.000	0.005
11002	50	0.01	0.004	0.025
11002	75	-0.11	-0.005	0.044
11002	100	-0.04	-0.004	0.001
11002	125	-0.02	0.007	0.073
11002	150	-0.07	-0.006	0.010
11002	200	0.07	0.007	0.006
11002	250	0.00	-0.001	-0.006
11002	300	-0.01	-0.001	-0.001
11002	500	0.00	0.000	0.007
11002	750	0.00	0.001	0.002
12004	1.5	0.39	0.035	-0.032
12004	25	-0.01	-0.003	-0.008
12004	50	0.01	0.003	0.020
12004	75	-0.01	0.002	0.024
12004	100	0.01	-0.001	-0.012
12004	125	-0.03	0.000	0.031
12004	150	0.02	0.002	0.001
12004	200	0.08	0.009	0.013
12004	250	0.06	0.020	0.137
12004	300	0.00	-0.001	-0.011
12004	500	0.00	0.000	0.002
12004	750	0.00	-0.001	-0.010

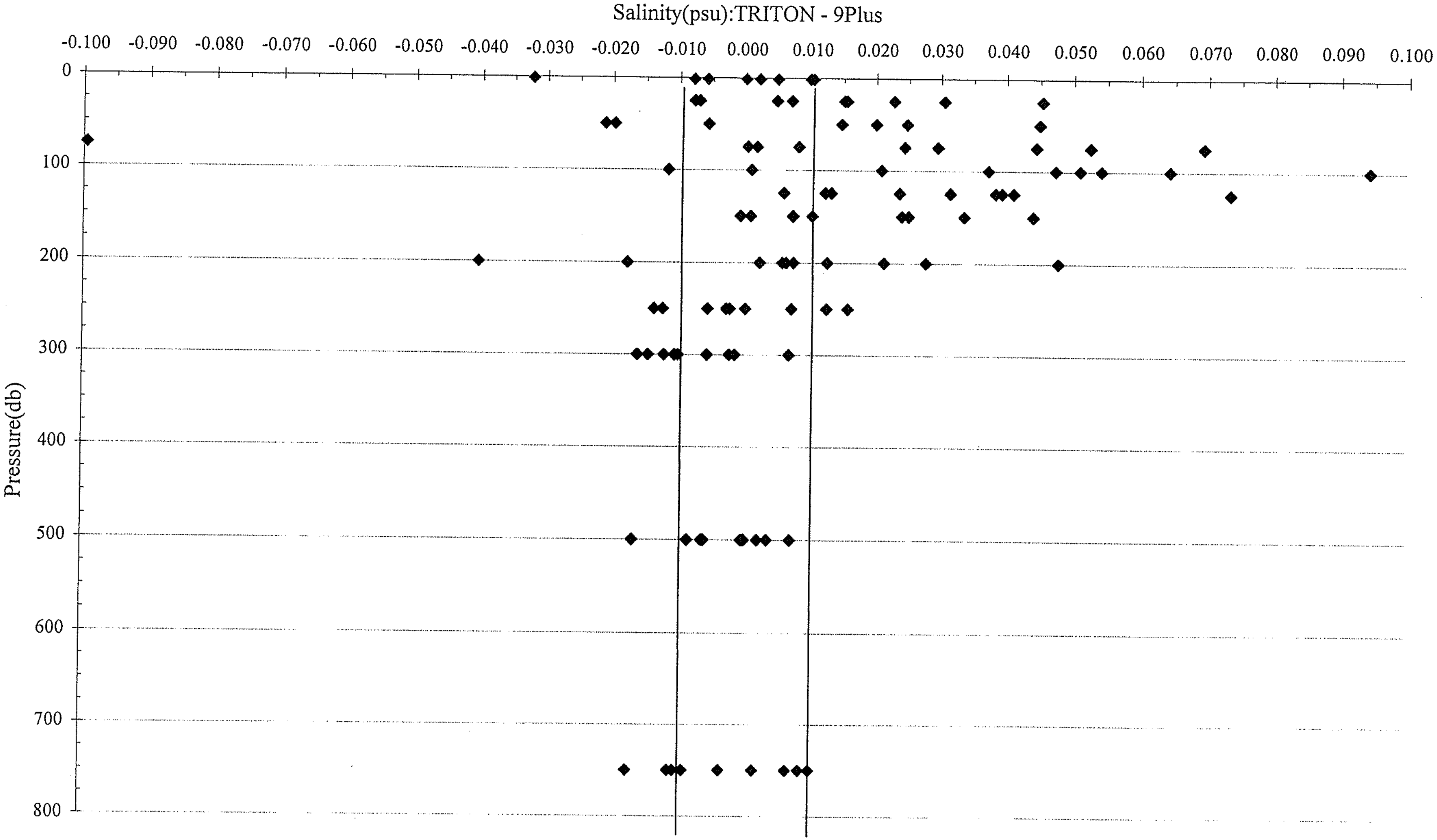


fig.8.2.-2 Salinity differences between TRITON buoys data and ship board CTD(9Plus) data

9. Argo float deployment

(1) Participants

Hideaki Hase	(JAMSTEC) (Leg.1)
Shigeki Hosoda	(JAMSTEC) (Leg.1)
Tomoyuki Takamori	(MWJ): Technical staff (Leg.1)
Sintarou Oku	(MWJ): Technical staff (Leg.1)
Tephei Sagara	(MWJ): Technical staff (Leg.1)

(2) Objective

Argo floats deployment is the scheme of the plan of the Argo project. The purpose of this work is to clarify real-time upper ocean structures up to 2000db using the profiling floats with conductivity, temperature and pressure sensors. Observed data are sent from the floats via ARGOS satellites every 10 days and are opened to the public immediately. In a few years, about 3000 floats will be deployed in the world ocean to be able to observe in each 3 degrees spatial grid. In this cruise, three models of the profiling floats were deployed, called PROVOR (METOCEAN Data System Limited), APEX (Webb Research Corporation) and NINJA (Tsurumi-Seiki Co.Ltd).

(3) Method

Seven APEX, three PROVOR and four NINJA floats were launched at 5-29N, 148-156E in Leg.1, the floats specifications are listed in Table 9-1. To deploy floats, two methods of launching were adopted in this cruise. The APEX floats were hung down by a crane with a thin wire and then launched by releasing a snap ring. The PROVOR and the NINJA floats were put into wooden box, hung down by a crane and then launched. Information of S/N, ARGOS ID, sensors, power on and launch time and exact launch location of each floats is shown in Table 9-2.

Table.9-1 The specifications of the deployed floats

Appellation	APEX	PROVOR	NINJA
Manufacturing corporations	Webb Research Corporation	METOCEAN Data Systems Limited	Tsurumi-Seiki Co.Ltd
Length : with antenna : without antenna	200.0 cm 130.0 cm	240.0 cm 190.0 cm	233.0 cm 163.0 cm
Diameter : casing : damping disk	16.5 cm 20.0 cm	17.0 cm 35.0 cm	16.5 cm 37.0 cm
Weight	26.0 kg	36.0 kg	30.0 kg
Firmware version	07 26 02	1.3.3	1.1.2
Buoyancy control	self-ballasted active control using with hydraulic pump	self-ballasted active control using with hydraulic pump	self ballasted active control using with plunger
Depth maintenance accuracy	±10 dbar at parking depth	±3 dbar at parking depth	±0.1 dbar at parking depth
Volume of the buoyancy control	260 cc	2300 cc	285 cc
Maximum profiling depth	2000 dbar	2000 dbar	2000 dbar
Expected life	approximately 150 cycles	approximately 150 cycles	approximately 150 cycles
CTP sensor	SBE-41(Sea-Bird Electronics Inc)	SBE-41(Sea-Bird Electronics Inc)	SBE-41(Sea-Bird Electronics Inc) TSK(Tsurumi-Seiki Co.Ltd)
Resolution of the data in ARGOS message	Pressure: 0.1dbar Temperature: 0.001 degC Salinity: 0.001 in PSS-78	Pressure: 0.1dbar Temperature: 0.001 degC Salinity: 0.002 in PSS-78	Pressure: 0.1dbar Temperature: 0.001 degC Salinity: 0.001 in PSS-78

Table.9-2 Deployment Information

Type	Serial	ARGOS ID	CTD senser	Maximum profiling depth	Power on Date and Time(UTC)	Launch Date and Time (UTC)	Launch Position
APEX	666	11479	SBE-41	2000 dbar	October 04, 2002 07:55	October 04, 2002 08:27	28-58.9642N, 148-01.4026E
APEX	685	11709	SBE-41	2000 dbar	October 04, 2002 20:25	October 04, 2002 21:28	26-46.1161N, 148-55.1902E
APEX	686	11735	SBE-41	2000 dbar	October 05, 2002 06:30	October 05, 2002 07:01	25-00.0666N, 149-36.9374E
APEX	687	12065	SBE-41	2000 dbar	October 05, 2002 22:38	October 05, 2002 23:14	22-00.2089N, 150-46.9464E
APEX	688	12269	SBE-41	2000 dbar	October 06, 2002 13:30	October 06, 2002 13:56	19-20.0666N, 151-48.1166E
APEX	690	12647	SBE-41	1500 dbar	October 07, 2002 02:32	October 07, 2002 02:53	17-00.0761N, 152-41.9684E
APEX	691	12733	SBE-41	1500 dbar	October 08, 2002 00:47	October 08, 2002 01:23	12-59.9114N, 154-11.8707E
PROVOR	MT064	19386	SBE-41CP	2000 dbar	October 09, 2002 22:52	October 09, 2002 23:17	08-00.0641N, 155-57.5940E
PROVOR	MT046	17486	SBE-41CP	2000 dbar	October 10, 2002 23:56	October 11, 2002 00:10	04-57.4370N, 156-05.2483E
NINJA	-	20480	SBE-41	2000 dbar	October 04, 2002 07:45	October 04, 2002 08:01	28-59.2254N, 148-00.9298E
NINJA	-	10864	TSK	2000 dbar	October 04, 2002 07:55	October 04, 2002 08:09	28-59.1371N, 148-01.0730E
NINJA	-	11087	TSK	2000 dbar	October 04, 2002 07:55	October 04, 2002 08:19	28-59.0617N, 148-01.2255E
NINJA	-	20486	SBE-41	2000 dbar	October 04, 2002 21:01	October 04, 2002 21:13	26-46.0836N, 148-55.0604E
NINJA	-	10867	TSK	2000 dbar	October 04, 2002 21:07	October 04, 2002 21:23	26-46.1027N, 148-55.1460E

Summary Report: KY0210 (Leg-2)

By: Andri Purwandani (1) and Dadan Gunawan (1)

1). Badan Pengkajian dan Penerapan Teknologi (BPPT).
The Assessment and Application of Technology Agency.

1 Introduction

A global phenomenon, the El Nino Southern Oscillation or commonly known as ENSO has become and may be the world's center of attention in the 21st century and for the rest of this millennium. The occurrences of this natural phenomenon was noticed to strike the west coast of South American Continent with a wide impact on marine life, economy, ecology and social life in general all over the Ecuador, Peru and Chile. Local Fishermen in Peru knew about the phenomenon and called it *Corriente del Nino* which means 'The Boy's Current'. The phenomenon was termed "El Nino" when it was first discovered in 1795 based on the report of Captain Colnet. In 1891, Dr. Luis Carranza, leader of the Lima Geographical Society wrote a small article in a public magazine bulletin also revealing the emergence of counter current moving from north to south along the Paita harbor to the Pacasmayo. The counter current, was discovered to bring warm water mass towards the south eventually raising the temperature of the waters along the coast of Peruvian.

The El Nino phenomenon turns out to be not as simple as it was predicted to be a mere local occurrence along the west coast of the South American Continent. According to a research outcome of the El Nino Programme Group established by the Intergovernmental Oceanographic Commission (IOC) of UNESCO in early 1970, after collecting and analyzing all data, it appeared that the key to El Nino natural phenomenon process lies around the Southeast Asian waters, especially in Indonesian waters. Since then, vast research on El Nino occurrence has being been focused in the equatorial part of the Western Pacific Ocean in Indonesian waters.

There is still one part of El Nino occurrence process which remains a mystery and yet uncovered up till now, the Southeast and Northeast Trade winds that are supposed to blow the whole year over the equatorial Pacific Ocean. These Trade winds are responsible in steering the surface water mass from the east to the west in form of Pacific Equatorial current. The key to solving the mystery of the weakening Southeast and Northeast Trade winds was predicted to be located in Indonesian waters, because during normal condition the Indonesian waters have become the meeting point of the two atmospheric circulations, the Walker and Hadley circulations. The Walker circulation, a large scale zonal circulation operates (E - W) over the equatorial Pacific and the Hadley circulation, a thermally-driven mean meridional circulation operates (N - S) over the equator and mid-latitude region. These two circulations regulate one part of global climate system on earth. During the El Nino, the meeting point moves towards the Central and or Eastern Pacific, along the equatorial Pacific Ocean in accordance with the weakening of Southeast and Northeast Trade winds thus influencing the global climate change.

Past researches, studies, hypotheses and the negative impacts of El Nino all indicate its significance and it is important that much emphasis be put into El Nino Research. The primary research focus location of El Nino occurrence process is in the Southeast Asia waters and its surroundings especially the Indonesia waters, since it holds the key to uncovering the mystery of El Nino occurrence.

When conducting El Nino research in Southeast Asian waters and its surroundings, especially in Indonesian waters, some consideration must be made as complex water mass circulation system that operates in its waters. There exists an Arus Lintas Indonesia (Arlindo), an Indonesian waters horizontal current which is controlled by a pressure gradient between the Pacific and Indian Oceans. The conveyor belt terms stated by oceanography experts, meaning that Indonesian waters is the connection point of the world's water mass circulation and Indonesian formation with its big and small islands and also its various under sea topography, is the cause of Indonesian waters surface current to become complex. The climate and season change factors in Indonesian waters also need to be considered in conducting an El Nino research in Indonesian waters. The correlation with Southern Oscillation phenomenon regulating the air pressure fluctuation over the Pacific and Indian Oceans should not be ruled out either.

El Nino is one of the phases of Southern Oscillation in which the Southeast and Northeast Trade winds weaken as the high-pressure settles over the Western Pacific Ocean and the low-pressure over the Eastern Pacific Ocean. The opposite of El Nino is a La Nina phase. La Nina is a phase of Southern Oscillation in which the sea surface temperature in the Central Pacific and Eastern Pacific Ocean shows a minimum value and there is an increase in the intensity Trade winds along the Equatorial Pacific Ocean. Therefore, one indicator of El Nino or La Nina phase is the Southern Oscillation Index (SOI). SOI is calculated from a pressure difference over Tahiti and that over Darwin. When SOI shows the lowest negative value, then Southern Oscillation is in El Nino phase and if SOI value shows the highest positive value, then Southern Oscillation is in La Nina phase.

2 Purpose

The purpose of this cruise was to observe the physical oceanographic and atmospheric conditions in and over the Tropical Western Pacific for better understanding of their interaction and its relation to the ENSO (EI Nino/ Southern Oscillation) and global climate change.

3 Observation Summary

The TOCS (Tropical Ocean Climate Study) group in Ocean Research Department of Japan Marine Science and Technology Center (JAMSTEC), Badan Pengkajian dan Penerapan Teknologi (BPPT) of Indonesia, and the National Weather Service of Papua New Guinea conducted CTD casts, XCTD measurement, current measurement by shipboard ADCP and Recovering and Deploying ADCP Moorings. Three subsurface ADCP moorings at 0N147E, 2.5S142E and 0N138E were recovered and re-deployed during this cruise and one subsurface mooring was recovered only at 2.5N138E. The 3 ADCPs are now being moored in the surveyed area (0N147E, 2.5S142E, and 0N138E). Seven Triton Buoys were checked at 5N147E, 2N147E, 0N147E, 0N138E, 2N138E, 5N138E and 7N138E. One at 2N147E has broken anemometer and transmission problem. CTD and XCTD were launched to measure Conductivity, Temperature and Depth profiling, T-S diagram to identified water mass. List of CTD and XCTD measurement can be look at Table 1.

Table 1. CTD and XCTD Observation.

No.	Type	Position	Date	Hour	Remark
1.	CTD (1000)	5N147E	Oct 19, 2002	08:30	1000 dB x 2
2.	XCTD	4.5N147E	Oct 19, 2002	13:00	1000 dB
3.	XCTD	4N147E	Oct 19, 2002	15:30	1000 dB
4.	XCTD	3.5N147E	Oct 19, 2002	18:00	1000 dB
5.	XCTD	3N147E	Oct 19, 2002	20:00	1000 dB

No.	Type	Position	Date	Hour	Remark
6.	XCTD	2.5N147E	Oct 19, 2002	22:30	1000 dB
7.	CTD (1000)	2N147E	Oct 20, 2002	08:30	1000 dB x2
8.	XCTD	1.5N147E	Oct 20, 2002	12:30	1000 dB
9.	XCTD	1N147E	Oct 20, 2002	15:00	1000 dB
10.	XCTD	0.5N147E	Oct 20, 2002	17:30	1000 dB
11.	CTD (1000)	0N147E	Oct 21, 2002	16:00	1000 dB x 2
12.	CTD (1000)	2.5S142E	Oct 23, 2002	15:30	1000 dB x 2
13.	XCTD	2.7S142E	Oct 23, 2002	18:00	1000 dB
14.	XCTD	2S142E	Oct 23, 2002	21:15	1000 dB
15.	XCTD	1.5S142E	Oct 23, 2002	23:05	1000 dB
16.	XCTD	1S142E	Oct 24, 2002	01:30	1000 dB
17.	XCTD	0.5S142E	Oct 24, 2002	04:00	1000 dB
18.	CTD (1000)	0 , 142E	Oct 24, 2002	07:00	1000 dB x 2
19.	CTD (1000)	1.25S138E	Oct 25, 2002	07:00	1000 dB
20.	CTD (1000)	1S138E	Oct 25, 2002	09:30	1000 dB
21.	CTD (1000)	0.5S138E	Oct 25, 2002	07:00	1000 dB
22.	CTD (1000)	0 , 138E	Oct 25, 2002	16:30	1000 dB x 2
23.	XCTD	0.5N138E	Oct 25, 2002	20:30	1000 dB
24.	CTD (1000)	1N138E	Oct 26, 2002	20:30	1000 dB x 2
25.	XCTD	1.5N138E	Oct 26, 2002	00:00	1000 dB
26.	CTD (1000)	2N138E	Oct 27, 2002	13:00	1000 dB x 2
27.	XTCD	2.5N138E	Oct 27, 2002	17:00	1000 dB
28.	CTD (1000)	3N138E	Oct 27, 2002	18:20	1000 dB x 2
29.	XCTD	3.5N138E	Oct 27, 2002	21:45	1000 dB
30.	CTD (1000)	4N,138E	Oct 28, 2002	00:30	1000 dB x 2
31.	XCTD	4.5N138E	Oct 28, 2002	04:30	1000 dB
32.	CTD (1000)	4.5N137E	Oct 28, 2002	08:30	1000 dB x 2
33.	XCTD	5.5N137E	Oct 28, 2002	12:30	1000 dB
34.	CTD (1000)	6N137E	Oct 28, 2002	15:00	1000 dB x 2
35.	XCTD	6.5N137E	Oct 28, 2002	18:45	1000 dB
36.	CTD (1000)	7N137E	Oct 28, 2002	21:00	1000 dB x 2
37.	XCTD	7.5N137E	Oct 29, 2002	00:30	1000 db
38.	CTD (1000)	7.66N136.69E	Oct 29, 2002	08:30	1000 dB x 2

4 Data Analysis

4.1 Temperature, Salinity and Sigma-theta at 147E Section using CTD and XCTD Data

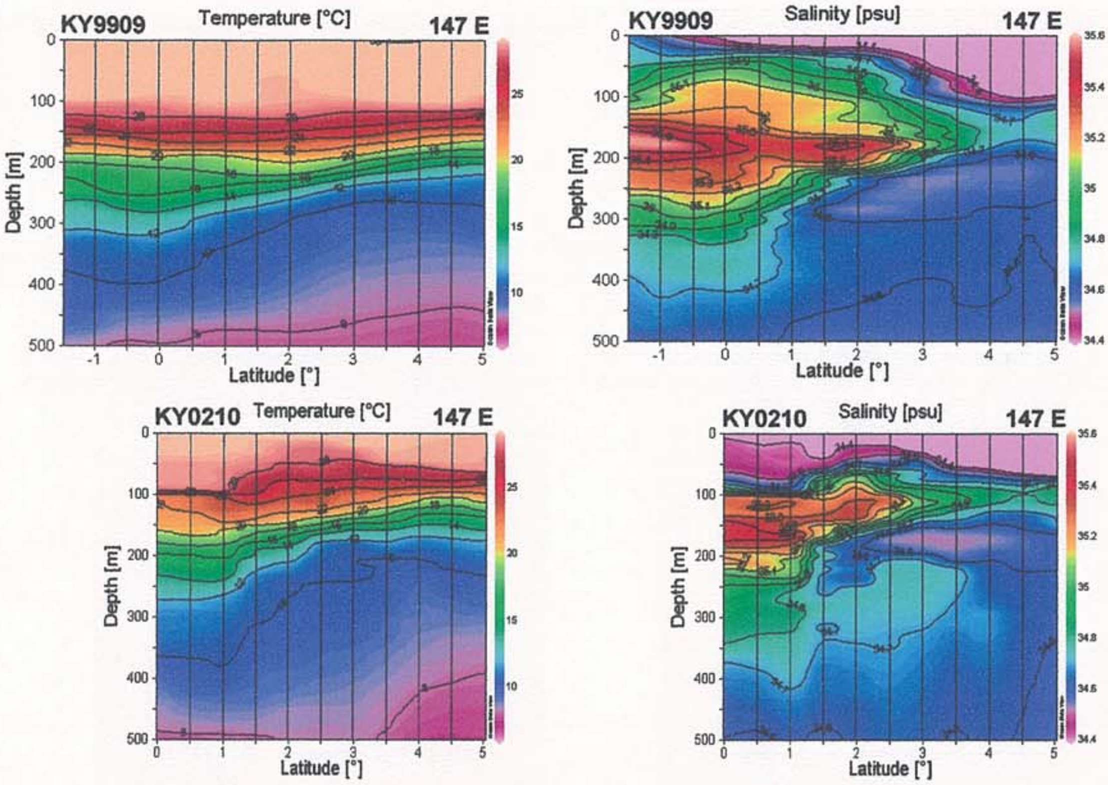


Figure 1. Temperature (left side) and Salinity (right side) cross section along 147E from TOCS in September1999 (top side) and TOCS in October 2002 (bottom side).

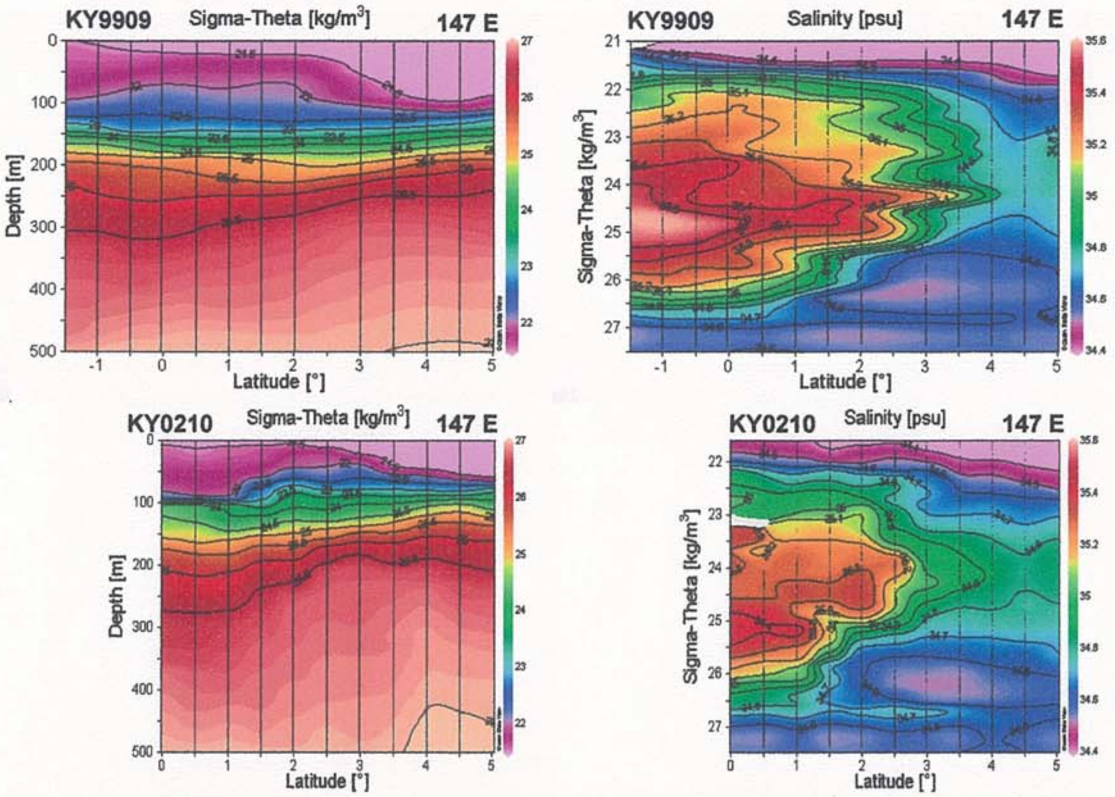


Figure 2. *Sigma-theta (left side) and Sigma-theta versus Salinity (right side) cross section along 147E from TOCS in September1999 (top side) and TOCS in October 2002 (bottom side).*

4.2 Water Mass at 147E Section using CTD and XCTD Data

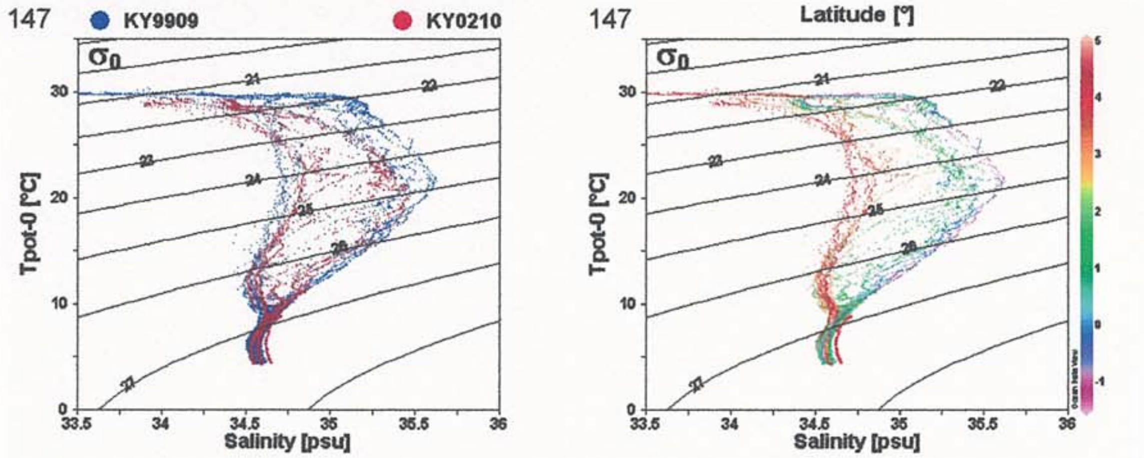


Figure 3. *Left side : TS Diagram along 147E from TOCS in September1999 (blue dot) and TOCS in October 2002 (red dot). Right side : z-axis as Latitude*

4.3 Temperature, Salinity and Sigma-theta at 142E Section using CTD and XCTD Data

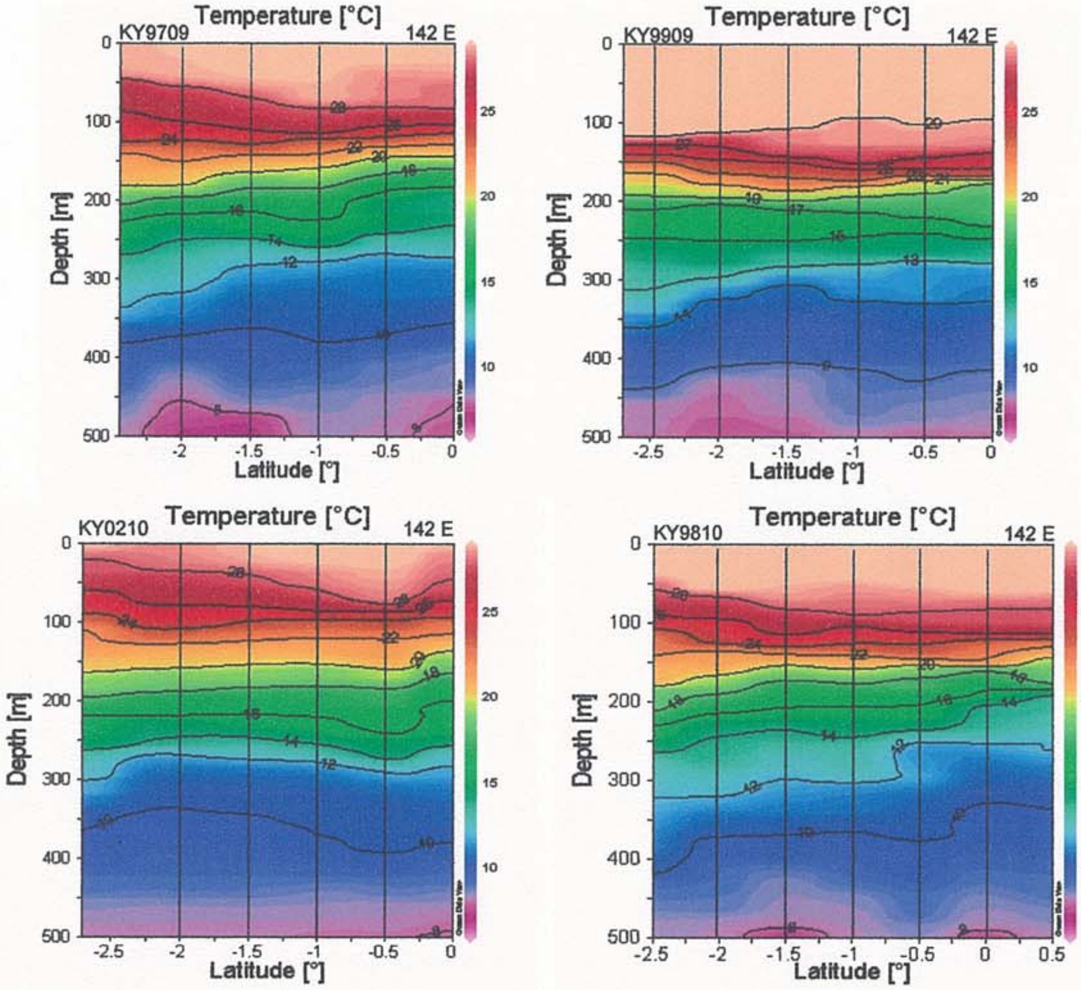


Figure 4. Temperature cross section along 142E from TOCS in September1997 (top-left/El Nino Phase) TOCS in September 1999 (top-right/La Nina Phase), TOCS in September 2002 (bottom-left) and TOCS in October 1998 (bottom-right/Normal).

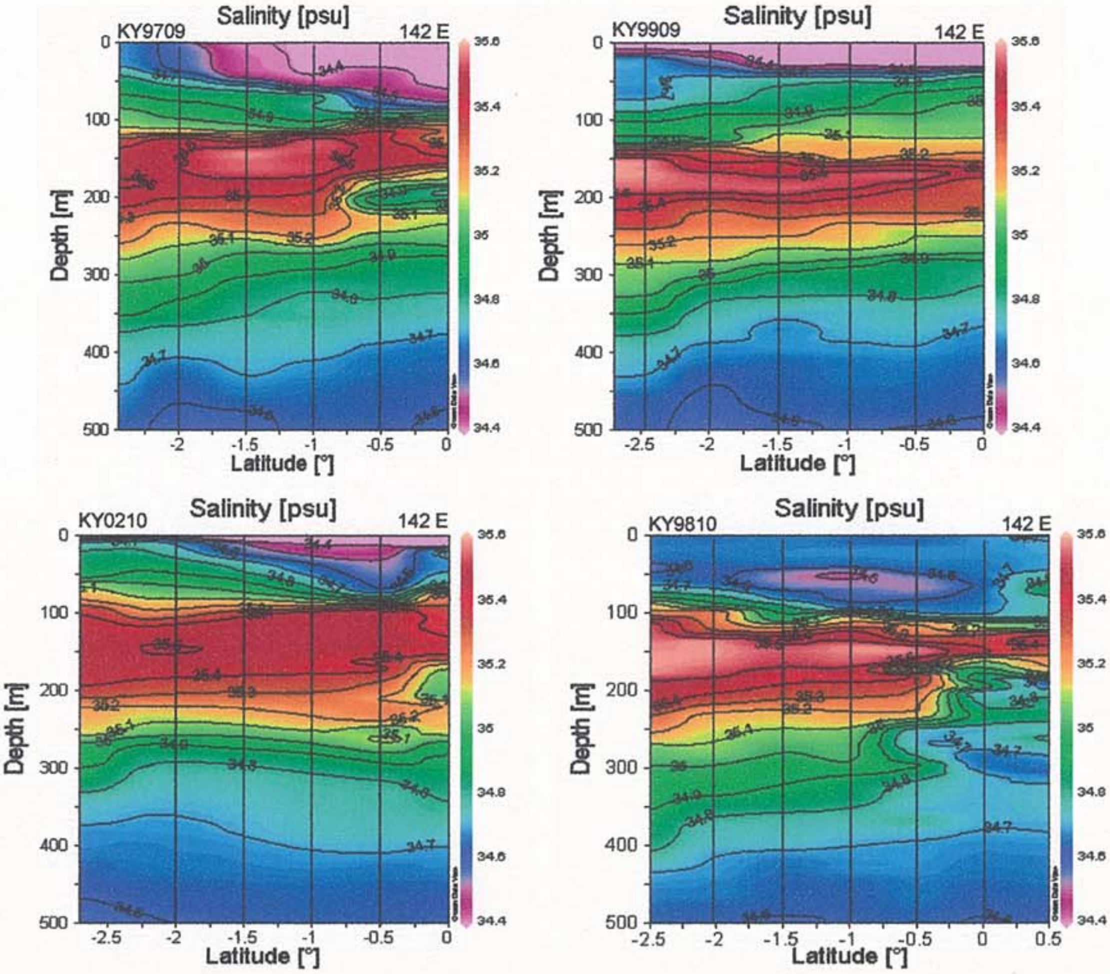


Figure 5. Salinity cross section along 142E from TOCS in September1997 (top-left/El Nino Phase) TOCS in September 1999 (top-right/La Nina Phase), TOCS in September 2002 (bottom-left) and TOCS in October 1998 (bottom-right/Normal).

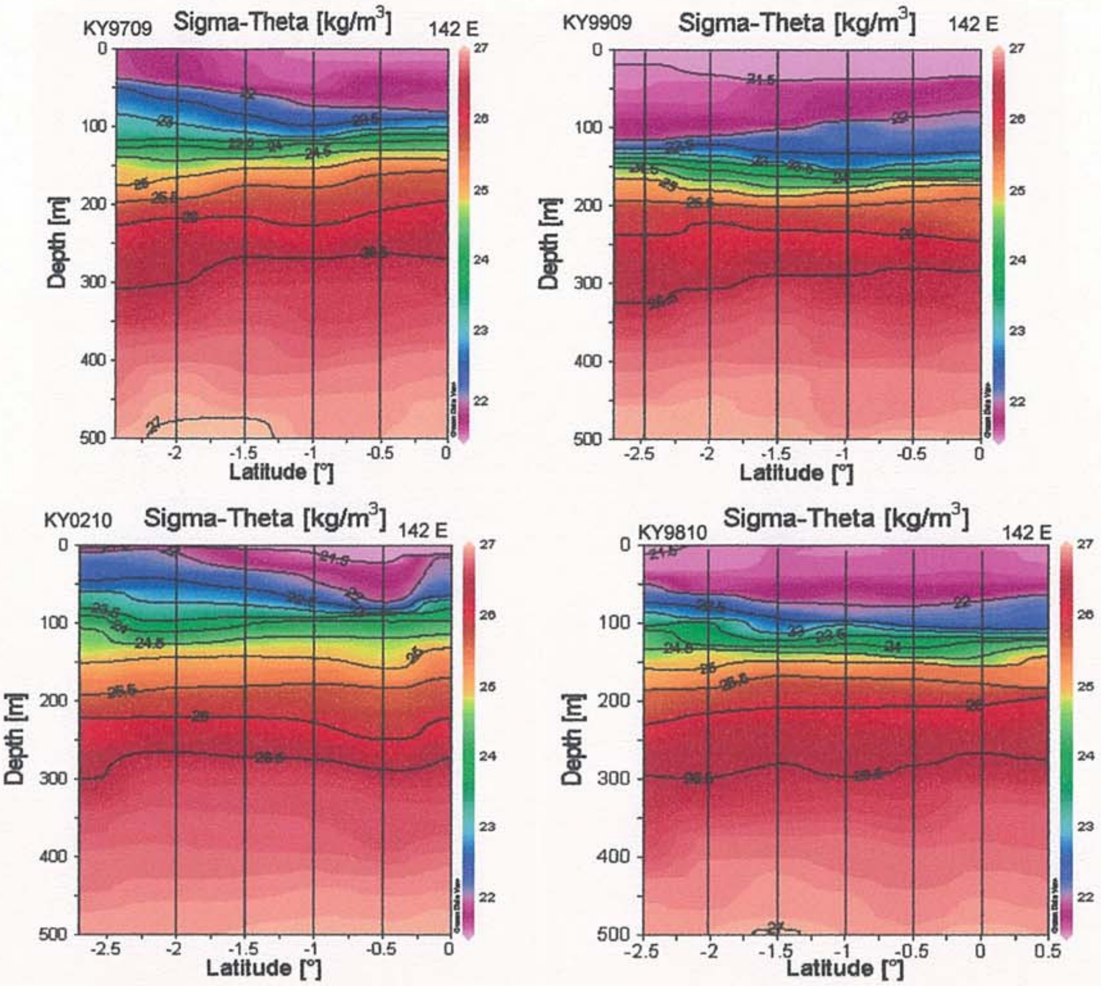


Figure 6. Sigma-theta cross section along 142E from TOCS in September1997 (top-left/El Nino Phase) TOCS in September 1999 (top-right/La Nina Phase), TOCS in September 2002 (bottom-left) and TOCS in October 1998 (bottom-right/Normal).

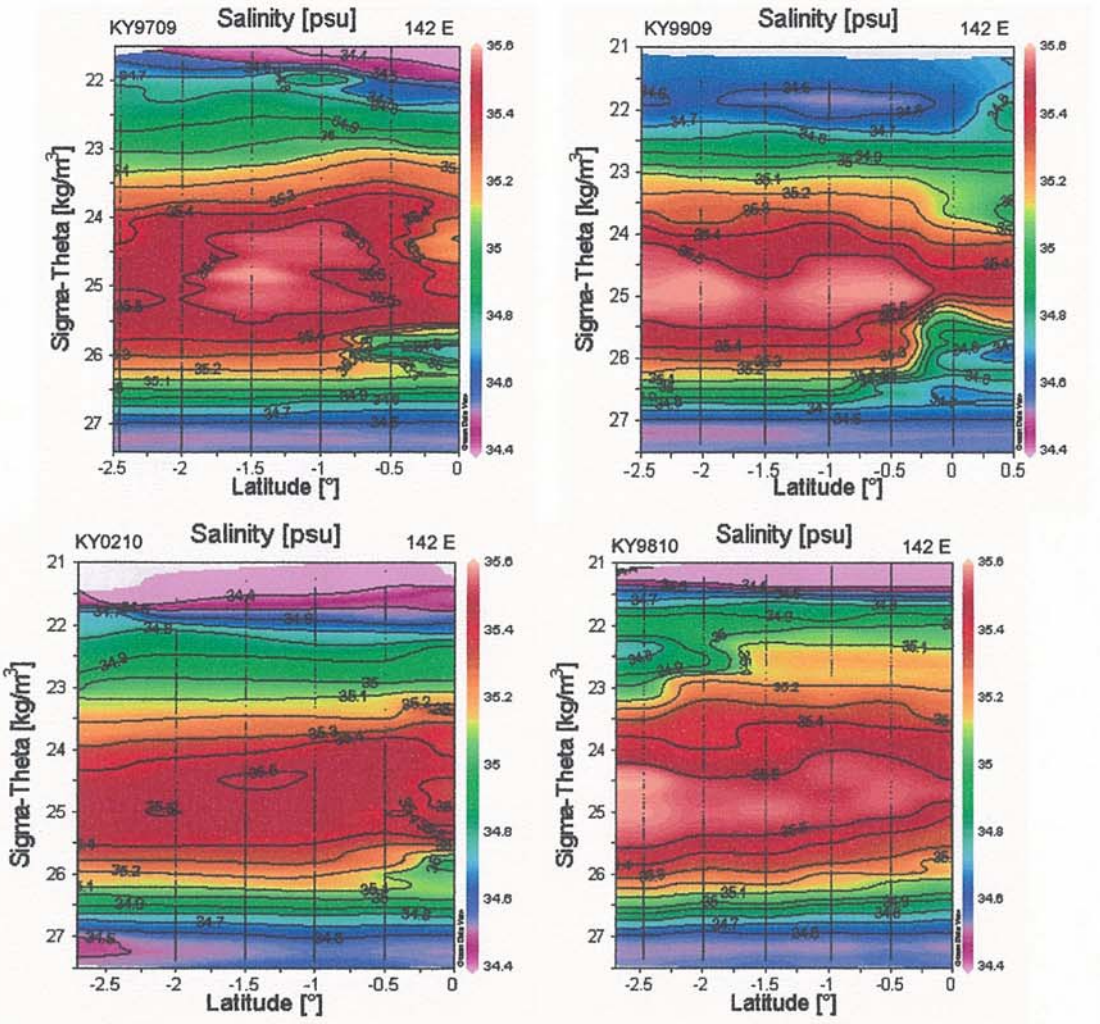


Figure 7. *Sigma-theta versus Salinity cross section along 142E from TOCS in September1997 (top-left/El Nino Phase) TOCS in September 1999 (top-right/La Nina Phase), TOCS in September 2002 (bottom-left) and TOCS in October 1998 (bottom-right/Normal).*

4.4 Water Mass at 142E Section using CTD and XCTD Data

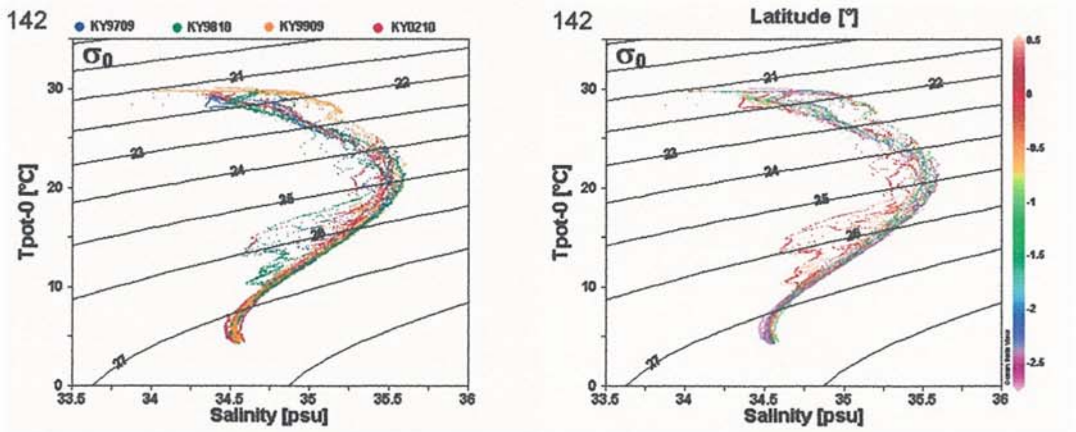


Figure 8. *Left side : TS Diagram along 142E from TOCS in September1997 (blue dot), TOCS in October 1998 (green dot), TOCS in September 1999 (yellow dot) and TOCS in October 2002 (red dot). Right side : z-axis as Latitude*

4.5 Temperature, Salinity and Sigma-theta at 138E Section using CTD and XCTD Data

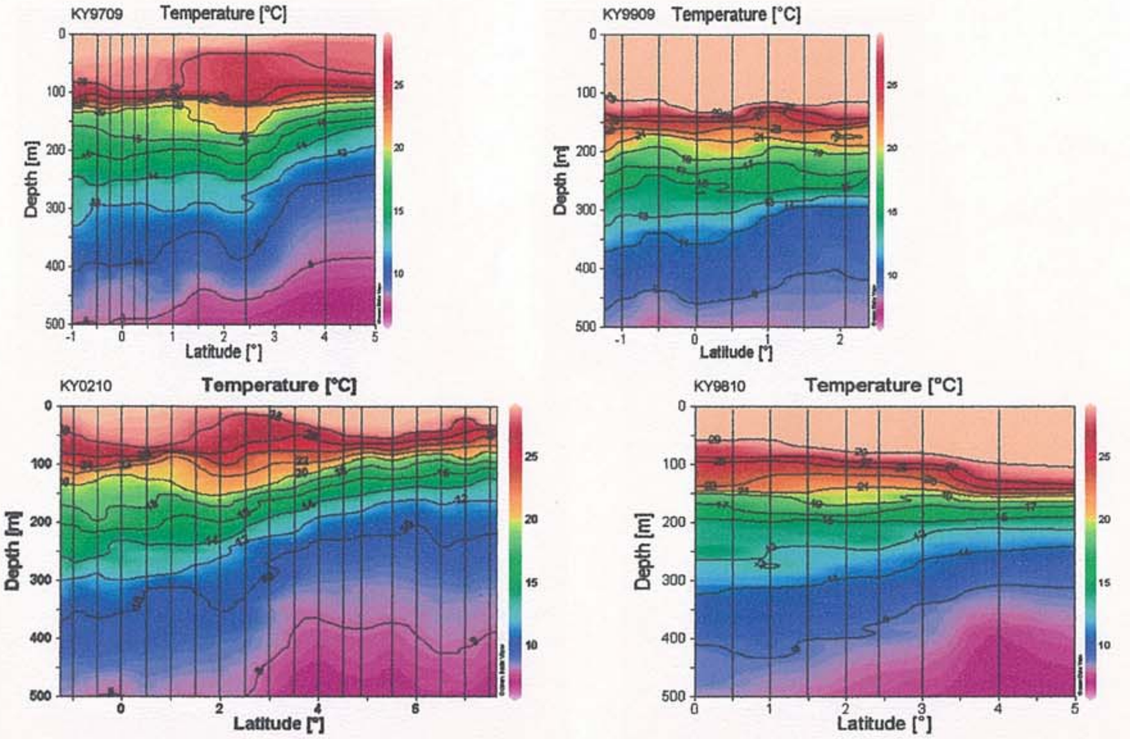


Figure 9. Temperature cross section along 138E from TOCS in September1997 (top-left/El Nino Phase) TOCS in September 1999 (top-right/La Nina Phase), TOCS in September 2002 (bottom-left) and TOCS in October 1998 (bottom-right/Normal).

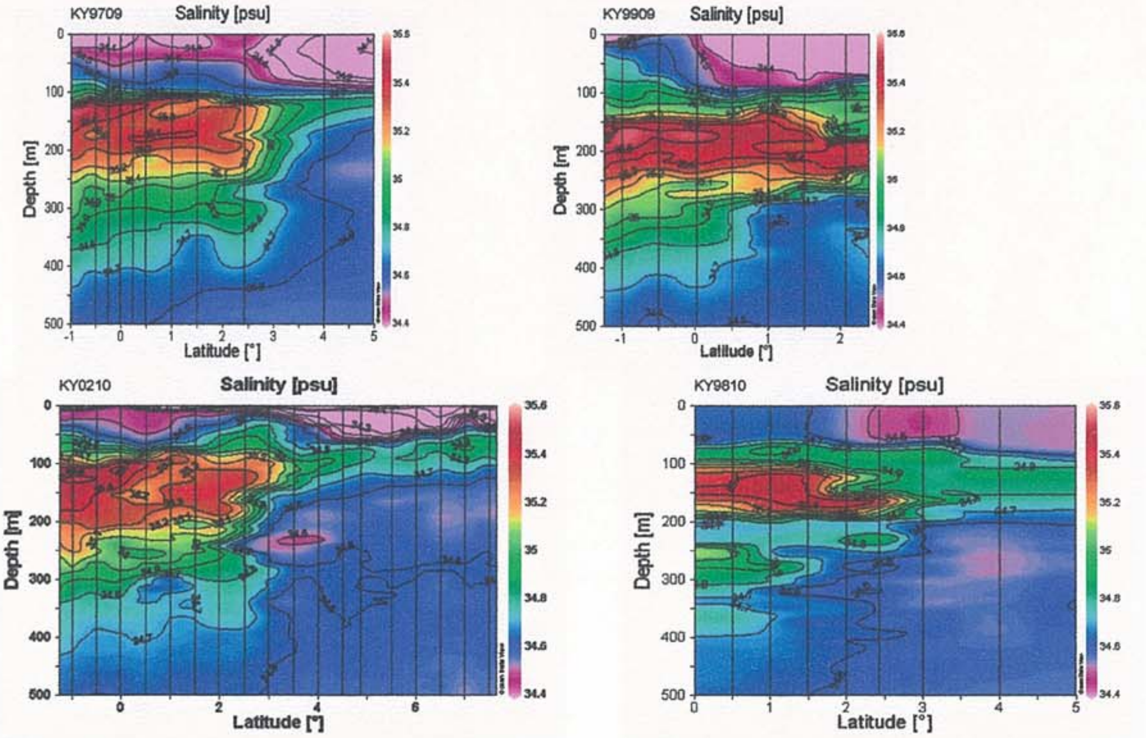


Figure 10. Salinity cross section along 138E from TOCS in September1997 (top-left/El Nino Phase) TOCS in September 1999 (top-right/La Nina Phase), TOCS in September 2002 (bottom-left) and TOCS in October 1998 (bottom-right/Normal).

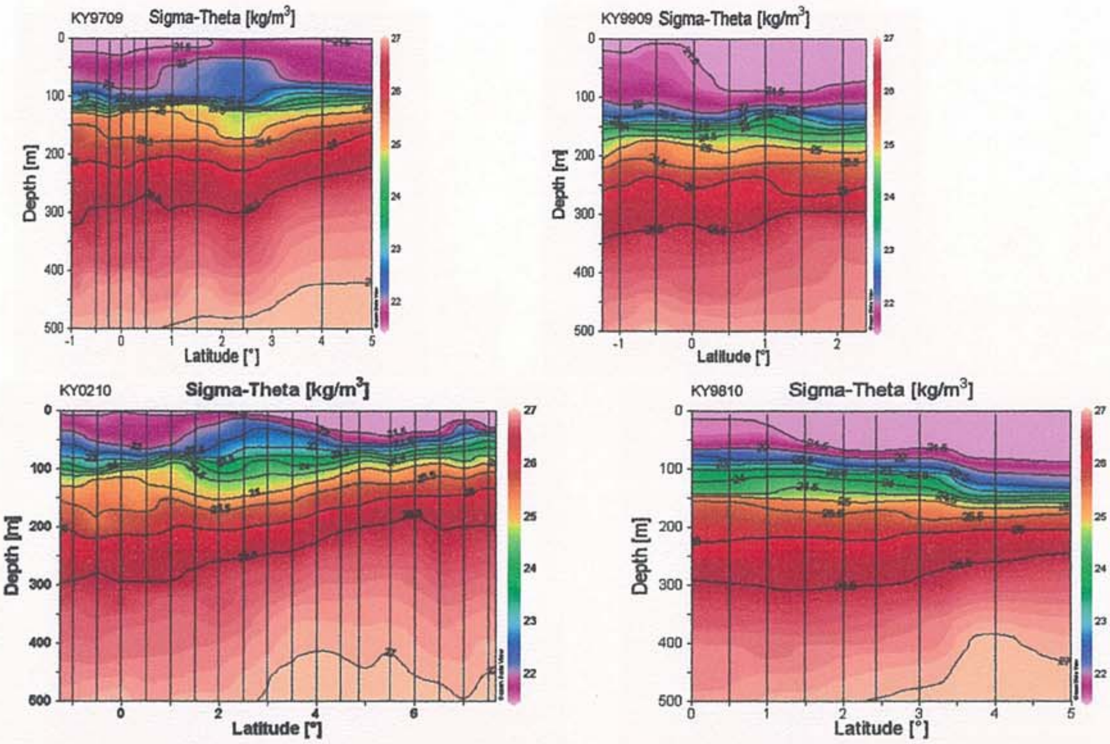


Figure 11. Sigma-theta cross section along 138E from TOCS in September1997 (top-left/El Nino Phase) TOCS in September 1999 (top-right/La Nina Phase), TOCS in September 2002 (bottom-left) and TOCS in October 1998 (bottom-right/Normal).

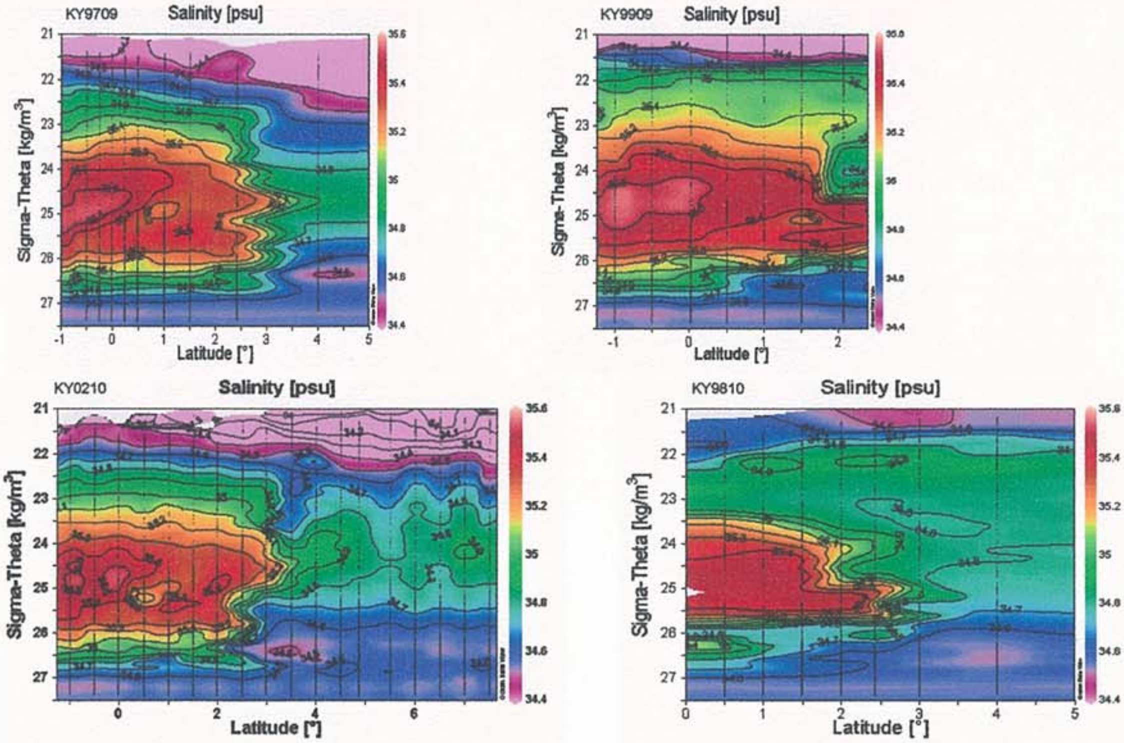


Figure 12. Sigma-theta versus Salinity cross section along 138E from TOCS in September1997 (top-left/El Nino Phase) TOCS in September 1999 (top-right/La Nina Phase), TOCS in September 2002 (bottom-left) and TOCS in October 1998 (bottom-right/Normal).

4.6 Water Mass at 138E Section using CTD and XCTD Data

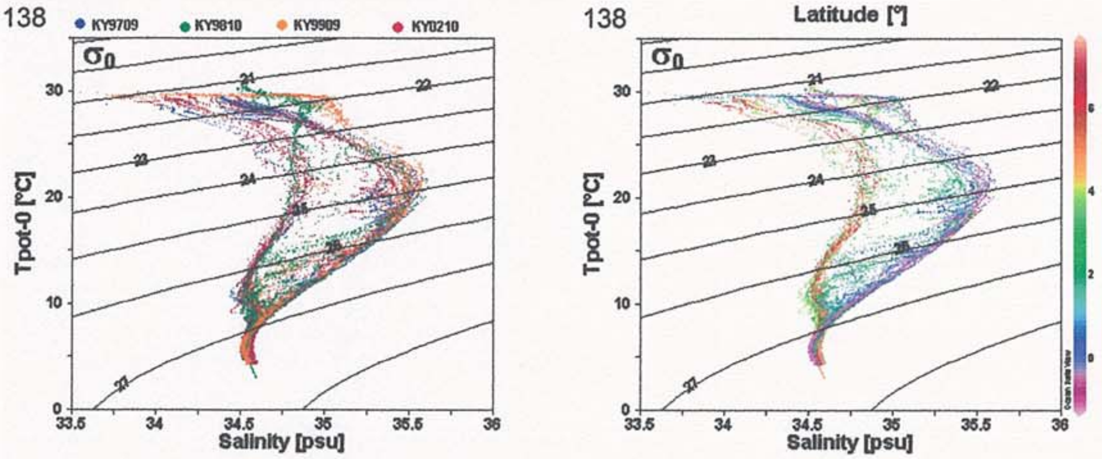


Figure 13. Left side : TS Diagram along 142E from TOCS in September1997 (blue dot), TOCS in October 1998 (green dot), TOCS in September 1999 (yellow dot) and TOCS in October 2002 (red dot). Right side : z-axis as Latitude

4.7 Ocean Current from Shipboard ADCP

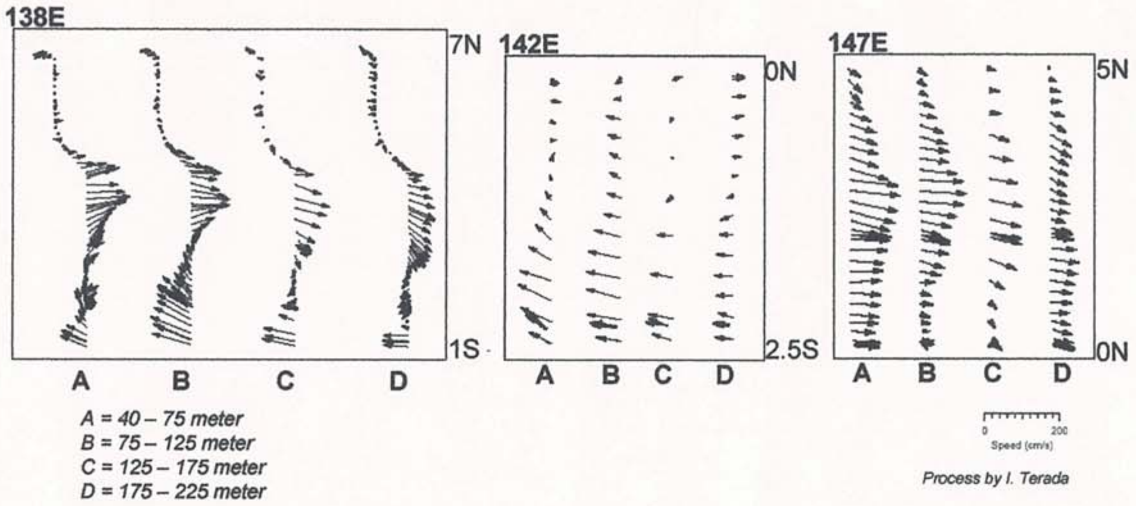


Figure 14. Comparison of Shipboard ADCP at Section 147E, 142E and 138E from TOCS in October 2002 (KY0210)

5 Discussion

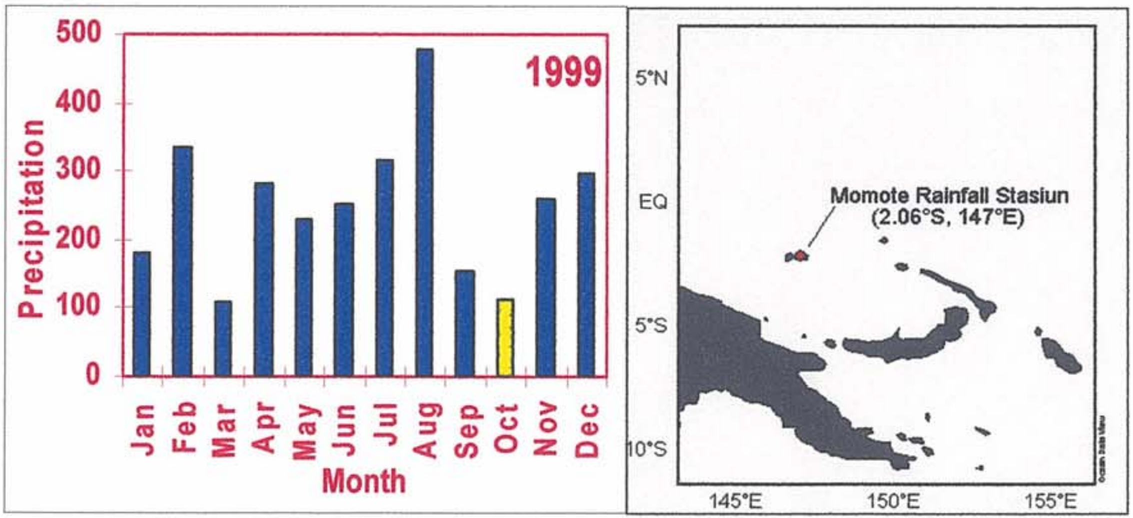
Section 147E

In this section we only used Kaiyo September 1999 data (KY9909) for comparison and study with the current cruise data (KY0210). Note, also that 1999 was at La Nina Phase. Sea surface temperature (SST) along 147E section from Kaiyo Cruise on September, 1999 was around 29.76 – 30.26°C more higher than Kaiyo Cruise on October 2002 which we observed to be around 28.82 – 29.68°C. This condition may have been caused by short wave radiation at the sea surface when La Nina occurred and during the strong Southeast and Northeast Trade winds. Water masses are pushed westward bring warm water to Eastern Indonesian waters to create warm water poll more deeper. Furthermore, a drop in the intensity of westerly wind burst which is now evident may also be responsible for the above process. Therefore from this KY0210 at 147E section, we believe that the warm water has been moving towards east and bring the warm water body and convection zone eventually into the Central Pacific. Walker Circulation also moved eastward transporting heat energy to the surface of the atmosphere in the Central Pacific Ocean.

Comparing the mix depth layer (MDL) between KY9909 and KY0210 along 147E show quiet different structures. On KY9909 from the northern part (5°N) until southern part (1.5°S) at 147E section, the MDL is homogeneous to 125 meter depth with temperature around 28°C. Temperature profile from KY0210 differ greatly from that of KY9909. The homogeneous layer tends to break and slop upward and MDL is much lower around 80 meter depth, especially on the northern part.

Termocline structure at this section from KY9909 clearly appears with 90 meter thickness and center of termocline body on 160 meter depth. On this cruise, we found unstable water mass at the termocline layer from the northern part to southern part. This seems to indicate some eastward migration in the warm water pool.

The Sea Surface Salinity (SSS) on this KY0210 cruise shows 32.08 – 34.47 psu, rather higher, fairly distributed with depth and closer to the surface than the past KY9909 cruise which has 33.07 – 34.41 psu, less distribution with depth and found deeper. The increase in salinity may be caused by decrease in rainfall, increased evaporation into the atmosphere and westward migration with the strong Trade winds and surface currents. The halocline layer show mostly similar structure in both cruises, however, we found at northern part at 147E section a little different. The depth of halocline from KY9909 cruise is 110 meters, which is deeper than this KY0210 cruise of 75 meters.



Data from : PNG National Weather Service

Figure 15: Rainfall data at Momote Station on 1999.

Section 142E

Along this section a comparison is made using KY9709, KY9810 and KY9909 which also are in El Nino, Normal and La Nina phases respectively. Along 142E section from KY9709, it shows the value of SST to be between 28.9 – 29.31°C when El Nino occurred and for KY9909, the SST is around 29.67 – 29.91°C which was the La Nina phase and from KY9810 during the Normal phase, the SST was around 29.71 – 29.98°C. In this KY0210 cruise we find the SST to be around 28.38 – 29.57°C. We could not decide from SST data to compare El Nino, normal, and La Nina condition, but from the data and the scenarios along this section (142°E) and 147°E, emerging El Nino condition can not be ruled out. We can say that because the average SST from this cruise at 142E section are more lower than the SST from the three other cruises.

We can only be sure from the analysis of MLD and comparisons are made with each other. We found that MDL on this cruise same with KY9709 around 70 meter depth at 27°C, actually from KY0210 more lower than KY9709 around 50 meter depth. From KY9909 when La Nina phase occurred, MDL at this section more deeper around 125 meter depth at 27°C and from KY9810 at normal condition we show the MDL around 100 meter depth. Therefore, we believe that we are in the early stages of the El Nino and the warm water pool is eventually migrating to the east.

The Shipboard ADCP at 147E show North Equatorial Counter Current (NECC) stronger and effectively until 175 meter depth. The North Equatorial Current (NEC) has diminished altogether which is very disturbing. At 142E section the shipboard ADCP shows New Guinea Coastal Current (NGCC) and New Guinea Coastal Under Current (NGCUC) to be more slower than usual at 2.5N – 1.5S.

The Sea Surface Salinity from KY9709 along 142E section shows 34.367 psu and increasing southward reaching the peak of 34.688 psu during the El Nino phase. Meanwhile during La Nina condition from KY9909, the SSS falls between 33.932 – 34.361 psu. From KY9810 during Normal phase, the SSS was between 34.637 – 34.672 psu. From this cruise KY0210 at 142E, we find SSS to be around 34.006 – 34.745 psu. Furthermore, from KY9810 along this section, we found the minimum range of SSS which may have been caused by high precipitation during the La Nina phase. We could not make any further comparison between El Nino from KY9709 and this cruise because we only used SSS. The strong different, we found from this cruise was in vertical profile at this section which we thought unusual was along 0.5N to the equator at 50 meter depth and also we found high salinity of 34.7 psu at 30 meter depth.

Section 138E

Along 138E section a comparison is made using KY9709, KY9810 and KY9909 which also are in El Nino, Normal and La Nina phases respectively. Kaiyo Cruise on October 30, 2002, was have longer section from south to north than other cruise above. We have more chance analyze the data to northward (1.25S to 7.64N), but we have some problem to compare this section because sampling point (CTD and XCTD cast) and the distance of each section were different. We find SST to be around 28.53 – 29.66°C which have unstructured variation from south to northward. The past of Kaiyo cruise from KY9709 (1S to 5N) during El Nino phase, we found SST to be around 28.77 – 29.56°C, decreasing from south to north. During La Nina phase from KY9909 (1.24S to 2.4N), we found SST around 29.89 – 30.54°C and from KY9810 (0N to 5S) during normal phase, we found SST around 29.45 – 30.40°C. Almost the SST form all cruise reach higher from south and decreasing to northward. We guess the high SST formed at south part could be associated with NGCC and shore along Papua Island as one of Western Boundary Current. The same condition we show when comparing at section 142E.

We analyzed that higher SST range from KY9909 (La Nina event) going to lower from KY9810 (Normal) followed by KY9709 and KY0210. This quit different when El Nino phase which have low SST and La Nina phase which have high SST. At the same case where we analyze along 142E and 147E. We also looked from our comparison study that strong different of SST variation found along 138E in this cruise. Furthermore we have to find how to vertical structure of SST formed in the water body.

We could see the homogenous layer, MDL, termocline depth and the thickness of termocline layer to figure out vertical structured. Comparing the MDL, we found MDL from KY9709 (El Nino) around 80 meter depth followed by slow decreasing of temperature to upward. The temperature of MDL is 28°C. We found the homogenous layer at 1N until 3.75N which has 75 meter thickness. Termocline depth was show at 122 meter depth which has a value of temperature around 24°C. Otherwise, from KY0210 in this cruise, the termocline depth has around 100 meter depth lower than KY9709 and also we found the temperature of termocline is 22°C colder than KY9709. Eventually, we found when we show MDL move to upward than KY9709 around 45 meter depth. We could remark and identifying at 138E section that we concluded end of this year will be El Nino event and more strong than El Nino on 1997. We also could feel the ocean seem calm and the wind was very slow as long as this cruise along 138E section. It means westerly wind burst was occurred.

Vertical cross section of temperature from KY9909 (La Nina phase) and KY9810 (Normal) have quiet different from KY0210 and KY9709 (El Nino phase) along this section. We would not discuss more in detail.

We found SSS along 138E from KY9709 (El Nina phase) around 34.035 – 34.403 psu and comparing to KY0210, we find the SSS was around 32.915 – 34.827 psu. From KY9810 (Normal), we show 34.476 – 34.645 psu and from KY9909 (La Nina), we found the SSS around 33.649 – 34.562 psu. We could find there have two type of halocline structured from KY0210 along 138E section. First, the halocline depth was found at 75 meter depth along 1.5S to 3N and second at 50 meter depth along 5.5N to 7.6N. We could see that the halocline was break at 4N. We guess at 4N could be boundary of different type of water mass.

Shallow Water Salinity (Section 138E)

We almost surprise when we find unusual vertical profile from KY0210 along this section in the shallow water (Figure 16).

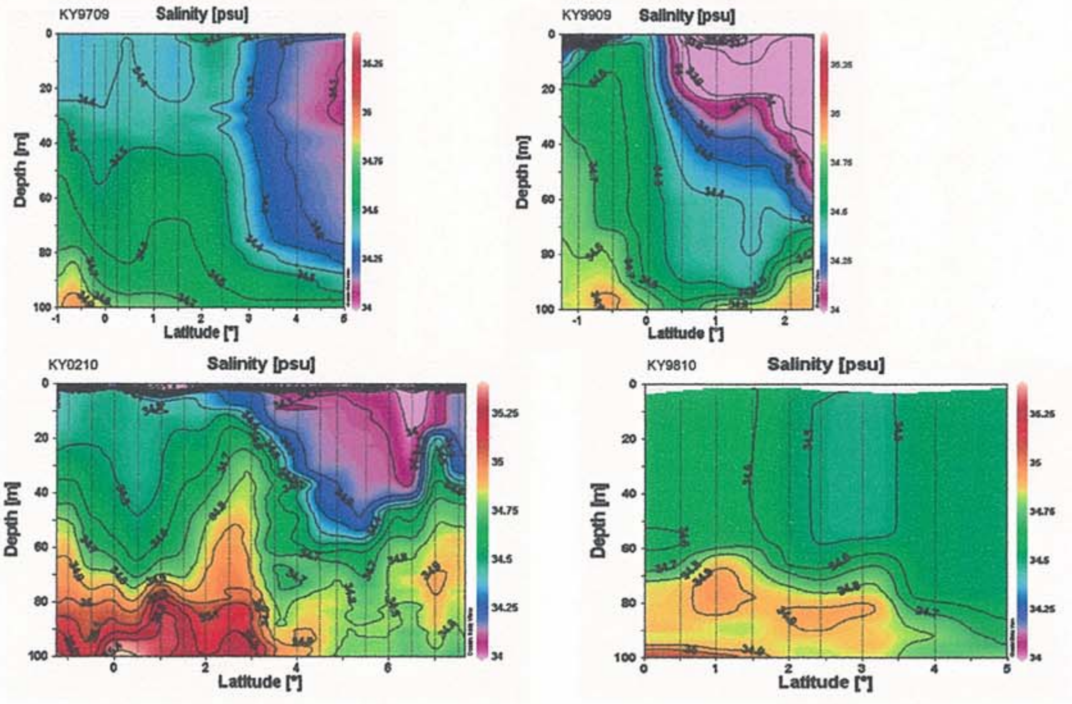


Figure 16. Comparison of temperature on shallow water along section 138E from KY9709 (top-left), KY0210 (bottom-left), KY9909 (top-right) and KY9810 (bottom-right).

We could not define what kind of this phenomenon because we did not find the data which related to this phenomenon. Variations of salinity at the water depend on some parameters such as precipitation, river runoff, evaporation and the melting of sea ice. We will try to find out this phenomenon later. We only suggest to analyze this phenomenon should be remained circulation around this water.

6 Conclusion

We believe that as the year approaches its end the El Nino phase has just begun. How strong will it be and for how long? At this stage we do not know. It would need more other observations and detailed analysis of combined oceanographic and atmospheric dataset. We have some information from the BPPT of the Indonesian government that dry season will strike some parts of Indonesia and is more likely to be longer than usual, especially eastern part of java, Lombok Island, NTT, NTB and southeast Celebes. But the other part of Indonesia have normal wet season with high precipitation, especially, in the West Sumatra and West Bormeo Islands. It could be caused by some processes in Indian Ocean and could be connected to fluctuation of Dipole Mode Event (DME) that activates strong monsoon. The convection zone of Walker Circulation migrating to the Central Pacific Ocean and convection zone of Hadley Circulation still remains around Indonesian region but weakened as the Walker Circulation pulls out on its eastward migration.

7 Acknowledgments

We would like to express our heart felt gratitude and special thanks to Captain K. Hasegawa and crew of R/V Kaiyo and Captain Cuncun Sunarya the Security Officer from Center of Survey and Mapping, Indonesian Navy and the engineers and technicians of Marine Work Japan Co. Ltd and Nihon Marine Enterprise Co. Ltd for an excellent support during TOCS K9505. Without their invaluable experience and support this research would not have been successful.

We also extend a special gratitude and thanks to Dr. S. Minato and Dr. S. Hosoda from Japan Marine Science and Technology who gave us some scientific experience to join R.V. Kaiyo cruise. We also would like to say thanks to Jimmy Gomoga from the National Weather Service of Papua New Guinea for our scientific discussion and also for our friendship along this cruise.

This cruise was a joint cruise by Japan Marine Science and Technology Center (JAMSTEC), Japan, Badan Pengkajian dan Penerapan Teknologi (BPPT), Indonesia, and the National Weather Service of Papua New Guinea under the Tropical Ocean Climate Study (TOCS) project. We thank our colleagues in JAMSTEC for their efforts in conducting this scientific cruise.

First Impression from:

Lieutenant CUNCUN SUNARYA

Indonesian Navy, Hydro-Oceanographic Office (leg-2 Security Officers)

For the first time I onboard on this ship, my first impression was I see that I have a good chance to learn more about Survey Equipment and Technology. I work as an electronic engineer to maintenance and service Hydro-Oceanographic equipments. On this cruise I can see that there are so many things that I could learn. Beside My duty as a security officer I learn about the system on this ship, there is a good system that I could see and learn too.

I would like to express my special thanks for Captain Hasegawa and all the crew of R/V KAIYO for the cooperation and their kindness as long as I doing my duty. Thanks for you all showing how the good team works doing their job. None of us as smart as all of us.

First Impression from:

Dadan Gunawan

The Assessment and Application Technology Agency (BPPT)

This is the first time to me to joint research with Japan Marine Science and Technology Center (JAMSTEC) at R/V Kaiyo in Oct. 17 - Oct. 31 2002. I am really impressed that Kaiyo is Catamaran Ship and the deck area is very widely. It is good to put on any purpose scientific equipments and many activities.

I would like to thank to Captain K. Hasegawa and his crew of R/V Kaiyo, technician from Marine Work Japan Co. Ltd and Nihon Marine Enterprise Co. Ltd. I also thank to Dr. Shinya Minato (Chief Scientist Leg. 2) and Dr. Shigeki Hosoda to support me and their assist. I hope that we can joint research together for the future. In this comments, I would like thank to Mr. Jimmy Gomoga for your kindness in Port Moresby.

Domo Arigato Gozaimasu

Sayonara....

TROPICAL OCEAN CLIMATE STUDY (TOCS)
KY02-10 LEG 2 R/V KAIYO CRUISE SUMMARY REPORT
October 16th – October 30th 2002

By: Mr. Jimmy GOMOGA – Papua New Guinea National Weather Service.

1.0 Introduction

Perhaps the earliest literacy ever recorded about El ñino is found in the Jewish (Hebrew) Torah. According to the Hebrew Torah (Christian Bible Genesis 41: 25 – 32, 53 – 57), Joseph interpreted and predicted that there would be seven years of plenty (great harvest) followed by seven years of famine. The famine started after seven years of great harvest and became very severe with its impact felt throughout the earth. A total of fourteen years elapsed before the rains came and restored the famished earth again.

Today on the average, El ñino Southern Oscillation (ENSO) occurs every three to seven years and has such a wide impact on marine life, ecology, economy and social life as in the days of Joseph throughout the world. Since its discovery from its impact along the western coast of South America in the late 17th century, various researches and studies were carried out along the coasts and oceans. By the 19th century the Scientists realized that the El ñino phenomenon was very complex and it proved to be more difficult then anticipated for it occurred as a result of a coupled ocean-atmospheric interaction. In 1970, by the resolution of the Intergovernmental Oceanographic Commission (IOC) of UNESCO the El Nino Programme Group was established. Tropical Ocean Climate Study (TOCS) Project is part of the outcome of this resolution and JAMSTEC has taken on the responsible to undertake research and observations in the Western Tropical Ocean and Kaiyo October 2002 was one of those observation and research cruises.

The purpose of this Scientific Cruise was to observe currents, temperatures, salinity at different depths in the Western Equatorial Pacific to help understand the ENSO (El Nino/ Southern Oscillation). It is believed to be triggered when the warm water pool, which is normally resident in the Western Equatorial Pacific, migrates towards the Central or Eastern Equatorial Pacific. It was therefore the main objective of this cruise to study the variability of this warm water pool using observed ocean data with some reference to the atmospheric data (rainfall).

2.0 Observation Summary (leg 2)

The October 2002 Tropical Ocean Climate Study observations was carried out by Ocean Research Department of Japan Marine Science and Technology Center (JAMSTEC), Badan Pengkajian dan Penerapan Teknologi (BPPT) of Indonesia, and the National Weather Service of Papua New Guinea with the support of the technicians and engineers of Marine Works Japan Co. Ltd and Nihon Marine Enterprise Co. Ltd and Captain and the Crew of R/V Kaiyo a Japanese Research vessel. CTD casts from the surface, 50, 100, 150, 200, 300, 400, 500, 600, 700, 800, and 900 and at 1000 meters (two samples), XCTD measurements were carried to the depth a 1000 meters and Triton Buoys were checked throughout the cruise, whilst the current parameters were measured by on board ADCP. CTD and XCTD were launched to measure Conductivity, Temperature and Depth profiles of the ocean and T-S diagram to identify water masses to the depth of about 1000 meters.

Three subsurface ADCP moorings at (0°N, 147°E), (2.5°S, 142°E) and (0°N, 138°E) were recovered and re-deployed and one subsurface mooring was recovered at (2.5°N, 138°E). Seven Triton Buoys were checked at (5°N, 147°E), (2°N, 147°E), (0°N, 147°E), (0°N, 138°E), 2°N, 138°E), (5°N, 138°E) and (7°N, 138°E). One at (2°N, 147°E) had broken anemometer and is experiencing transmission problems.

All these observations were conducted in the open seas in the waters of Papua New Guinea, Indonesia and Palau EEZ.

Table 1: CTD and XCTD Observations.

No.	Type	Position	Date	Hour	Depth (db)	Max. Depth
1.	CTD (1000)	5N147E	Oct. 19, 2002	8:30	50 - 1000	1000 dB x 2
2.	XCTD	4.5N147E	Oct. 19, 2002	13:00	Free fall	1000 dB
3.	XCTD	4N147E	Oct. 19, 2002	15:30	Free fall	1000 dB
4.	XCTD	3.5N147E	Oct 19, 2002	18:00	Free fall	1000 dB
5.	XCTD	3N147E	Oct 19, 2002	20:30	Free fall	1000 dB
6.	XCTD	2.5N147E	Oct 19, 2002	22:30	Free fall	1000 dB
7.	CTD (1000)	2N147E	Oct 20, 2002	08:30	50 - 1000	1000 dB x2
8.	XCTD	1.5N147E	Oct 20, 2002	12:30	Free fall	1000 dB
9.	XCTD	1N147E	Oct 20, 2002	15:00	Free fall	1000 dB
10.	XCTD	0.5N147E	Oct 20, 2002	17:30	Free fall	1000 dB
11.	CTD (1000)	0, 147E	Oct 21, 2002	16:00	50 - 1000	1000 dB x 2
12.	CTD (1000)	2.5S, 142E	Oct 23, 2002	16:30	50 - 1000	1000 dB x 2
13.	XCTD	2.7S, 142E	Oct 23, 2002	18:00	Free fall	1000 dB
14.	XCTD	2S, 142E	Oct 23, 2002	21:15	Free fall	1000 dB
15.	XCTD	1.5,S, 142E	Oct 23, 2002	23:05	Free fall	1000 dB
16.	XCTD	1S, 142E	Oct 24, 2002	01:30	Free fall	1000 dB
17.	XCTD	0.5, 142E	Oct 24, 2002	04:00	Free fall	1000 dB
18.	CTD (1000)	0,142E	Oct 24, 2002	07:00	50 - 1000	1000 dB x 2
19.	CTD (1000)	1.25,138E	Oct 25, 2002	07:00	Free fall	1000 dB
20.	CTD (1000)	1S, 138E	Oct 25, 2002	09:30	Free fall	1000 dB
21.	CTD (1000)	0,138E	Oct 25, 2002	07:00	Free fall	1000 dB
22.	CTD (1000)	0,138E	Oct 25, 2002	16:30	50 - 1000	1000 dB x 2
23.	XCTD	0.5N, 138E	Oct 25, 2002	20:30	Free fall	1000 dB
24.	CTD (1000)	1N, 138E	Oct 26,2002	20:30	50 - 1000	1000 dB x 2
25.	XCTD	1.5N, 138E	Oct 26,2002	00:00	Free fall	1000 dB
26.	CTD (1000)	2N, 138E	Oct 27,2002	11:30	50 - 1000	1000 dB x 2
27.	XTCD	2.5N, 138E	Oct 27,2002	17:00	Free fall	1000 dB
28.	CTD (1000)	3N, 138E	Oct 27,2002	19:30	50 - 1000	1000 dB x 2
29.	XCTD	3.5N, 138E	Oct 27,2002	23:00	Free fall	1000 dB
30.	XCTD	4N, 138E	Oct 28,2002	01:30	Free fall	1000 dB

3.0 Preliminary Results and Discussion

The R/V Kaiyo 2002 October Cruise, cosigned KY0210 was carried out during transitional period and despite the tropical heat, the weather was fine throughout the cruise and all the Triton buoys were successfully checked and all the ADCP Buoys were successfully recovered and redeployed by the hard working technicians of the Marine Works Japan, the JAMSTEC and crew of the R/V Kaiyo. Currently the data transmission from the Buoys is excellent except for the Triton Buoy at (2°N, 147°E).

The KY0210 cruise covered three meridional sections of different lengths in the Tropical Western Pacific, along which CTD and XCTD casts and observations were carried out and these were along 147°E, 142°E and 138°E. The data was sampled and analyzed and the preliminary results for the ocean salinity and temperature with some reference to the rainfall are given in the preceding sections. Only selected data was used and may not convey much, nonetheless, the preliminary results are overwhelming. Further detailed analysis and complete data sets for this cruise will be retrieved in the JAMSTEC Laboratory in Japan and made available on website.

Discussion

Analysis for the 147°E longitude from the equator up to 5°N latitude show the temperature distribution of 28 - 30.1°C with depth to be more uniform from the surface down to about 60 meters and loses its uniformity as you go beyond (See figure 1, 2, 3 & 4). The high temperature region extends from the equator to about 1° north and the cold waters begin to up well, and levels off at 3°N moving the high concentration of salinity more than 35 psu to the south. The Mix Depth Layer between the 100 – 200 meters shows some discontinuity from 5°N to the equator, with termoclines sloping towards the equator. The high concentration of salinity (35 psu or more) is found within the MLD with potential temperatures ranging from 15.7 – 23.0°C. This clearly indicates instability along 147°E and southward movement of the warm water.

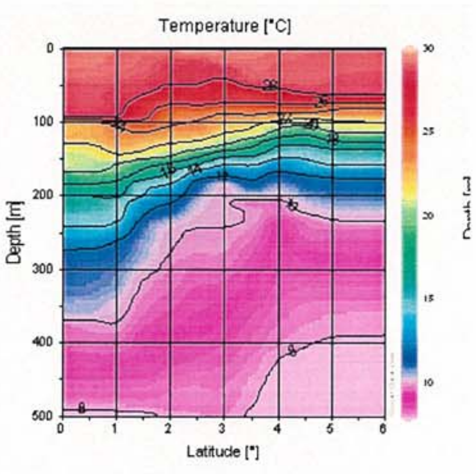


Figure 1: KY0210 Kaiyo 2002 October Temperature Profile along 147°E.

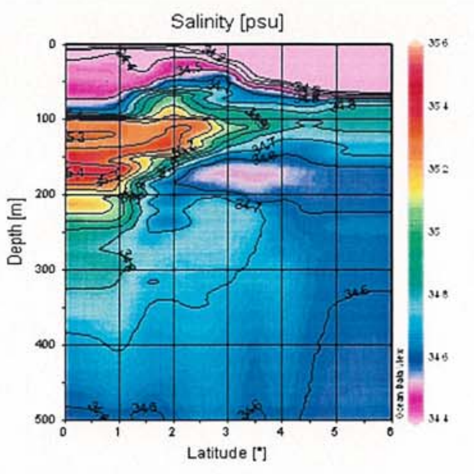


Figure 2: KY0210 Kaiyo 2002 October Salinity Profile along 147°E.

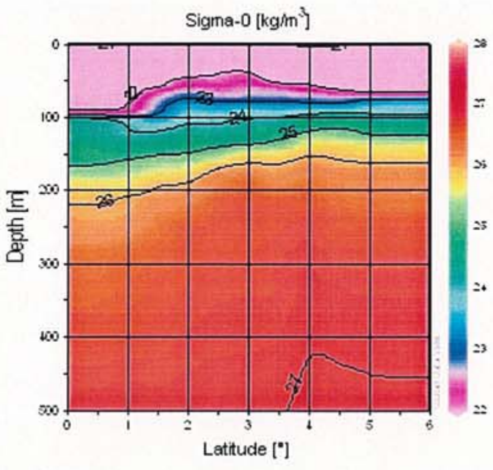


Figure 3: KY0210 Kaiyo 2002 October Sigma_0 Profile along 147°E.

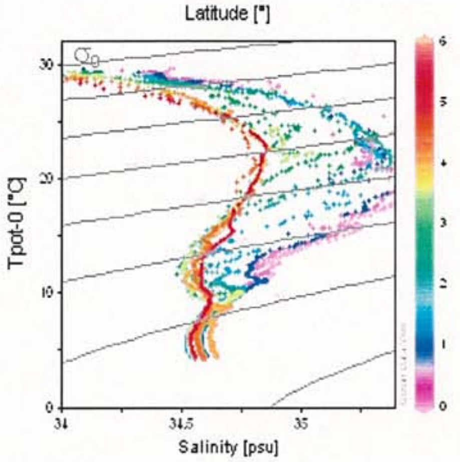


Figure 4: KY0210 Kaiyo 2002 October Tpot_0 Profile along 147°E.

The section 142°E from the equator down to 2.5°S shows completely a different scenario. It shows a lot more stability than along the 147°E. The temperatures of 28 - 29.6°C are found from the surface to about 70 meters. The thermoclines are more uniformly distributed with depth, though there is a little irregularity (pulse) traveling away from the equator towards the south (See figures 5, 6, 7 & 8). This pulse may represent an oscillating atmospheric high trying to establish it's self over the location or a disturbance coming somewhere from the north. The High concentrations of salinity of more than 35 psu is more evenly distributed and widely spread and resides in the Mix Depth Layer (MLD) which lies between the 80 – 260 meters. The potential temperature with in the MLD ranges from 14.5 – 25.0°C, further indicating more stable water mass that the eastern sector.

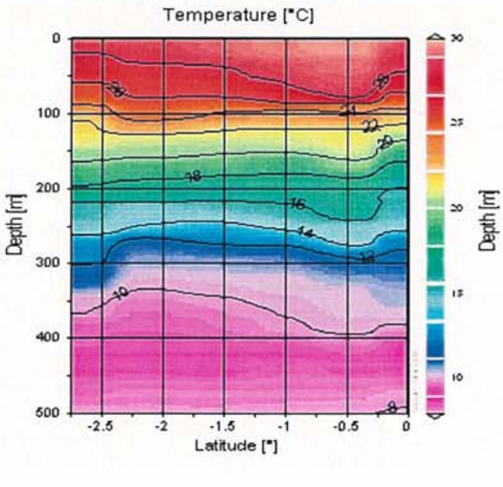


Figure 3: KY0210 Kaiyo 2002 October Temperature Profile along 142°E.

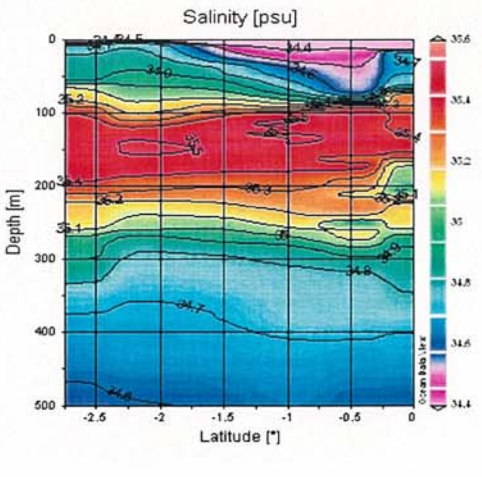


Figure 4: KY0210 Kaiyo 2002 October Salinity Profile along 142°E.

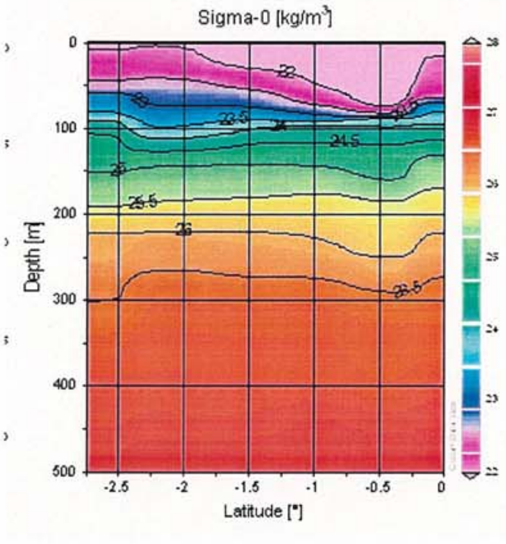


Figure 5: KY0210 Kaiyo 2002 October Sigma_0 Profile along 142°E.

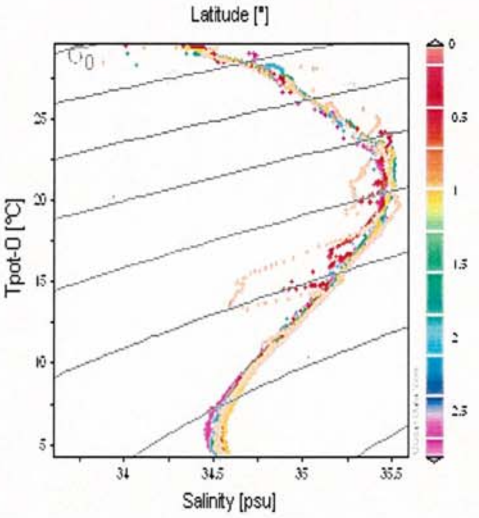


Figure 6: KY0210 Kaiyo 2002 October Tpot_0 Profile along 142°E.

A very clear picture is portrayed from the two sections, supporting the easterly movement of the warm waters. Though no comparison is made with the previous cruise data, one cannot ignore the distribution and the scenarios that are presented along the 142°E and 147°E longitudes suggesting an emerging El ñino that should not be ruled. Table two shows the derived ocean variable to compare the two sections.

Table 2: Derived Ocean Variables at MLD.

Section	Depth (m)	Temp (°C)	Salinity (psu)	T_pot (°)	Density (kg/m$^{3)}$	Max. Temp. (°)
147E	100	23.0	> 35.0	23.0	24.12	30.1
	200	15.7	> 35.0	15.6	25.90	
142E	80	25.0	>35.0	25.0	23.55	29.6
	260	14.5	>35.0	14.4	26.16	

Furthermore, the rainfall analysis for the selected Papua New Guinea rainfall stations show a remarkable drop indicating reduced annual rainfall especially for the stations near the warm pool region and (see annex: 2 and Map), further indicating a developing El ñino. It is interesting to note also that there was some major event that occurred about two decades ago that caused such major reduction (by half) in the amount of rainfall. Further study and research will be required.

4.0 Conclusion

Less salinity concentration may indicate higher rainfall rate, however, from the analysis it shows that high salinity concentration is mostly found with high temperatures with higher evaporation rate and lie close to the surface especially along 142°E. Lower salinity concentration is associated with lower temperatures and deeper below the surface layer of the oceans. This indicate a cooling process from the atmosphere as the high sets in bringing descending cold air and the ascending cold currents from the ocean depths

Sea surface temperatures (SSTs) along 147°E section are found to be higher than 142°E and moving away from the equator towards the south and east, clearly indication a northerly or atmospheric disturbance that would indicate an high establishing its self where the meeting point of the Walker and the Hadley circulations, thus separating the two. The Walker Circulation moves towards the central or eastern Pacific depending on the strength of El ñino and thereby weakening the Hadley circulation. The Northwest monsoon will therefore be not as effect as last year. Stronger monsoon activity are normally anticipated when the two atmospheric circulation overlap and are in phase.

Furthermore, the current distribution of Sea Surface Temperature is favorable for relatively stronger winds than would be expected over New Guinea Islands of Papua New Guinea. The usual southeasterly airflow has shifted to be more southerly following the migrating warm water pool and the Walker Circulation thereby resulting in higher evaporation rate and abnormal drying effect over much of the Islands and the north coast of Papua New Guinea including the Southwest Pacific and the South Eastern Asia.

From experience, Southern Oscillation Index (SOI) is not very reliable to calculate phases of El ñino or La ñina and can be misleading at times. Geostrophic approximation cannot be applied within the tropics, for higher derivatives become noisier. The only way we can study El ñino in the tropics and really understand its trigger mechanism is, more Cruises as this one but requires time and resources.

Finally, it may be possible that very strong El ñino event occurs every fourteen years on the average with normal to above normal rainfall for the first seven years and reduced rainfall during the following seven years. The easterly winds over the African Continent should be watched and monitored closely, for the strong easterly winds caused a severe famine in the days of Joseph may resolve the mystery of the El ñino like phenomena which moves warm waters in the Indian Ocean west ward during Pacific El ñino.

5.0 Acknowledgments

I would like to express my gratitude and special thanks to Captain K. Hasegawa and crew of R/V Kaiyo and Captain Cuncun Sunarya the Security Officer from Center of Survey and Mapping, Indonesian Navy and the engineers and technicians of Marine Work Japan Co. Ltd and Nihon Marine Enterprise Co. Ltd for an excellent support

during TOCS KY0210. Without their invaluable experience and support this research would not have been successful.

I also extend a special gratitude and thanks to Dr. S. Hosoda and Dr. S. Minato from Japan Marine Science and Technology by taking me as part of the team to join this very important TOCS cruise and the fellow scientists from Indonesian BPPT, Mr. A. Purwandani for setting up my computer and helping me to understand oceanography and Mr. D. Gunawan. We all shared our experiences and I had a great time and enjoyed every bit of the journey, although it was very tiring.

Finally, but not the least, I owe it all to the Director of PNG National Weather Service, the Civil Aviation Authority and the Government of Papua New Guinea to release me from my daily tasks to be part of this TOCS project cruise which has been a co operative research cruise between Japan Marine Science and Technology Center (JAMSTEC), Japan, Badan Pengkajian dan Penerapan Teknologi (BPPT), Indonesia, and the National Weather Service of Papua New Guinea.

Thank you,

Jimmy GOMOGA
Papua New Guinea National Weather Service.

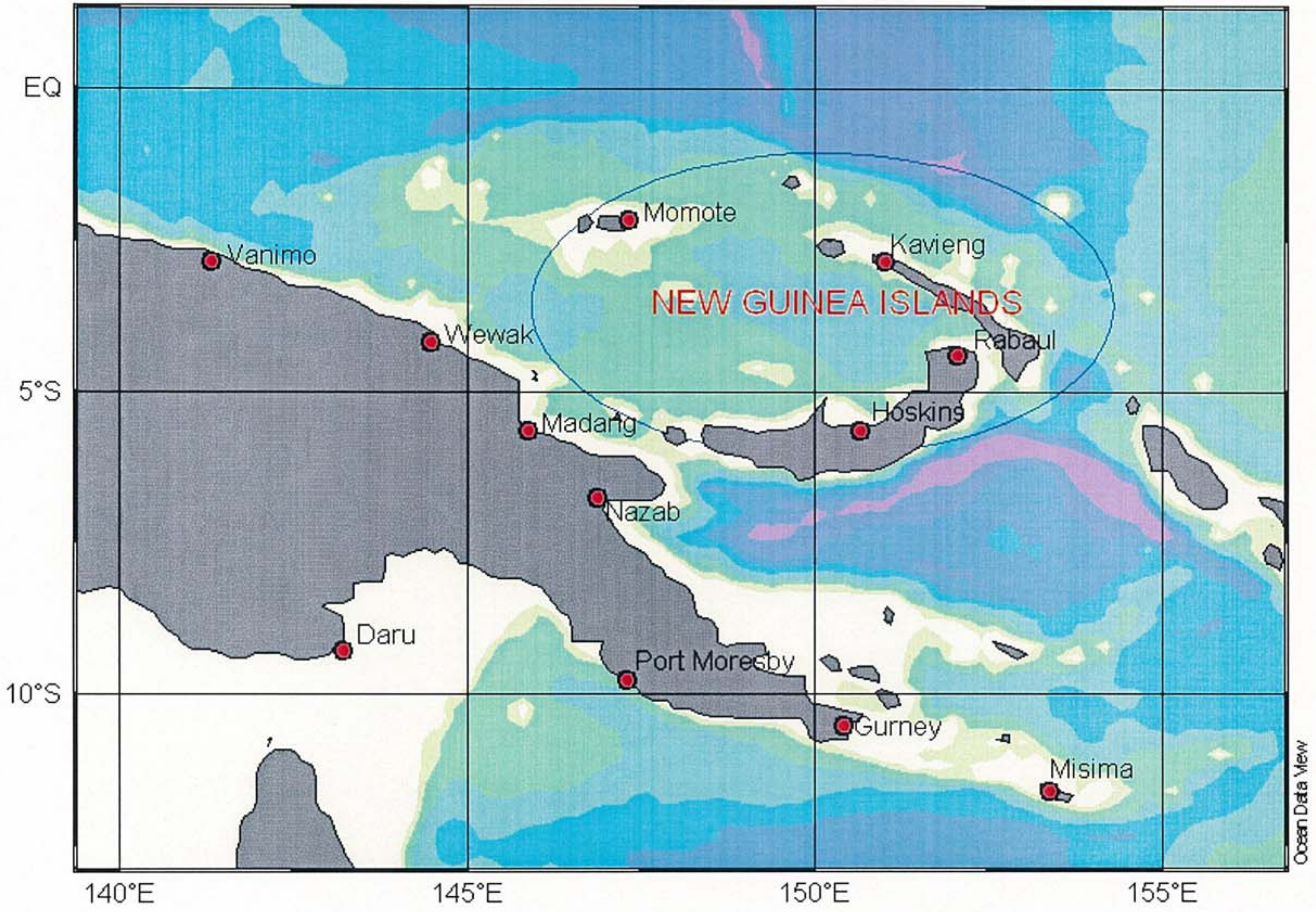
Attachments:

Annex 1: Map of PNG New Guinea Islands.

Annex 2: Rainfall Figures.

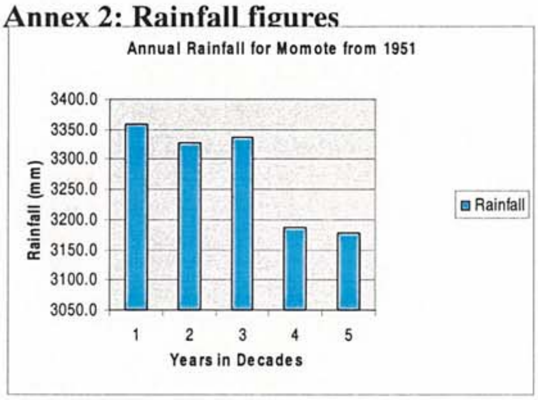
Annex 3: Comments.

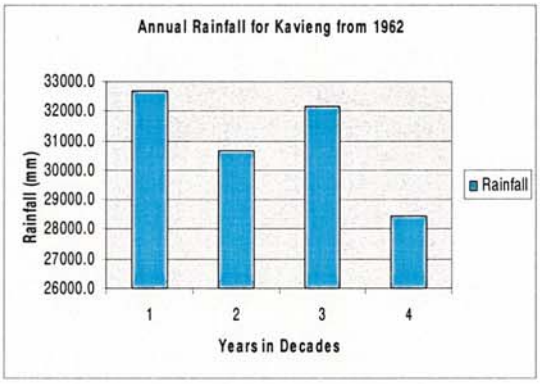
Annex 1: PNG Map

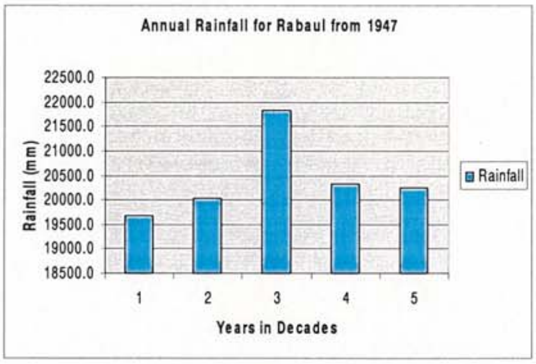

EQ
5°S
10°S
140°E
145°E
150°E
155°E
Momote
Kavieng
Vanimo
NEW GUINEA ISLANDS
Wewak
Rabaul
Madang
Hoskins
Nazab
Daru
Port Moresby
Gurney
Misima
Ocean Data View

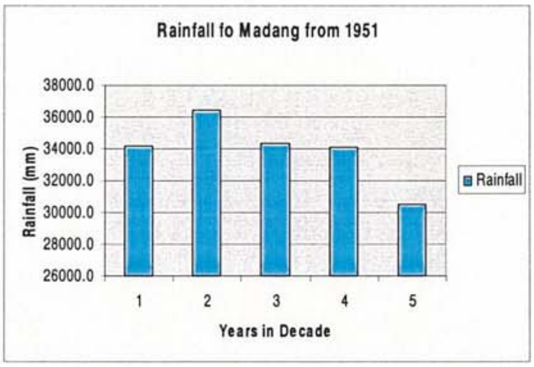
Annex 2: List of Rainfall figures for New Guinea Islands of Papua New Guinea.

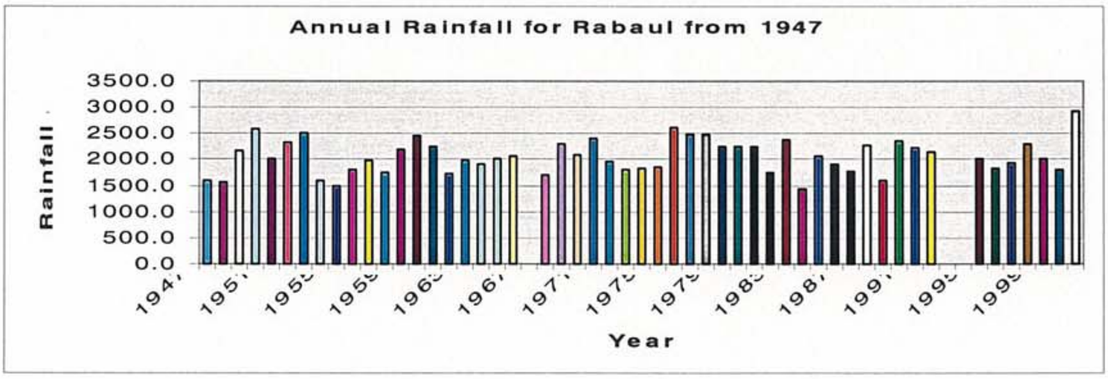
Annex 2: Rainfall figures

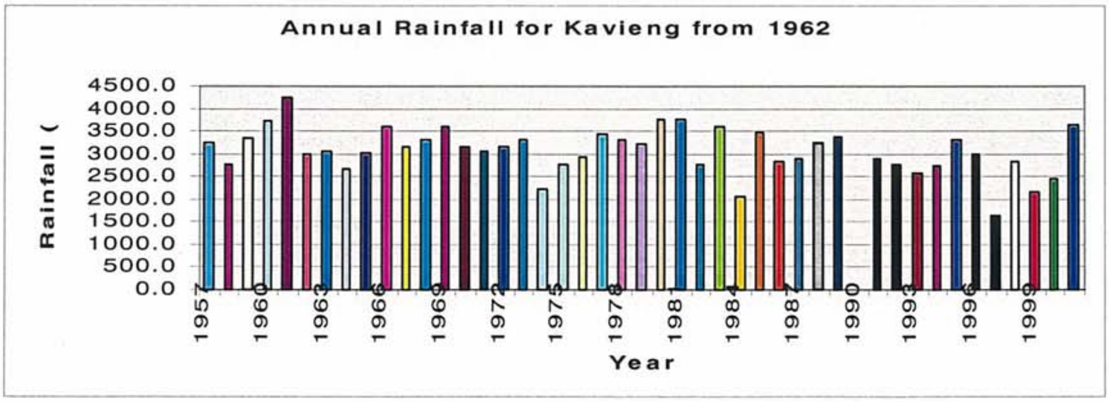


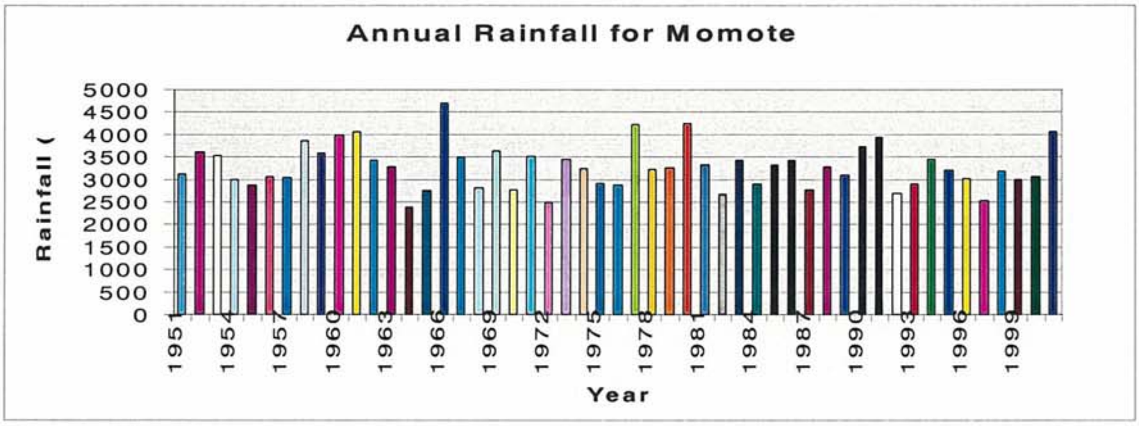


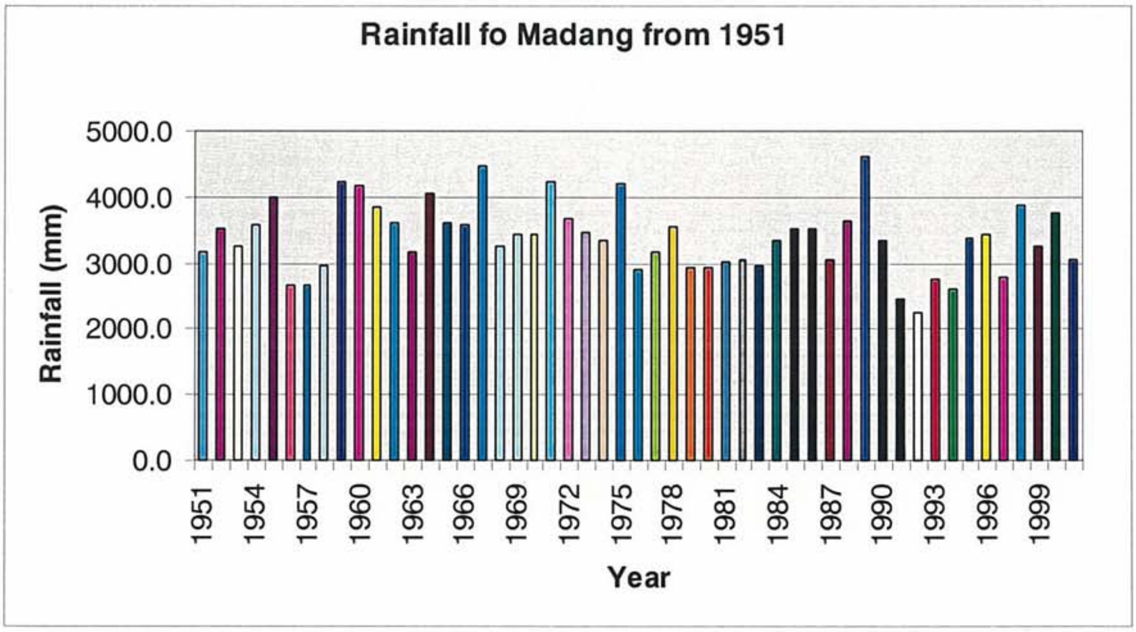









Annual Rainfall for Momote
Rainfall (
5000
4500
4000
3500
3000
2500
2000
1500
1000
500
0
1951
1954
1957
1960
1963
1966
1969
1972
1975
1978
1981
1984
1987
1990
1993
1996
1999
Year


Rainfall fo Madang from 1951
Rainfall (mm)
5000.0
4000.0
3000.0
2000.0
1000.0
0.0
1951
1954
1957
1960
1963
1966
1969
1972
1975
1978
1981
1984
1987
1990
1993
1996
1999
Year