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MR00-K01

6.Jan - 7 Feb. 2000

Preliminary Cruise Report

Mr. Kurihara, chief officer of R/V Mirai, is ready for observation and waiting for scientists on the freezed deck at station 50N (courtesy of Dr. Nojiri)

Apr. 2000

Japan Marine Science and Technology Center

MR00-K01 Preliminary Cruise Report

Contents

1. Preface

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Two years ago, R/V Mirai, which is one of the largest research vessel in the world with the newest instruments, challenged the early winter cruise (between the late November and the middle of December, 1998) in the Northwestern North Pacific. However sea condition was too tough for her to conduct enough observation especially in the region north of 40^{o}N. Therefore some of participants who experienced the above cruise expected that we should put up with sea sick and could not take enough sample and data to study biogeochemistry in winter. In fact, R/V Mirai could not arrive at her mother port, Sekinehama, on time and left there behind schedule. When we quickly changed our direction toward southern stations (south of 40^{o}N) and started observation, most of participants might remember that nightmere.

However something was different from the previous winter cruise. Although Aleutian low pressure took place in the Northwestern North pacific continuously, there were a few relatively calm days after stormy days, when wave height and wind velocity became lower enough to carry out observation. Captain Hashimoto predicted these days so correctly that we could carry out observation at stations higher than one after another that we could visited stations north of 40^{o}N and carry out observation. We succeeded to visit station 4 (KNOT) and observe biogeochemistry under the early winter condition by floating sediment trap experiment, *in situ* measurement of primary production, multiple core sampling, and so on. At the second visit to station KNOT, we also succeeded to conduct the hydrocasting at station 5 (KNOT-N) where sea condition was really winter's one. Another high light of this cruise was the visit to station 6 (50N) and carrying out the comprehensive observation. Suffering from low air temperatuire of minus 8 degree centigrade, snow falling inducing slippy deck, and freezed trigger of rosett multiple sampler, we could carry out not only hydrocasting, but also drifting sediment trap experiment, plankton net sampling. In addition, success of recovery and redeployment of time-series sediment trap mooring system at station 8 (40N) was one of the biggest crops. All of participants must feel satisfied with valuable sample and data obtained in winter in the Northwestren North Pacific.

On behalf of cruise participants, I deeply acknowledge captain Hashimoto, chief engeneer Inoue, chief officer Kurihara, and ship crews for their devotional work and effort. I thank marine technicians from Marine Works Japan (MWJ) and Global Ocean Development (GODI) for their technical support including CTD/RMS operation, chemical analysis and

geological survey. Without their assist, participants from national institutions, agency and universities could not concentrate on their own science. Although scientific result from most of sample and data obtained this cruise are not ready, we would like to express our appreciation to them with scientific publication and presentation at scientific meeting in near future.

2. Outline of MR00-K01

2.1 Cruise summary

Objective of this cruise was the acquisition of biogeochemical data and the verification of biogeochemical material's cycle in the northwestern North Pacific in winter season when enough oceanographic data has not been obtained before. We planed to visit 21 stations located within 32.5°- 50°N and 142.5 - 165°E. R/V Mirai left her mother port, Sekineha ma, on 6 Jan. 2000 and was back to Sekinehama on 7 Feb.. Institutions and universities which participated this cruise were as follows:

Japan Marine Science and Technology center (JAMSTEC)
National Institute of Environmental Science (NIES)
National Institute for Resources and Environment (NIRE)
Japan Meteorological Agency (JMA)
Hokkaido University (HU)
Nagoya University (NU)
Tokyo Institution of Technology (TIT)
Washington University (WU)
(*Technical support*)
Marine Works Japan Ltd. (MWJ)
Global Ocean Development, Inc. (GODI)

Low pressure came to the Northwestern North pacific one after another. Averages of wind velocity and wave height during this cruise were 13 m/sec and 4 m, respectively. Sea surface was usually covered with white caps. However there were a few relatively calm days after stormy days, when wave height and wind velocity became lower enough to carry out observation. Thanks to the appropriate prediction by captain and devoted hard work by ship crews and marine technicians, we could visited stations north of 40^{o}N including station 50N and carry out observation. After all, we could conduct observation at stations with approximately 80 % coverage rate.

Conducted observation and analysis were as follows (Institutions in the parentheses are in charge for each observation):

(1) Hydrocasting

At 16 stations, we conducted water sampling with RMS (Rosette Multi-bottle array water sampling system) with CTD (SBE 9 plus). These sea water were or will be used for the following analysis:

DO, nutrients (JAMSTEC, NIES)
Carbonate chemistry: pH, TCO_2, TALK, ^{13}C, ^{14}C, Alkenone (JAMSTEC, NIES)
Pigments (NIES, NU, HU,)
Trace metal: Fe (JAMSTEC, NIES)
Trace gas: DMS, CFCs, N_2, Ar , Ne, CH_4, CO (HU, TIT, WU)
Radionuclides: ^{222}Rn, ^{210}Po, ^{234}Th (JAMSTEC, NIRE, HU)

(2) Underway measurements (JAMSTEC, NIES)

Along the cruise track, pCO_2, TCO_2, nutrients, salinity, and temperature in the surface sea water were continuously measured by an automated system installed on R/V "MIRAI".

(3) Sea floor sediment coring (NIRE)

Sea floor sediment and sea water above the sea floor was collected at station 1 and 4 (KNOT) by a multiple core sampler. Radionuclides such as ^{14}C and nutrients in the sediment and pore water will be measured at the laboratory.

(4) Drifting sediment trap experiment (JAMSTEC, NIRE, NIES, NU, HU)

In order to collect settling particulate matters in the shallow water, drifting sediment trap experiments were conducted at stations 4 (KNOT) , 6 (50N), and 8 (40N). Sediment trap mooring system with sets of "Knauer type trap" was drifted for few days. Thanks to the GPS buoy system, the drifting speed and direction of the mooring system could be monitored during the experiment. Some of collected sample was filtered and the others were stored in the refrigerator on board. These samples will be distributed to the trap working group and, in future, organic and inorganic carbon, opal, carbonate, carbon and nitrogen stable isotopes, radionuclides, and zoo-plankton in the sample will be measured.

(5) Time-series sediment trap experiment (JAMSTEC)

Time-series sediment trap experiment has been conducted since December, 1997 at three stations (St. KNOT: Japanese biogeochemical time-series station, St. 50N: western subarctic gyre, and St. 40N: subarctic front). During MR00-K01 cruise, the sediment trap

mooring systems at St. 40N which deployed in May 1999 was recovered and re-deployed successfully. On board, heights of total mass flux in collecting cups were measured as the first observation (Fig. 2.1). In May and June, during when total mass flux was expected to be high because of spring bloom, total mass flux did not increase. Total mass flux at 1000 m water depth increased from the middle of July to September (relatively high flux observed in the last interval should be artifact judging from low fluxes observed during other two intervals in winter). Total mass flux at 3000 m and at 5000 m also increased from July to September. The highest total mass flux was observed during September, which did not appear at 1000 m. In general, seasonal variability in total mass flux synchronized each other. These samples will be transported to laboratory being kept in refrigerator. At laboratory, chemical components such as carbon, nitrogen, carbonate, opal and trace elements will be measured. These analysis will reveal property of biological pump in the northwestern North Pacific.

(6) Atmospheric observation (TIT)

Air sample was collected on the flying bridge along the cruise track. No methane hydrocarbon will be measured at laboratory.

(7) Primary productivity and bio-optical measurement for ocean color remote sensing (NIES, NU, HU)

Using ^{13}C as a tracer, *in situ* and *in vitro* incubation experiments were carried out at station 4 (KNOT), 6 (50N), 8 (40N), and 15 (KNOT2). ^{13}C uptaked by phytoplankton will be measured by mass spectrometry, and primary productivity in winter season in this area will be presented.

In addition, the underwater spectral downward irradiance and upward radiance were measured by MER and FRRF in order to validate and develop bio-optical algorithm for new series ocean color sensors such as Sea WiFS and GLI.

(8) Plankton net (NIES)

The objective of this study is to reveal the species succession of phytoplankton, microzooplankton, and zooplanktonin northwestern subarctic Pacific. These plankton were collected using three types nets: Palumbo-Chun-Petersen (PCP) type closing net (45cm mouth diameter, 0.06mm mesh), Twin-type (0.33mm mesh) and single type (0.2mm mesh) NORPAC nets (45cm mouth diameter, Motoda 1957). All net samples were immediately preserved in 5% buffered formalin-seawater solution.

(9) XBT / XCTD, P-ALACE float (JMA)

In order to investigate the structure and variation of sub-surface temperature and salinity in the subarctic circulation area focusing on the formation, advection, and diffusion of the North Pacific Intermediate Water (NPIW), XBT / XCTD were deployed along the cruise track. In addition, two P-ALACE floats were deployed around station 8 (40N). These floats descended by the abyssal water with the planned density (approximately 1500 m) and drifted. These will ascend to sea surface each 10 days and send these own positions and vertical profile of salinity and temperature. This study is a part of ARGO project.

(10) Geological survey (JAMSTEC)

In addition to the biogeochemical and physical oceanographic observations, geological survey such as magnetic field, gravity and sea floor topography observation were carried out.

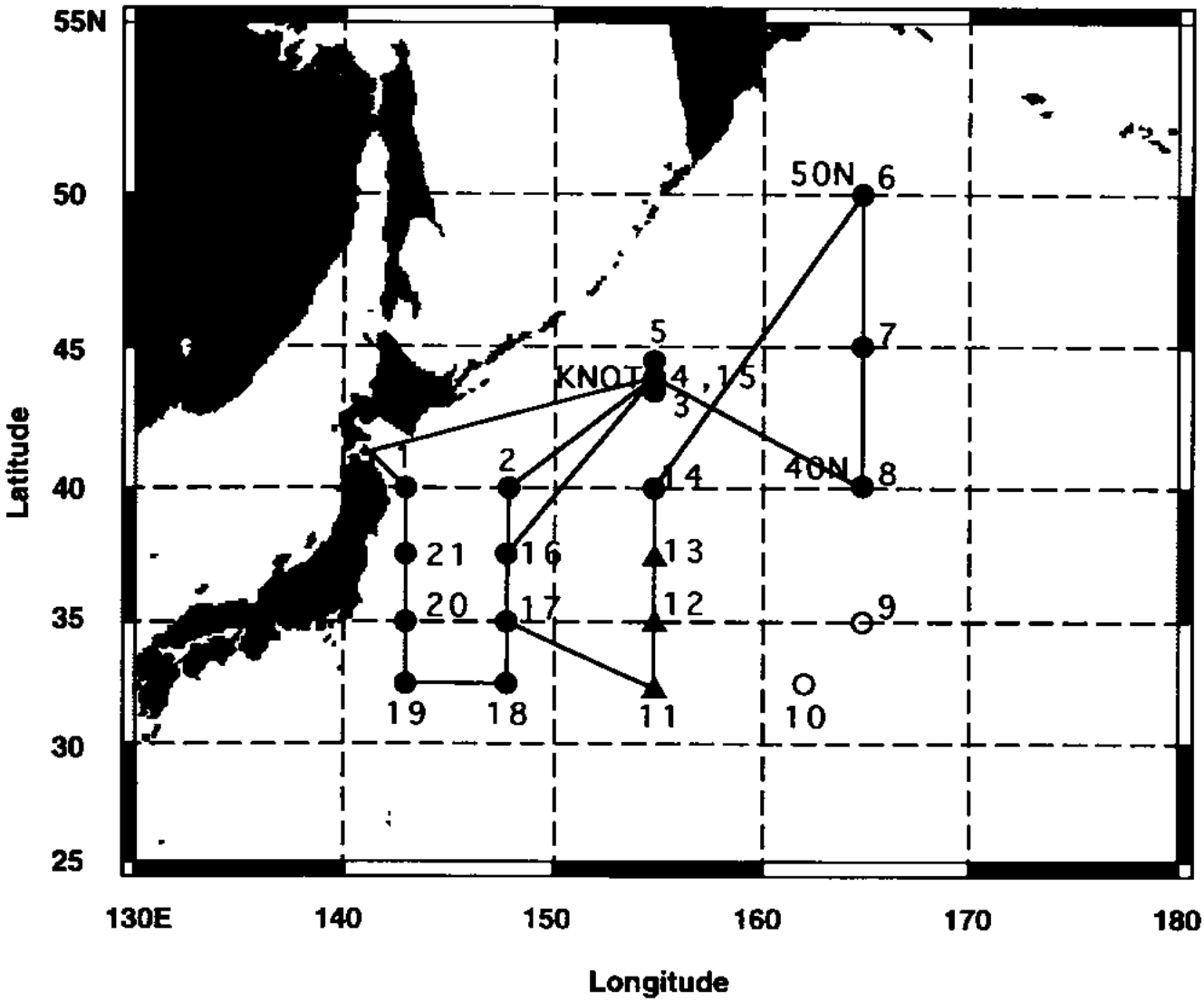
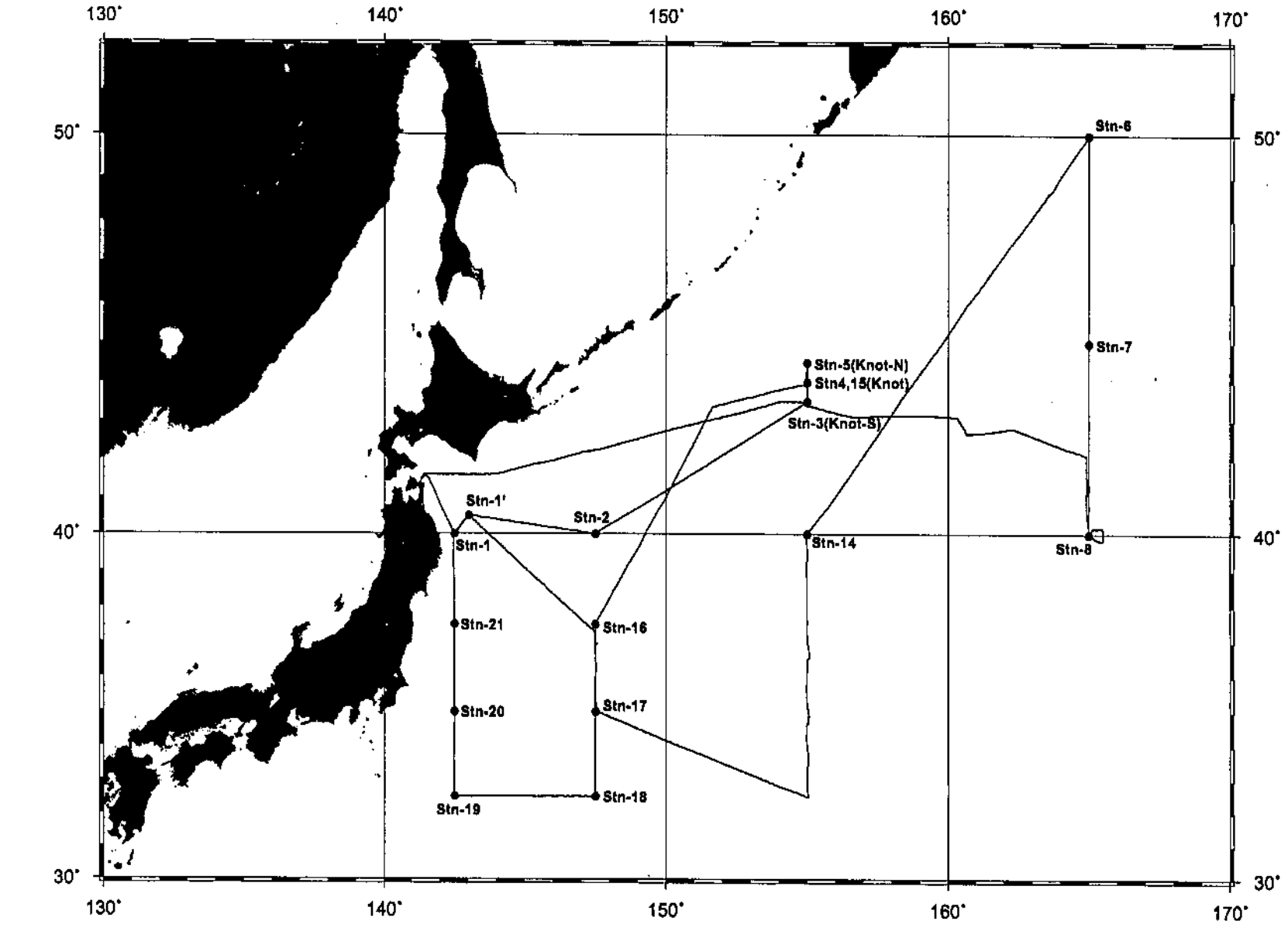


Fig.2.1 Cruise track and stations

▲ XBT or XCTD
○ no visit

2.2 Cruise log and cruise track



GMT Feb 7 05:36

Cruise Track

Date	Start Time(LST)	Station	Position (start) Lat.	Long.	Events
2000/1/6					Departure from Sekinehama
	17:30	1	**40-00.00 N**	**142-30.00 E**	Arrival at Station 1
	17:56	1	39-59.41 N	142-30.06 E	Large CTD/RMS cast (3000m)
	19:08	1	39-58.98 N	142-30.09 E	Large CTD/RMS cast (700m)
	19:44	1	39-58.56 N	142-30.17 E	Surface water sampling
	22:30				Departure from Stn.1
1/7	10:00	1	40-00.00 N	142-30.00 E	Return to Station 1
	10:03	1	40-00.06 N	142-29.88 E	Small CTD/RMS cast (700m)
	11:23	1	39-58.50 N	142-29.24 E	Small CTD/RMS cast (200m)
	11:58	1	29-58.46 N	142-28.65 E	MER measurement
	12:11	1	39-58.29 N	142-28.46 E	FRRF measurement
	12:16	1	39-58.28 N	142-28.46 E	Surface water sampling
	12:30				Departure from Stn. 1
	14:23	X-001	39-29.91 N	142-28.10 E	XBT deployment
	16:19	X-002	38-59.93 N	142-28.89 E	XBT deployment
	18:21	XC-001	38-29.88 N	142-30.05 E	XCTD deployment
	20:17	X-003	37-59.94 N	142-29.87 E	XBT deployment
	22:18	**21**	**37-30.00 N**	**142-30.00 E**	Arrival at Station 21
	22:22	21	37-30.43 N	142-29.90 E	Small CTD/RMS cast (200m)
	23:32	21	37-30.78 N	142-29.92 E	Small CTD/RMS cast (1000m)
1/8	0:44	21	37-30.88 N	142-29.62 E	Large CTD/RMS cast (1000m)
	1:43	21	37-31.42 N	142-29.50 E	Surface water sampling
	2:30				Departure from Stn. 21
	5:01	X-004	36-59.96 N	142-29.97 E	XBT deployment
	7:30	X-005	36-29.96 N	142-30.14 E	XBT deployment
	9:44	XC-002	36-00.12 N	142-29.96 E	XCTD deployment
	11:53	X-006	35-29.89 N	142-29.89 E	XBT deployment
	14:00	**20**	**35-00.00 N**	**142-30.00 E**	Arrival at Station 20
	14:08	20	34-59.98 N	142-29.89 E	MER measurement
	14:20	20	35-00.15 N	142-30.10 E	FRRF measurement
	14:25	20	35-00 N	142-30 E	Surface water sampling
	14:44	20	35-00.52 N	142-30.32 E	Small CTD/RMS cast (500m)
	17:21	20	35-02.31 N	142-31.88 E	Small CTD/RMS cast (3000m)
	20:56	20	35-02.78 N	142-31.51 E	Small CTD/RMS cast (200m)
	21:00	20	35-02.81 N	142-31.56 E	Surface water sampling
	21:30				Departure from Stn. 20
	23:51	X-007	34-29.93 N	142-30.01 E	XBT deployment
1/9	1:51	X-008	34-00.60 N	142-30.02 E	XBT deployment
	3:53	XC-003	33-29.98 N	142-29.49 E	XCTD deployment
	5:50	X-009	32-59.94 N	142-29.99 E	XBT deployment
	8:00	**19**	**32-30.00 N**	**142-30.00 E**	Arival at Station 19
	8:00	19	32-30.21 N	142-29.56 E	Small CTD/RMS cast (500m)
	8:44	19	32-30.19 N	142-29.31 E	MER measurement
	8:55	19	32-30.21 N	142-29.23 E	FRRF measurement
	8:57	19	32-30.21 N	142-29.22 E	Surface water sampling
	9:28	19	32-30.39 N	142-29.06 E	Large CTD/RMS cast (3000m)
	11:27	19	32-21.37 N	142-28.92 E	Surface water sampling
	12:58	19	32-31.30 N	142-29.01 E	MER measurement
	13:09	19	32-31.36 N	142-29.15 E	FRRF measurement
	13:32	19	32-31.28 N	142-29.37 E	Small CTD/RMS cast (6000m)
	17:36				Departure from Stn. 19
	21:00	X-010	32-30.08 N	143-30.06 E	XBT deployment
1/10	0:10	X-011	32-29.79 N	144-30.05 E	XBT deployment
	3:29	X-012	32-29.78 N	145-30.09 E	XBT deployment
	6:50	X-013	32-30.03 N	146-30.27 E	XBT deployment
	10:00	**18**	**32-30.00 N**	**147-30.00 E**	Arrival at Station 18
	10:10	18	32-30.21 N	147-29.09 E	MER measurement
	10:22	18	32-30.11 N	147-29.24 E	FRRF measurement
	10:24	18	32-30.11 N	147-29.25 E	Surface water sampling
	10:43	18	32-29.97 N	147-29.51 E	Small CTD/RMS cast (500m)
	11:27	18	32-29.62 N	147-30.24 E	Large CTD/RMS cast (3000m)
	13:33	18	32-28 N	147-31 E	Surface water sampling
	14:44	18	32-28.38 N	147-32.88 E	Small CTD/RMS cast (6000m)
	18:42				Departure from stn. 18
	21:08	X-014	33-00.09 N	147-29.80 E	XBT deployment
	23:13	XC-004	33-29.97 N	147-29.71 E	XCTD deployment
1/11	1:22	X-015	34-00.03 N	147-30.09 E	XBT deployment
	3:27	X-016	34-30.00 N	147-29.58 E	XBT deployment

	6:00	17	**35-00.00 N**	**147-30.00 E**	Arrival at Station 17 (skip)
	9:13	X-017	35-30.01 N	147-30.09 E	XBT deployment
	11:41	XC-005	36-00.40 N	147-30.69 E	XCTD deployment
	14:04	X-018	36-30.56 N	147-30.65 E	XBT deployment
	16:46	X-019	37-00.00 N	147-30.03 E	XBT deployment
	20:10	X-020	37-29.96 N	147-10.79 E	XBT deployment
1/12	0:22	X-021	38-00.00 N	146-28.93 E	XBT deployment
	4:17	XC-006	38-29.94 N	145-47.72 E	XCTD deployment
	8:06	X-022	39-00.01 N	145-05.73 E	XBT deployment
	11:44	XC-007	39-30.21 N	144-23.81 E	XCTD deployment
	15:12	X-023	40-00.02 N	143-41.79 E	XBT deployment
	18:06	1'	**40-30.00 N**	**143-00.0 E**	Arrival at Station 1'
	18:10	1'	40-29.94 N	142-59.94 E	Multiple core sampling
	18:12	1' (X-024)	40-29.94 N	142-59.94 E	XBT deployment
	19:42				Departure from Stn. 1'
	21:22	XC-008	40-26.45 N	143-31.07 E	XCTD deployment
	22:52	X-025	40-23.63 N	144-00.12 E	XBT deployment
1/13	0:25	XC-009	40-19.89 N	144-30.50 E	XCTD deployment
	1:55	X-026	40-16.71 N	145-00.10 E	XBT deployment
	3:28	XC-010	40-13.10 N	145-30.20 E	XCTD deployment
	5:00	X-027	40-09.89 N	146-00.10 E	XBT deployment
	6:32	XC-011	40-06.68 N	146-29.99 E	XCTD deployment
	8:05	X-028	40-03.41 N	147-00.11 E	XBT deployment
	9:42	2	**40-00.00 N**	**147-30.00 E**	Arrival at Station 2
	9:43	2	40-00.03 N	147-30.24 E	MER measurement
	9:54	2	40-00.11 N	147-30.38 E	FRRF measurement
	9:56	2	40-00.12 N	147-30.39 E	Surface water sampling
	10:14	2	40-00.22 N	147-30.68 E	Large CTD/RMS cast (300m)
	11:13	2	40-00.48 N	147-31.08 E	Small CTD/RMS cast (500m)
	11:51	2	40-00.88 N	147-31.46 E	Large CTD/RMS cast (3000m)
	13:42	2	— N	— E	Surface water sampling
	14:36	2	40-01.17 N	147-33.04 E	Small CTD/RMS cast (3000m)
	16:36				Departure from Stn. 2
	18:15	XC-012	40-14.49 N	147-59.89 E	XCTD deployment
	20:10	X-029	40-28.68 N	148-30.07 E	XBT deployment
	22:02	XC-013	40-41.81 N	149-00.16 E	XCTD deployment
	23:53	X-030	40-55.75 N	149-30.09 E	XBT deployment
1/14	1:42	XC-014	41-09.97 N	150-00.06 E	XCTD deployment
	3:32	X-031	41-24.29 N	150-30.07 E	XBT deployment
	5:20	XC-015	41-38.64 N	151-00.00 E	XCTD deployment
	7:11	X-032	41-52.26 N	151-30.04 E	XBT deployment
	9:09	XC-016	42-06.70 N	152-00.15 E	XCTD deployment
	11:12	X-033	42-20.20 N	152-30.08 E	XBT deployment
	13:16	XC-017	42-34.10 N	152-59.54 E	XCTD deployment
	15:26	X-034	42-48.86 N	153-30.04 E	XBT deployment
	17:38	XC-018	43-02.63 N	153-59.99 E	XCTD deployment
	20:06	X-035	43-16.42 N	154-30.06 E	XBT deployment
	22:21	XC-019	43-29.73 N	154-59.83 E	XCTD deployment
1/15	0:59	XC-020	43-59.99 N	155-00.81 E	XCTD deployment
	3:35	XC-021	44-30.03 N	155-00.55 E	XCTD deployment
	7:30	**4 (KNOT-1)**	**44-00.00 N**	**155-00.00 E**	Arrival at Station 4
1/16	6:45	4	44-00.28 N	154-59.98 E	JAMSTEC drifting sediment trap deployment
	8:27	4	44-01.20 N	155-00.69 E	CREST drifting sediment trap deployment
	9:43	4	44-00.22 N	155-02.51 E	Large CTD/RMS cast (300m)
	10:02	4	44-00.29 N	155-02.61 E	Surface water sampling
	10:08	4	44-00.71 N	155-02.75 E	MER measurement
	11:07	4	44-00.66 N	155-02.69 E	FRRF measurement
	11:27	4	44-00.63 N	155-02.71 E	Small CTD/RMS cast (200m)
	11:33	4	44-00.63 N	155-02.72 E	Surface water sampling
	12:35	4	43-59.99 N	155-00.07 E	Small CTD/RMS cast (5100m)
	14:23	4	43-59 N	155-00 E	Surface water sampling
1/17	2:57	4	43-59.96 N	155-00.03 E	Small CTD/RMS cast (200m)
	5:25	4	43-59.92 N	154-59.92 E	*In situ* incubation system deployment
	6:15	4	44-00.01 N	154-59.70 E	Large CTD/RMS cast (300m)
	7:44	4	44-00.05 N	154-59.25 E	Large CTD/RMS cast (500m)
	8:11	4	44-00.03 N	154-59.09 E	Surface water sampling
	9:18	4	44-00.00 N	154-58.33 E	Small CTD/RMS cast (500m)
	10:08	4	43-59.58 N	154-57.26 E	MER measurement
	10:21	4	43-59.58 N	154-57.26 E	FRRF measurement
	11:05	4	43-59.69 N	154-57.24 E	Multiple core sampling
	15:12	4	44-00.96 N	154-58.65 E	Large CTD/RMS cast (800m)
	16:51	4	44-01.36 N	154-57.61 E	Plankton net (0～200m)
	17:06	4	44-01.35 N	154-57.56 E	Plankton net (0～150m)
	17:22	4	44-01.32 N	154-57.54 E	Plankton net (0～500m)
	17:47	4	44-01.25 N	154-57.49 E	Plankton net (500～1000m)
	18:40	4	44-01.15 N	154-57.47 E	Plankton net (1000～1500m)

	19:50	4	44-00.80	N	154-57.30	E	Plankton net (250~500m)
	20:20	4	44-00.57	N	154-57.30	E	Plankton net (80~250m)
	20:55	4	44-00.22	N	154-57.20	E	Plankton net (0~80m)
	21:08	4	44-00.12	N	154-57.11	E	Large CTD/RMS cast (5100m)
	21:31	4	44-00.02	N	154-57.07	E	Surface water sampling
1/18	5:10	4	—	N	—	E	*In situ* incubation system recovery
	6:02	4	—	N	—	E	CREST drifting sediment trap recovery
	6:55	4	43-57.34	N	154-58.61	E	JAMSTEC drifting sediment trap recovery
							Departure from Stn. 4
	11:07	X-036	43-48.34	N	153-59.89	E	XBT deployment
	23:38	X-040	41-59.80	N	150.14.61	E	XBT deployment
1/19	4:03	X-041	41-00.00	N	150-00.90	E	XBT deployment
	8:55	X-042	40-00.01	N	149-16.34	E	XBT deployment
	11:22	XC-022	39-29.64	N	148-55.94	E	XCTD deployment
	13:45	X-043	38-59.99	N	148-33.28	E	XBT deployment
	16:03	XC-023	38-29.81	N	148-11.88	E	XCTD deployment
	18:15	X-044	37-59.96	N	147-51.38	E	XBT deployment
						E	
	20:30	**16**	**37-30.00**	**N**	**147-30.00**	**E**	Arrival at Station 16
	20:41	16	37-30.10	N	147-30.22	E	Small CTD/RMS cast (500m)
	21:21	16	37-30.63	N	147-30.74	E	Large CTD/RMS cast (3000m)
	23:25	16	37-30.96	N	147-30.10	E	Surface water sampling
1/20	0:20	16	37-30.99	N	147-32.77	E	Small CTD/RMS cast (5400m)
	4:00						Departure from Stn. 16
	5:58	X-045	36-59.97	N	147-29.45	E	XBT deployment
	8:07	X-046	36-30.08	N	147-31.14	E	XBT deployment
	10:35	X-047	36-00.05	N	147-30.62	E	XBT deployment
	13:02	X-048	35-30.00	N	147-29.90	E	XBT deployment
	15:24	**17**	**35-00.00**	**N**	**147-30.00**	**E**	Arrival at Station 17
	15:25	17	35-00.04	N	147-30.01	E	Small CTD/RMS cast (3000m)
	16:45	17	35-00.49	N	147-30.25	E	Surface water sampling
	17:36						Departure from Stn. 17
	19:25	X-049	34-50.52	N	148-00.05	E	XBT deploymnet
	21:11	X-050	34-40.75	N	148-30.03	E	XBT deploymnet
	23:01	X-051	34-29.79	N	149-00.02	E	XBT deploymnet
1/21	0:46	X-052	34-19.63	N	149-30.02	E	XBT deploymnet
	2:27	X-053	34-09.46	N	150-00.02	E	XBT deploymnet
	4:02	X-054	33-59.61	N	150-30.01	E	XBT deploymnet
	5:31	X-055	33-50.28	N	150-59.98	E	XBT deploymnet
	7:00	X-056	33-40.31	N	151-30.00	E	XBT deploymnet
	8:36	X-057	33-29.85	N	152-00.01	E	XBT deploymnet
	10:14	X-058	33-20.03	N	152-30.06	E	XBT deploymnet
	11:54	X-059	33-10.05	N	152-59.97	E	XBT deploymnet
	13:44	X-060	32-59.68	N	153-30.01	E	XBT deploymnet
	15:37	X-061	32-49.19	N	154-00.02	E	XBT deploymnet
	17:30	X-062	32-40.25	N	154-30.03	E	XBT deploymnet
1/23	9:48	**14**	**40-00.00**	**N**	**155-00.00**	**E**	Arrival at Station 14
	9:57	14	39-59.95	N	154-59.70	E	Small CTD/RMS cast (3000m)
	12:25	14	39-58.38	N	154-59.47	E	MER measurement
	12:40	14	39-58.38	N	154-59.71	E	FRRF measurement
	13:02	14	39-58.38	N	155-00.04	E	Small CTD/RMS cast (200m)
	13:13	14	39-58	N	155-00	E	Surface water sampling
	14:11	14	39-58.76	N	155-00.59	E	Small CTD/RMS cast (2000m)
	15:43	14	39-58.94	N	155-00.90	E	Small CTD/RMS cast (3000m)
	18:59	14	39-59.93	N	155-01.00	E	Small CTD/RMS cast (400m)
	19:08	14	40-00.02	N	155-00.97	E	Surface water sampling
	19:57	14	39-59.92	N	155-00.96	E	Large CTD/RMS cast (300m)
	21:09	14	39-59.80	N	155-00.26	E	Large CTD/RMS cast (500m)
	22:18						Departure from Stn. 14
1/24	0:48	X-063	40-30.01	N	155-30.21	E	XBT deployment
	3:16	XC-024	41-00.12	N	155-59.84	E	XCTD deployment
	5:44	X-064	41-31.16	N	156-28.43	E	XBT deployment
	7:58	XC-025	41-59.84	N	156-54.86	E	XCTD deployment
	10:25	X-065	42-30.03	N	157-22.98	E	XBT deployment
	12:52	XC-026	42-59.67	N	157-50.09	E	XCTD deployment
	15:22	X-066	43-30.05	N	158-17.30	E	XBT deployment
	18:03	XC-027	44-01.65	N	158-48.89	E	XCTD deployment
	20:23	X-067	44-30.23	N	159-17.92	E	XBT deployment
	22:47	XC-028	45-00.46	N	159-48.32	E	XCTD deployment
1/25	1:09	X-068	45-30.23	N	160-16.62	E	XBT deployment
	3:47	X-069	46-01.75	N	160-47.04	E	XBT deployment
	6:21	X-070	46-31.82	N	161-19.63	E	XBT deployment
	8:47	X-071	47-00.54	N	161-48.90	E	XBT deployment

	14:15	XC-029	47-59.35	N	162-53.47	E	XCTD deployment
	20:02	X-072	49-00.18	N	163-58.22	E	XBT deployment
1/26	1:30	**6**	**50-00.00**	**N**	**165-00.00**	E	Arrival at Station 6
	6:04	6	50-00.60	N	165-00.01	E	Drifting sediment trap deployment
	7:31	6	50-00.66	N	165-00.63	E	Large CTD/RMS cast (300m)
	8:30	6	50-01.01	N	165-00.33	E	Small CTD/RMS cast (500m)
	9:14	6	50-01.05	N	165-00.07	E	Large CTD/RMS cast (5300m)
	11:31	6	50-01.58	N	165-00.06	E	Surface water sampling
	13:02	6	50-01.88	N	165-00.14	E	MER measurement
	13:15	6	50-01.99	N	165-00.41	E	FRRF measurement
	13:37	6	50-02.04	N	165-00.70	E	Small CTD/RMS cast (200m)
	13:42	6	—	N	—	E	Surface water sampling
	14:42	6	50-02.29	N	165-00.26	E	Small CTD/RMS cast (5300m)
	15:41	6	---	N	—	E	Surface water sampling
	18:14	6	50-01.55	N	165-00.38	E	Plankton net (200m)
	18:30	6	50-01.44	N	165-00.31	E	Plankton net (150m)
	18:44	6	50-01.36	N	165-00.23	E	Plankton net (500m)
	19:25	6	50-01.34	N	164-59.96	E	Small CTD/RMS cast (50m)
	19:42	6	50-01.49	N	164-59.69	E	Large CTD/RMS cast (300m)
	20:30	6	50-01.54	N	164-59.45	E	Surface water sampling
	21:26	6	50-01.52	N	164-59.53	E	Small CTD/RMS cast (200m)
1/27	2:55	6	50-00.00	N	165-00.01	E	Small CTD/RMS cast (200m)
	5:30	6	50-05.07	N	165-58.99	E	Drifting sediment trap recovery
	7:06	6	50-00.02	N	165-00.09	E	MER measurement
	7:18	6	50-00.15	N	165-00.24	E	FRRF measurement
	7:21	6	50-00.18	N	165-00.29	E	Surface water sampling
	7:.30						Deaparture from Stn. 6
	9:39	X-073	49-29.97	N	165-00.60	E	XBT deployment
	11:38	XC-029	48-59.99	N	165-00.02	E	XCTD deployment
	13:50	X-074	48-30.00	N	165-00.85	E	XBT deployment
	16:00	XC-030	48-00.00	N	165-00.71	E	XCTD deployment
	18:14	X-075	47-29.98	N	165-00.81	E	XBT deployment
	20:27	XC-031	47-00.34	N	165-00.10	E	XCTD deployment
	22:42	X-076	46-29.98	N	165-00.35	E	XBT deployment
1/28	0:50	XC-033	46-00.02	N	165-00.09	E	XCTD deployment
	2:54	X-077	45-29.96	N	165-00.30	E	XBT deployment
	5:12	**7**	**45-00.00**	**N**	**165-00.00**	**E**	Arrival at Station 7
	7:57	7	45-00.08	N	165-00.08	E	Small CTD/RMS cast (200m)
	8:47	7	44-59.83	N	164-59.78	E	Small CTD/RMS cast (200m)
	9:16	7	44-59.91	N	164-59.86	E	MER measurement
	9:28	7	45-00.05	N	164-59.96	E	FRRF measurement
	9:31	7	45-00.22	N	165-00.22	E	Surface water sampling
	9:53	7	45-00.25	N	165-00.49	E	Small CTD/RMS cast (3000m)
	11:57	7	45-00.50	N	165-00.71	E	Large CTD/RMS cast (3000m)
	13:43	7	—	N	—	E	Surface water sampling
	16:26	7	44-59.75	N	165-00.12	E	Small CTD/RMS cast (300m)
	17:42	7	44-59.69	N	165-00.51	E	Large CTD/RMS cast (200m)
	18:30						Departure from Stn. 7
	20:27	X-078	44-29.94	N	165-00.15	E	XBT deployment
	22:12	XC-034	44-00.01	N	165-00.18	E	XCTD deployment
1/29	0:17	X-079	43-29.97	N	164-59.94	E	XBT deployment
	2:12	XC-035	43-00.01	N	165-00.27	E	XCTD deployment
	4:07	X-080	42-29.99	N	164-59.46	E	XBT deployment
	5:58	XC-036	42-00.01	N	165-00.04	E	XCTD deployment
	7:50	X-081	41-30.00	N	165-00.04	E	XBT deployment
	9:43	XC-037	40-59.96	N	164-59.96	E	XCTD deployment
	9:50		40-59.11	N	164-59.96	E	P-ALACE deployment
	11:46	X-082	40-29.98	N	165-00.07	E	XBT deployment
	13:42	**8**	**40-00.00**	**N**	**165-00.00**	**E**	Arrival at Station 8
	13:47	8	40-00.22	N	165-00.37	E	Drifting sediment trap deployment
	14:34	8	40-00.68	N	165-00.24	E	Small CTD/RMS cast (200m)
	15:01	8	40-00.90	N	165-00.27	E	Large CTD/RMS cast (5300m)
	17:50	8	40-01.88	N	165-00.45	E	Surface water sampling
	18:49	8	50-00.91	N	165-01.61	E	Small CTD/RMS cast (3000m)
	5:30	8	40-00.67	N	165-00.43	E	Drifting sediment trap recovery
	10:03	8	40-00.61	N	165-00.58	E	MER measurement
	10:16	8	40-00.57	N	165-00.88	E	FRRF measurement
	10:35	8	40-00.53	N	165-00.96	E	Plankton net (200m)
	10:48	8	40-00.50	N	165-00.78	E	Plankton net (150m)
	11:01	8	40-00.45	N	165-00.65	E	Plankton net (500m)
	11:30	8	40-00.39	N	165-00.64	E	Small CTD/RMS cast (200m)
	11:33	8	40-00.36	N	165-00.67	E	Surface water sampling
	11:58	8	40-00.22	N	165-00.32	E	Large CTD/RMS cast (300m)
	12:54	8	40-00.36	N	164-59.98	E	Small CTD/RMS cast (200m)
	13:20	8	40-00.22	N	164-59.83	E	Large CTD/RMS cast (1000m)
	14:00	8	—	N	—	E	Surface water sampling
	15:30	8	40-01.83	N	165-06.32	E	Drifting sediment trap recovery

	16:30	8				SEABEAM survey
	2:54	8	39-59.87	N	165-00.00 E	Small CTD/RMS cast (200m)
1/31	5:25	8	40-00.67	N	165-04.66 E	Time series sediment trap deployment
	6:55	8	40-00.21	N	165-00.73 E	P-ALACE deployment
	7:00					Departure from Stn. 8
	9:00	X-083	40-30.04	N	164-59.26 E	XBT deployment
	11:01	XC-038	41-01.28	N	164-55.35 E	XCTD deployment
	12:59	X-084	41-30.08	N	164-55.55 E	XBT deployment
	15:06	XC-039	41-59.99	N	164-54.25 E	XCTD deployment
	17:51	X-085	42-13.34	N	164-29.93 E	XBT deployment
	20:16	XC-040	42-20.19	N	164-00.02 E	XCTD deployment
	22:54	X-086	42-28.78	N	163-29.97 E	XBT deployment
2/1	1:29	XC-041	42-37.43	N	163-00.02 E	
	4:15	X-087	42-45.74	N	162.30.03 E	
	7:14	XC-042	42-46.63	N	161-59.99 E	
	10:02	X-088	42-43.59	N	161-29.99 E	
	12:34	XC-043	42-41.33	N	160-59.99 E	
	16:04	X-089	42-54.72	N	160-30.03 E	
	19:30	XC-044	43-07.49	N	160-00.01 E	
	21:55	X-090	43-08.07	N	159-29.94 E	
2/2	0:14	XC-045	43-08.69	N	159-00.05 E	
	2:39	X-091	43-08.93	N	158-30.02 E	
	5:03	XC-046	43-08.77	N	158-00.03 E	
	7:39	X-092	43-08.13	N	157-30.03 E	
	10:07	XC-047	43-07.30	N	156-59.97 E	
	12:29	X-093	43-08.17	N	156-30.00 E	
	15:01	XC-048	43-13.26	N	156-00.01 E	
	17:48	X-094	43-19.03	N	155-30.01 E	
	21:11	XC-049	43-29.96	N	155-00.28 E	
2/3	1:06	XC-050	43-59.94	N	154-59.75 E	
	5:13	XC-051	44-29.99	N	154-59.99 E	
	22:18	**5(KNOT-N)**	**44-30.00**	**N**	**155-00.00 E**	Arrival at Station KNOT-N
2/4	2:22	5	44-30.04	N	155-00.02 E	Small CTD/RMS cast (2000m)
	3:27	5		N	E	Surface water sampling
	4:00					Departure from Stn. KNOT-N
	6:06	**4(KNOT-2)**	**44-00.00**	**N**	**155-00.00 E**	Arrival at Station KNOT again
	6:18	4	43-59.99	N	154-59.93 E	Small CTD/RMS cast (500m)
	7:02	4	43-59.86	N	154-59.43 E	Plankton net (200m)
	7:14	4	43-59.81	N	154-59.40 E	Plankton net (150m)
	7:27	4	43-59.72	N	154-59.26 E	Plankton net (500m)
	8:02	4	43-59.75	N	154-59.14 E	Large CTD/RMS cast (300m)
	8:22	4	43-59.77	N	154-59.09 E	Surface water samping
	8:57	4	43-59.93	N	154-58.77 E	MER measurement
	9:08	4	43-59.90	N	154-58.68 E	FRRF measurement
	9:32	4	43-59.81	N	154-58.40 E	Small CTD/RMS cast (200m)
	9:37	4	43-59.72	N	154-58.20 E	Surface water samping
	10:00	4	43-59.90	N	154-58.17 E	Large CTD/RMS cast (800m)
	11:36	4	44-00.79	N	154-58.30 E	Drifting sediment trap calibration
	14:05	4	44-00.10	N	155-00.01 E	Large CTFD/RMS cast (5100m)
	17:50	4	43-59.84	N	155-00.07 E	Small CTD/RMS cast (200m)
	18:12					Departure from Stn. KNOT-2
	20:12	**3(KNOT-S)**	**43-30.00**	**N**	**155-00.10 E**	Arrival at Station 3
	20:19	3	43-30.10	N	155-00.10 E	Small CTD/RMS cast (2000m)
	21:17	3	43-30.34	N	155-0.31 E	Surface water sampling
	21:42					Departure from Stn. 3
	23:21	X-095	43-30.66	N	154-30.03 E	XBT deployment
2/5	0:54	XC-052	43-59.90	N	154-00.03 E	XCTD deployment
	2:27	X-096	43-23-61	N	153-30.03 E	XBT deployment
	11:56	X-099	42-50.06	N	150-29.93 E	XBT deployment
	13:27	XC-056	42-44.38	N	150-00.04 E	XCTD deployment
	15:03	X-100	42-38.20	N	149-30.01 E	XBT deployment
	16:39	XC-057	42-31.83	N	149-00.03 E	XCTD deployment
	18:16	X-101	42-25.76	N	148-29.91 E	XBT deployment
	19:49	XC-058	42-19.24	N	148-00.01 E	XCTD deployment
	21:26	X-102	42-13.89	N	147-29.74 E	XBT deployment
	22:56	XC-059	42-09.90	N	146-59.98 E	XCTD deployment
2/6	0:28	X-103	42-03.74	N	146-29.85 E	XBT deployment
	1:59	XC-060	41-57.48	N	145-59.87 E	XCTD deployment
	3:29	X-104	41-53.14	N	145-29.91 E	XBT deployment
	4:56	XC-061	41-47.57	N	144-59.99 E	XCTD deployment
2/7	8:15					Arrival at Sekinehama

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3 Observation

3.1 Meteorological observation

Satoshi Okumura
(Global Ocean Development Inc.)

(1) Introduction

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

Name	Sampling Interval	Acronyms in Table 3.1.2
Wind direction	6 sec./10 min. averaged	WD
Wind speed	6 sec./10 min. averaged	WS
Weather	3 hourly	Weather
Pressure (adjusted to the sea surface level)		
	6 sec./10 min. averaged	P
Air temperature	6 sec./10 min. averaged	T
Dewpoint temperature	6 sec./10 min. averaged	DPT
Relative humidity	6 sec./10 min. averaged	RH
Sea surface temperature	6 sec./10 min. averaged	SST
Rainfall amount	3 hourly (accumulated)	Rain
Significant wave height	3 hourly (20 min. averaged)	Wv. Ht.
Significant wave period	3 hourly (20 min. averaged)	Wv. Pd.

(2) Methods

The meteorological sensors onboard R/V Mirai are listed in Table 3.1.1. Surface meteorological data were collected and processed by KOAC-7800 weather data processor and some sensors assembled by Koshin Denki, Japan.

Table 3.1.1

Sensors	Type	Maker	Location (Altitude from surface)
Anemometer:	KE-500	Koshin Denki, Japan	Foremast (24m)
Thermometer:	FT	Koshin Denki, Japan	Compass Deck (19m)
Dew point meter:	DW-1	Koshin Denki, Japan	Compass Deck (19m)
Barometer:	F-451	Yokogawa, Japan	Weather observation room
			Captain Deck (13m)
Rain gauge:	50202	Young, U.S.A.	Compass Deck (19m)
Optical Rain gauge:	ORG-115DR	SCTI, U.S.A.	Compass Deck (19m)
Radiometer:	MS-801 (short wave)		
	MS-200 (long wave)	Eiko Seiki, Japan	Radar mast (28m)
Wave height meter:	MW-2	Tsurumi-seiki, Japan	Bow

(3) Preliminary Results

Table 3.1.2 shows the part of the observation results for the permanent sensors.

(4) Data Archive

The dataset with 6 seconds, 10 minutes and 1hour interval are available in the 3.5' magnetic optical (MO) disk. The dataset will be submitted to the DMO (Data Management Office), JAMSTEC and will be under their control.

Time				Position		Weather	WD	WS	P	T	DPT	RH	SST	Rain	Wv.Ht.	Wv.Pd.
UTC		ship		Lat.	Long.		(deg)	(m/s)	(hPa)	(deg.C)	(deg.C)	(%)	(deg.C)	(mm/3h)	(m)	(sec)
5-Jan	21:00	6-Jan	6:00	41-21 N	141-14 E	c	100	6.6	1025.4	3.5	-3.5	60	9.3	0.0	0.2	8
6-Jan	0:00		9:00	41-21 N	141-14 E	c	130	4.9	1025.1	3.7	-2.3	65	9.0	0.0	0.2	7
	3:00		12:00	41-12 N	141-46 E	o	120	13.9	1022.9	4.0	-1.8	66	12.3	0.0	1.2	5
	6:00		15:00	40-32 N	142-08 E	o	140	13.5	1021.1	5.7	-0.5	65	11.5	0.0	1.7	7
	9:00		18:00	39-59 N	142-30 E	o	150	13.8	1020.6	6.4	1.9	73	8.1	0.0	2.1	8
	12:00		21:00	39-57 N	142-29 E	o	140	12.3	1017.7	6.8	4.1	83	8.1	1.3	2.6	9
	15:00	7-Jan	0:00	40-15 N	142-46 E	r	150	16.4	1014.3	7.9	6.1	88	8.5	0.4	4.1	10
	18:00		3:00	40-30 N	142-59 E	r	160	10.9	1011.6	8.7	7.7	93	8.1	3.5	3.8	99
	21:00		6:00	40-28 N	142-59 E	r	150	14.8	1006.9	9.1	9.5	100	8.1	1.6	3.7	10
7-Jan	0:00		9:00	40-09 N	142-39 E	o	180	11.1	1005.6	8.5	9.4	100	6.8	1.1	4.3	12
	3:00		12:00	39-58 N	142-28 E	o	340	6.8	1004.7	9.1	7.4	89	7.7	0.0	3.0	10
	6:00		15:00	39-20 N	142-28 E	o	360	13.6	1008.0	8.9	6.7	86	8.3	0.0	3.7	10
	9:00		18:00	38-35 N	142-30 E	o	360	12.2	1011.0	7.5	4.9	84	8.0	0.0	4.6	11
	12:00		21:00	37-48 N	142-30 E	c	360	8.3	1013.2	7.8	5.6	86	9.1	0.0	3.2	12
	15:00	8-Jan	0:00	37-30 N	142-29 E	bc	360	8.8	1013.7	8.5	3.3	70	18.2	0.0	2.7	10
	18:00		3:00	37-26 N	142-29 E	bc	360	9.1	1014.3	8.2	2.4	67	17.8	0.0	3.1	14
	21:00		6:00	36-48 N	142-30 E	o	10	8.7	1015.1	10.8	3.9	62	20.1	0.0	4.0	19
8-Jan	0:00		9:00	36-10 N	142-29 E	c	60	6.2	1016.2	13.0	7.1	67	20.7	0.0	3.7	15
	3:00		12:00	35-28 N	142-29 E	c	90	7.0	1014.2	15.1	10.0	72	19.4	0.0	3.6	15
	6:00		15:00	35-00 N	142-30 E	c/p	190	4.8	1014.6	17.6	10.8	64	20.0	0.0	3.7	12
	9:00		18:00	35-02 N	142-32 E	c	250	11.5	1015.4	17.0	7.0	52	20.0	0.0	3.4	11
	12:00		21:00	35-02 N	142-31 E	c	270	13.8	1016.4	17.2	6.4	49	20.0	0.0	3.3	10
	15:00	9-Jan	0:00	34-27 N	142-30 E	bc	270	15.9	1016.3	16.7	7.6	55	19.9	0.0	3.6	11
	18:00		3:00	33-43 N	142-29 E	bc	280	12.6	1018.9	16.5	8.6	60	20.0	0.0	3.6	12
	21:00		6:00	32-57 N	142-29 E	bc	300	8.5	1020.4	16.4	9.9	66	20.6	0.0	3.0	16
9-Jan	0:00		9:00	32-30 N	142-29 E	bc	330	5.9	1021.6	17.0	8.6	58	20.5	0.0	2.8	10
	3:00		12:00	32-31 N	142-28 E	bc	330	5.7	1020.8	16.9	8.0	56	20.4	0.0	2.6	10
	6:00		15:00	32-31 N	142-29 E	c	10	2.9	1020.0	16.7	8.6	59	20.4	0.0	2.4	10
	9:00		18:00	32-29 N	142-33 E	c	100	0.9	1021.3	16.6	8.0	57	20.5	0.0	2.3	10
	12:00		21:00	32-30 N	143-29 E	o	120	2.2	1021.5	17.3	8.3	56	20.5	0.0	2.9	11
	15:00	10-Jan	0:00	32-29 N	144-26 E	o	90	5.2	1019.2	17.4	10.1	62	20.2	0.0	2.7	12
	18:00		3:00	32-29 N	145-21 E	o	100	7.7	1017.6	18.2	12.8	71	19.8	0.0	2.5	9
	21:00		6:00	32-29 N	146-15 E	o	110	6.3	1018.2	17.9	14.0	78	19.5	0.0	2.0	9
10-Jan	0:00		9:00	32-29 N	147-09 E	o	110	7.5	1017.2	18.7	14.7	77	19.3	0.0	2.1	7
	3:00		12:00	32-29 N	147-30 E	c	120	6.6	1013.5	19.2	15.9	81	19.3	0.0	2.5	8
	6:00		15:00	32-28 N	147-33 E	c	170	5.1	1012.0	18.9	16.5	86	19.3	0.0	2.6	8
	9:00		18:00	32-27 N	147-34 E	o	240	5.9	1011.4	18.3	16.6	90	19.3	0.0	2.4	9
	12:00		21:00	32-58 N	147-29 E	o	210	9.6	1010.1	17.8	16.4	92	18.9	0.0	2.7	12
	15:00	11-Jan	0:00	33-40 N	147-29 E	o	240	10.1	1008.4	17.8	16.7	94	18.7	0.0	2.2	13
	18:00		3:00	34-23 N	147-29 E	o	340	15.0	1008.7	15.8	11.6	76	19.3	0.0	2.1	9
	21:00		6:00	35-00 N	147-29 E	o	340	15.7	1012.4	12.9	5.9	52	19.4	0.5	3.6	7
11-Jan	0:00		9:00	35-27 N	147-30 E	bc	340	14.0	1015.0	11.1	4.1	62	19.3	0.0	3.7	9
	3:00		12:00	36-04 N	147-30 E	bc	320	14.1	1014.8	10.5	1.2	53	20.1	0.0	3.7	9
	6:00		15:00	36-42 N	147-31 E	c	300	16.4	1016.0	9.5	-0.6	49	15.0	0.1	4.6	10
	9:00		18:00	37-14 N	147-30 E	c	300	19.1	1017.4	8.7	-0.5	52	15.3	0.0	5.7	11
	12:00		21:00	37-35 N	147-02 E	bc	300	16.8	1019.6	6.7	-1.9	54	15.5	0.4	6.6	12
	15:00	12-Jan	0:00	37-57 N	146-32 E	o	310	14.8	1021.2	5.8	-1.1	61	15.3	0.9	4.3	8
	18:00		3:00	38-19 N	146-01 E	c	310	11.7	1021.9	5.1	-2.2	59	15.3	0.0	5.6	10
	21:00		6:00	38-42 N	145-29 E	o	300	10.8	1023.5	4.5	-4.2	53	13.2	0.0	6.6	10
12-Jan	0:00		9:00	39-07 N	144-55 E	o	300	13.4	1025.4	4.1	-3.5	58	13.9	0.0	5.6	10
	3:00		12:00	39-32 N	144-20 E	o	320	11.7	1025.1	2.5	-2.8	68	13.5	0.1	4.1	9
	6:00		15:00	39-57 N	143-44 E	o	340	7.8	1026.2	1.3	-3.9	69	8.6	0.0	1.6	4
	9:00		18:00	40-29 N	143-00 E	c	20	6.3	1027.2	0.5	-6.2	61	5.1	0.0	1.0	4
	12:00		21:00	40-27 N	143-24 E	c	120	1.9	1027.7	0.8	-6.6	58	8.8	0.0	1.2	13
	15:00	13-Jan	0:00	40-20 N	144-21 E	c	140	2.4	1026.0	2.8	-5.5	55	13.8	0.0	1.6	13
	18:00		3:00	40-14 N	145-21 E	o	120	6.9	1025.3	2.1	-5.3	58	5.5	0.0	1.6	15
	21:00		6:00	40-07 N	146-19 E	o	100	8.7	1024.9	3.6	-2.8	63	7.4	0.0	1.9	14
13-Jan	0:00		9:00	40-01 N	147-18 E	o	110	11.2	1024.1	5.1	-0.9	65	6.4	0.0	1.6	9
	3:00		12:00	40-00 N	147-31 E	o	110	11.5	1021.2	7.3	3.0	74	7.2	0.0	1.8	8
	6:00		15:00	40-01 N	147-33 E	r	110	13.3	1017.5	7.4	5.8	90	7.2	0.2	2.2	7
	9:00		18:00	40-12 N	147-55 E	o	140	14.0	1015.9	9.1	8.1	94	9.8	0.3	2.5	8
	12:00		21:00	40-34 N	148-43 E	o	150	22.4	1014.9	10.9	7.5	80	12.8	3.4	3.7	9
	15:00	14-Jan	0:00	40-56 N	149-32 E	o	150	20.1	1013.1	10.5	6.7	77	10.1	0.2	4.5	10
	18:00		3:00	41-20 N	150-21 E	o	150	17.2	1011.6	7.6	4.6	81	4.7	0.0	3.7	10
	21:00		6:00	41-43 N	151-10 E	o	150	20.3	1011.0	9.2	5.8	79	9.0	0.4	4.5	12
14-Jan	0:00		9:00	42-05 N	151-58 E	o	150	18.7	1011.2	8.6	5.6	81	6.1	0.1	5.0	10
	3:00		12:00	42-25 N	152-41 E	o	150	20.2	1007.4	8.9	5.9	82	7.5	4.1	4.8	10
	6:00		15:00	42-45 N	153-23 E	o	150	22.1	1005.1	9.5	7.6	88	8.6	7.2	5.6	11
	9:00		18:00	43-04 N	154-03 E	o	150	21.7	1004.4	8.5	8.9	100	8.4	5.4	7.3	11

Table3.1.2-1

Time UTC		Time ship		Position Lat.	Position Long.	Weather	WD (deg)	WS (m/s)	P (hPa)	T (deg.C)	DPT (deg.C)	RH (%)	SST (deg.C)	Rain (mm/3h)	Wv.Ht. (m)	Wv.Pd. (sec)
14-Jan	12:00	14-Jan	21:00	43-21 N	154-41 E	r	150	20.4	1003.7	8.3	8.2	100	7.9	8.9	6.9	11
	15:00	15-Jan	0:00	43-48 N	155-00 E	r	220	13.4	1005.1	6.5	7.3	100	3.9	1.5	5.8	14
	18:00		3:00	44-23 N	155-01 E	o	220	10.7	1008.7	2.5	2.6	100	2.6	0.0	5.8	14
	21:00		6:00	44-13 N	155-00 E	bc	220	9.2	1011.4	3.7	2.4	91	3.3	0.0	5.5	10
15-Jan	0:00		9:00	43-49 N	154-59 E	bc	230	6.9	1014.2	4.7	3.2	90	3.7	0.0	4.6	10
	3:00	15-Jan	12:00	44-06 N	154-59 E	o	260	9.5	1013.9	3.3	1.0	85	3.6	0.0	4.5	12
	6:00		15:00	43-59 N	155-00 E	o	290	6.3	1016.0	2.6	-0.1	82	3.8	0.0	3.6	9
	9:00		18:00	43-54 N	155-00 E	o	330	9.8	1015.4	2.2	-0.3	83	3.9	0.0	4.0	11
	12:00		21:00	44-10 N	155-00 E	o	360	5.6	1016.8	1.8	-1.8	77	3.7	0.0	3.7	9
	15:00	16-Jan	0:00	43-46 N	154-59 E	o	10	12.5	1013.9	1.4	-1.5	81	3.6	0.0	3.5	11
	18:00		3:00	44-11 N	154-57 E	o	10	10.6	1013.5	1.4	-2.2	77	3.7	0.0	3.2	11
	21:00		6:00	44-00 N	154-59 E	o	10	13.3	1013.0	1.2	-1.1	85	3.7	0.1	3.1	10
16-Jan	0:00		9:00	44-01 N	155-00 E	o	360	13.1	1011.5	1.4	-0.9	85	3.6	0.0	2.9	8
	3:00		12:00	44-00 N	155-01 E	o	360	15.3	1008.5	1.3	-2.6	75	3.8	0.0	3.0	8
	6:00		15:00	43-59 N	154-59 E	o	360	15.7	1009.2	1.4	-3.0	73	3.7	0.0	3.3	8
	9:00		18:00	43-58 N	154-58 E	o	350	14.3	1009.3	0.3	-1.2	90	3.7	0.3	3.4	8
	12:00		21:00	43-57 N	154-57 E	o	330	16.3	1009.8	0.5	-1.8	85	3.7	0.1	3.3	8
	15:00	17-Jan	0:00	43-59 N	154-55 E	o	330	15.9	1009.6	0.5	-2.7	80	3.7	0.0	3.5	7
	18:00		3:00	43-59 N	155-00 E	o	320	12.5	1010.5	0.7	-6.4	59	3.7	0.0	3.2	7
	21:00		6:00	43-59 N	154-59 E	o	330	12.8	1011.7	-0.3	-5.9	66	3.6	0.0	2.9	7
17-Jan	0:00		9:00	44-00 N	154-58 E	o	330	10.4	1012.9	-0.1	-5.4	67	3.5	0.0	2.7	7
	3:00		12:00	44-00 N	154-57 E	o	300	11.5	1013.2	0.0	-5.7	65	3.5	0.0	2.4	7
	6:00		15:00	44-01 N	154-58 E	o	290	8.4	1014.5	0.2	-8.0	54	3.4	0.0	2.2	7
	9:00		18:00	44-01 N	154-57 E	o	300	6.3	1015.9	0.0	-6.9	60	3.4	0.0	2.1	7
	12:00		21:00	44-00 N	154-57 E	o	310	2.6	1016.1	0.4	-8.1	53	3.4	0.0	2.0	7
	15:00	18-Jan	0:00	43-59 N	154-56 E	o	200	3.6	1016.3	0.2	-4.4	72	3.4	0.1	2.0	7
	18:00		3:00	43-58 N	155-01 E	o	110	3.9	1015.0	0.0	-3.3	79	3.5	0.0	1.5	7
	21:00		6:00	43-57 N	154-59 E	o	130	8.5	1014.1	1.3	1.1	98	3.7	0.8	1.5	8
18-Jan	0:00		9:00	43-55 N	154-44 E	r	260	2.8	1014.1	1.9	1.2	95	3.6	0.3	1.9	9
	3:00		12:00	43-45 N	153-41 E	s	20	2.5	1011.0	0.1	-0.8	94	3.1	1.1	1.6	10
	6:00		15:00	43-33 N	152-38 E	s	50	11.3	1008.0	0.5	-0.4	94	3.4	0.1	1.6	8
	9:00		18:00	43-18 N	151-36 E	s	40	12.5	1005.1	0.2	0.2	100	3.4	5.7	2.0	19
	12:00		21:00	42-36 N	151-07 E	s	10	19.1	1001.3	0.2	-0.4	96	3.1	0.0	3.3	22
	15:00	19-Jan	0:00	41-54 N	150-37 E	o	360	21.5	999.9	1.4	0.1	91	4.0	4.1	3.9	20
	18:00		3:00	41-13 N	150-09 E	o	340	19.9	1003.5	1.7	-1.1	82	3.8	0.0	6.7	18
	21:00		6:00	40-35 N	149-41 E	o	340	18.6	1007.7	3.0	-2.7	66	13.0	0.0	6.6	18
19-Jan	0:00		9:00	39-58 N	149-15 E	o	330	15.3	1011.4	3.3	-4.6	56	12.4	0.0	7.5	18
	3:00		12:00	39-22 N	148-50 E	o	340	10.7	1012.9	4.0	-3.7	58	15.4	0.0	5.2	18
	6:00		15:00	38-43 N	148-22 E	o	340	9.0	1014.5	6.0	-2.6	54	17.0	0.0	4.4	19
	9:00		18:00	38-03 N	147-53 E	o	360	4.5	1016.5	7.1	-2.0	53	15.3	0.0	3.5	20
	12:00		21:00	37-30 N	147-30 E	o	100	4.9	1016.9	8.1	-1.0	53	14.2	0.0	3.1	98
	15:00	20-Jan	0:00	37-30 N	147-32 E	bc	130	8.2	1015.0	9.1	1.2	58	14.4	0.0	2.8	9
	18:00		3:00	37-32 N	147-32 E	c	130	13.9	1011.3	10.1	3.3	63	14.1	0.0	2.8	10
	21:00		6:00	36-59 N	147-29 E	r	150	18.2	1008.2	12.9	7.6	70	14.8	1.0	2.7	9
20-Jan	0:00		9:00	36-18 N	147-31 E	r	190	12.5	1009.1	13.3	12.6	95	18.2	5.5	3.1	9
	3:00		12:00	35-42 N	147-30 E	o	220	15.0	1005.2	15.9	13.1	83	19.0	0.3	3.2	10
	6:00		15:00	35-04 N	147-29 E	o/o	310	12.4	1005.9	14.3	12.2	87	19.1	1.5	3.3	11
	9:00		18:00	34-59 N	147-35 E	o	280	13.7	1006.8	16.6	8.1	57	19.1	0.1	3.4	13
	12:00		21:00	34-41 N	148-26 E	o	260	13.7	1007.5	13.7	9.4	75	18.9	0.6	3.4	16
	15:00	21-Jan	0:00	34-24 N	149-16 E	o	270	16.6	1006.6	15.2	10.2	72	18.9	0.1	4.1	16
	18:00		3:00	34-06 N	150-10 E	o	270	16.5	1006.4	15.5	8.3	63	19.2	0.0	5.3	21
	21:00		6:00	33-46 N	151-10 E	bc	260	16.6	1007.4	15.6	9.0	65	19.3	0.0	4.7	19
21-Jan	0:00		9:00	33-27 N	152-07 E	c	260	16.3	1008.5	15.3	9.9	70	18.9	0.3	4.2	18
	3:00		12:00	33-09 N	153-01 E	c	270	15.6	1006.0	16.2	10.2	67	18.9	0.0	5.7	18
	6:00		15:00	32-52 N	153-50 E	bc	270	13.8	1006.3	16.8	8.6	58	18.9	0.0	8.1	17
	9:00		18:00	32-37 N	154-38 E	o	280	14.0	1007.2	15.1	9.7	70	18.7	1.0	6.2	17
	12:00		21:00	32-48 N	155-01 E	c	270	13.4	1005.9	15.8	9.1	65	18.8	0.0	5.3	10
	15:00	22-Jan	0:00	33-29 N	155-02 E	o	300	13.2	1004.9	12.8	7.7	72	16.8	0.4	5.2	12
	18:00		3:00	34-09 N	154-59 E	c	290	13.4	1005.7	11.6	5.4	66	17.9	0.4	4.5	10
	21:00		6:00	34-49 N	155-02 E	bc	290	13.1	1005.9	11.2	4.6	64	16.7	5.0	5.3	11
22-Jan	0:00		9:00	35-23 N	154-59 E	bc	350	11.0	1012.4	9.5	1.1	55	15.3	0.7	6.4	12
	3:00		12:00	35-55 N	155.00 E	bc	330	14.4	1013.7	8.4	-1.7	49	17.0	0.0	6.6	13
	6:00		15:00	36-28 N	155-01 E	c	320	18.0	1016.0	6.7	-1.2	57	17.3	0.3	5.5	11
	9:00		18:00	36-57 N	155-01 E	c	300	18.2	1018.9	4.6	-1.1	67	12.7	0.1	5.6	11
	12:00		21:00	37-30 N	155-00 E	c	320	16.1	1021.4	5.2	-4.6	49	13.4	0.0	5.8	11
	15:00	23-Jan	0:00	38-05 N	155-00 E	bc	310	15.2	1021.9	4.4	-4.9	51	14.0	0.1	7.1	11
	18:00		3:00	38-39 N	155-00 E	c	300	15.5	1022.7	4.2	-3.3	58	13.7	0.0	5.6	10
	21:00		6:00	39-15 N	154-59 E	o	310	11.8	1023.9	4.0	-3.6	58	13.6	0.3	4.1	10
23-Jan	0:00		9:00	39-50 N	154-59 E	c	290	11.1	1023.3	3.3	0.3	81	11.9	0.4	4.8	10
	3:00		12:00	39-58 N	154-59 E	c	280	8.5	1021.2	5.9	-1.4	59	12.0	0.0	4.2	10

Table3.1.2-2

Time UTC		Time ship		Position Lat.	Position Long.	Weather	WD (deg)	WS (m/s)	P (hPa)	T (deg.C)	DPT (deg.C)	RH (%)	SST (deg.C)	Rain (mm/3h)	Wv.Ht. (m)	Wv.Pd. (sec)
23-Jan	6:00	23-Jan	15:00	39-58 N	155-00 E	o	310	6.2	1021.1	5.1	1.2	76	12.1	0.0	3.4	10
	9:00		18:00	39-59 N	155-01 E	o	290	5.1	1021.4	5.6	0.0	68	12.1	0.0	3.2	10
	12:00		21:00	39-59 N	155-00 E	bc	230	6.3	1021.0	6.2	0.3	66	12.1	0.0	2.9	9
	15:00	24-Jan	0:00	40-20 N	155-20 E	o	210	8.2	1017.9	7.8	1.2	63	12.1	0.0	3.2	10
	18:00		3:00	40-57 N	155-57 E	o	210	7.8	1013.8	7.1	2.4	72	8.9	0.2	3.3	9
	21:00		6:00	41-34 N	156-31 E	c	210	11.6	1010.0	6.3	3.3	81	7.5	0.0	2.9	13
24-Jan	0:00		9:00	42-12 N	157-06 E	r	250	14.8	1008.1	5.5	4.7	94	8.6	1.4	3.6	12
	3:00		12:00	42-49 N	157-40 E	o	340	14.4	1005.0	2.3	-1.0	79	9.1	0.0	4.3	13
	6:00		15:00	43-25 N	158-13 E	o	320	12.7	1007.1	-0.7	-4.2	77	6.7	0.5	4.3	12
	9:00		18:00	44-01 N	158-48 E	o	300	14.4	1007.7	-2.1	-7.7	65	4.9	0.3	4.1	11
	12:00		21:00	44-38 N	159-25 E	o	290	15.4	1006.7	-2.5	-9.7	58	4.6	0.0	3.6	11
24-Jan	15:00	25-Jan	0:00	45-15 N	160-02 E	o	290	15.6	1004.8	-2.8	-12.2	49	3.3	0.0	4.2	12
	18:00		3:00	45-53 N	160-38 E	o	290	13.8	1002.5	-3.5	-9.9	61	3.0	0.0	4.2	12
	21:00		6:00	46-28 N	161-16 E	o	290	11.1	1000.4	-3.8	-11.3	56	3.0	0.2	4.0	12
25-Jan	0:00		9:00	47-02 N	161-51 E	c	270	8.7	998.1	-3.0	-11.8	51	3.7	0.0	3.7	12
	3:00		12:00	47-36 N	162-28 E	o	290	8.6	994.5	-3.4	-12.6	49	2.6	0.0	3.6	12
	6:00		15:00	48-07 N	163-01 E	o	310	7.1	992.1	-3.6	-12.1	52	2.7	0.0	3.7	11
	9:00		18:00	48-38 N	163-35 E	o	310	8.7	990.9	-3.9	-11.3	56	2.8	0.2	3.0	12
	12:00		21:00	49-11 N	164-08 E	s	260	7.3	989.9	-5.4	-9.9	71	2.7	0.2	3.3	12
	15:00	26-Jan	0:00	49-43 N	164-43 E	s	340	8.1	988.8	-7.2	-9.4	85	2.0	4.9	2.8	11
	18:00		3:00	50-00 N	164-59 E	s/o	290	2.5	988.0	-6.6	-9.3	81	2.6	8.5	2.6	8
	21:00		6:00	50-00 N	165-00 E	o	330	11.0	989.0	-5.4	-11.4	62	2.6	1.4	2.4	8
26-Jan	0:00		9:00	50-00 N	165-00 E	bc	310	9.8	989.4	-5.1	-17.2	38	2.7	0.0	2.5	8
	3:00		12:00	50-01 N	165-00 E	bc	290	8.0	988.9	-5.3	-19.1	33	2.7	0.0	2.7	9
	6:00		15:00	50-02 N	165-00 E	o	230	4.3	989.3	-5.5	-17.6	38	2.7	0.0	2.2	8
	9:00		18:00	50-01 N	165-00 E	s	250	3.9	988.9	-6.7	-9.7	79	2.7	0.9	2.2	8
	12:00		21:00	50-01 N	164-59 E	s	230	6.4	988.4	-5.8	-10.5	70	2.6	0.0	2.3	9
	15:00	27-Jan	0:00	50-02 N	165-00 E	bc	250	5.0	987.3	-4.9	-13.3	52	2.7	0.0	2.6	9
	18:00		3:00	50-00 N	164-59 E	o	280	7.9	987.5	-5.3	-13.1	55	2.7	0.1	2.6	8
	21:00		6:00	50-05 N	164-59 E	s	120	0.8	988.3	-7.0	-10.3	77	2.5	1.5	2.6	8
27-Jan	0:00		9:00	49-39 N	165-00 E	o	290	11.8	989.1	-4.9	-13.0	53	2.5	0.0	3.6	10
	3:00		12:00	48-54 N	165-00 E	s/o	290	16.2	990.7	-4.6	-9.5	68	2.7	0.5	5.4	8
	6:00		15:00	48-13 N	165-00 E	o	290	18.3	995.1	-3.4	-10.0	61	2.6	0.0	7.1	8
	9:00		18:00	47-32 N	165-00 E	c	300	15.6	998.6	-3.1	-8.5	66	3.5	0.3	5.9	10
	12:00		21:00	46-53 N	164-59 E	s	300	16.2	1001.1	-3.3	-6.3	80	3.5	2.3	6.0	9
	15:00	28-Jan	0:00	46-11 N	165-00 E	c	310	13.3	1003.3	-1.4	-6.6	68	3.2	0.1	5.9	9
	18:00		3:00	45-28 N	165-00 E	c	290	14.0	1005.5	-0.7	-8.5	55	4.2	0.8	5.4	9
	21:00		6:00	45-00 N	164-59 E	c	290	10.3	1007.6	-1.0	-7.2	63	4.1	0.1	4.3	9
28-Jan	0:00		9:00	44-59 N	164-59 E	bc	300	10.2	1009.1	-1.4	-5.5	73	4.1	0.4	3.4	9
	3:00		12:00	45-00 N	165-00 E	s/c	300	10.1	1009.6	-1.4	-5.8	72	4.1	2.7	3.0	9
	6:00		15:00	44-59 N	165-00 E	c	290	8.7	1011.0	-0.3	-6.6	62	4.1	0.0	2.9	8
	9:00		18:00	44-59 N	165-00 E	c	270	11.2	1013.1	-1.6	-4.5	81	4.1	0.8	2.7	8
	12:00		21:00	44-21 N	165-00 E	c	290	10.1	1013.9	1.1	-5.7	61	4.0	0.0	3.1	13
	15:00	29-Jan	0:00	43-34 N	164-59 E	c	300	13.8	1014.8	1.3	-2.1	78	6.8	3.3	3.2	14
	18:00		3:00	42-47 N	165-00 E	o	300	11.5	1015.4	2.9	-5.9	53	7.1	0.0	3.1	16
	21:00		6:00	41-59 N	165-00 E	o	320	7.5	1017.0	3.3	-3.4	61	6.9	0.0	2.6	15
29-Jan	0:00		9:00	41-10 N	165-00 E	o	10	6.2	1016.7	3.6	-0.1	77	10.2	0.0	2.7	18
	3:00		12:00	40-26 N	165-00 E	c	350	7.1	1014.9	5.2	-1.0	64	10.4	0.0	2.5	17
	6:00		15:00	40-00 N	165-00 E	c	360	10.6	1015.7	5.0	-1.1	65	10.5	0.0	1.9	7
	9:00		18:00	40-01 N	165-00 E	c	330	12.1	1017.0	4.5	-4.6	52	10.5	0.0	1.8	7
	12:00		21:00	39-59 N	165-02 E	c	320	10.0	1017.4	4.4	-3.1	58	10.4	0.1	2.0	8
	15:00	30-Jan	0:00	39-59 N	165-04 E	o	310	11.5	1017.2	4.7	-5.9	46	12.1	0.0	2.2	7
	18:00		3:00	39-59 N	165-03 E	o	310	10.7	1017.2	5.1	-3.5	54	11.7	0.0	2.4	7
	21:00		6:00	39-59 N	165-00 E	c	320	11.7	1017.7	5.4	-3.1	54	9.9	0.0	2.6	7
30-Jan	0:00		9:00	40-00 N	165-00 E	bc	300	9.9	1018.0	4.9	-0.1	70	9.9	0.0	2.5	7
	3:00		12:00	40-00 N	165-00 E	c	320	13.3	1016.4	4.8	0.5	73	9.9	0.0	2.4	7
	6:00		15:00	40-01 N	165-05 E	c	310	14.7	1016.9	4.9	0.5	73	10.3	0.1	3.4	12
	9:00		18:00	40-10 N	165-23 E	c	310	13.9	1017.6	4.9	0.0	70	12.3	0.0	4.6	16
	12:00		21:00	39-55 N	165-09 E	c	300	10.9	1017.3	5.5	-1.8	59	11.9	0.0	3.6	8
	15:00	31-Jan	0:00	39-58 N	165-03 E	bc	280	12.2	1015.1	5.9	-2.5	55	9.8	0.0	2.9	9
	18:00		3:00	39-59 N	164-59 E	bc	250	10.7	1012.2	6.9	-0.2	61	10.0	0.0	3.4	9
	21:00		6:00	40-00 N	165-02 E	c	210	14.4	1007.5	8.6	1.3	60	9.9	0.0	3.2	9
31-Jan	0:00		9:00	40-30 N	164-56 E	o	210	19.6	998.3	9.1	5.8	80	10.5	0.0	4.7	11
	3:00		12:00	41-16 N	164-55 E	r	250	21.1	986.5	6.3	6.4	100	9.9	4.4	5.5	14
	6:00		15:00	41-58 N	164-54 E	o	270	18.5	981.3	6.9	3.6	80	7.0	0.0	6.5	16
	9:00		18:00	42-13 N	164-27 E	o	360	12.2	980.2	1.8	-1.1	81	7.7	12.4	5.2	10
	12:00		21:00	42-22 N	163-51 E	o	360	16.0	984.8	-0.2	-3.3	80	6.7	0.0	4.9	10
	15:00	1-Feb	0:00	42-32 N	163-17 E	bc	330	15.8	988.7	-0.8	-7.7	60	6.9	0.1	4.7	10
	18:00		3:00	42-42 N	162-43 E	o	310	18.7	991.9	-2.5	-7.3	69	8.1	2.8	4.9	9
	21:00		6:00	42-47 N	162-12 E	c	300	18.5	993.3	-1.4	-5.9	72	7.7	1.8	5.3	10

Table3.1.2-3

Time UTC		Time ship		Position Lat.	Position Long.	Weather	WD (deg)	WS (m/s)	P (hPa)	T (deg.C)	DPT (deg.C)	RH (%)	SST (deg.C)	Rain (mm/3h)	Wv.Ht. (m)	Wv.Pd. (sec)
1-Feb	0:00	1-Feb	9:00	42-44 N	161-41 E	c/s	300	15.7	995.9	-0.4	-7.3	60	6.4	1.0	5.9	10
	3:00		12:00	42-41 N	161-06 E	c/s	300	14.4	995.7	-0.3	-7.1	60	7.3	1.3	5.3	10
	6:00		15:00	42-46 N	160-36 E	c/s	300	13.9	995.7	-0.5	-7.0	61	6.5	2.1	5.1	10
	9:00		18:00	43-06 N	160-16 E	c	290	14.5	995.4	-0.8	-6.6	65	5.5	1.4	5.2	10
	12:00		21:00	43-08 N	159-41 E	c	300	16.2	995.5	-0.8	-6.3	66	5.6	0.7	4.6	9
	15:00	2-Feb	0:00	43-08 N	159-02 E	c	290	16.4	995.1	-1.2	-6.1	69	6.8	1.0	6.4	12
	18:00		3:00	43-08 N	158-25 E	c	300	18.9	994.7	-2.6	-6.4	75	6.1	1.1	8.8	12
	21:00		6:00	43-08 N	157-49 E	c	300	18.0	998.0	-2.0	-7.0	68	7.5	0.2	8.9	12
2-Feb	0:00		9:00	43-07 N	157-13 E	s/c	330	14.5	999.5	-2.1	-6.6	71	5.8	1.6	6.1	11
	3:00		12:00	43-07 N	156-35 E	s/c	320	13.8	999.9	-2.2	-7.0	70	8.9	0.3	4.6	10
	6:00		15:00	43-13 N	155-59 E	o	290	15.6	1000.8	-2.8	-7.9	68	9.6	1.0	4.6	9
	9:00		18:00	43-19 N	155-27 E	c	310	16.5	1003.2	-3.6	-9.6	63	5.6	0.2	5.1	9
	12:00		21:00	43-28 N	155-00 E	c	300	17.8	1003.7	-4.7	-8.5	74	2.4	0.4	4.5	9
	15:00	3-Feb	0:00	43-51 N	154-59 E	s/c	310	18.9	1003.9	-5.2	-8.0	80	2.3	1.2	5.4	9
	18:00		3:00	44-13 N	154-59 E	o	310	18.8	1004.5	-4.7	-8.8	74	1.8	1.0	6.2	9
	21:00		6:00	44-26 N	154-59 E	o	310	17.0	1006.4	-6.5	-7.3	94	1.7	0.8	4.7	11
3-Feb	0:00		9:00	44-04 N	155-00 E	o	310	18.2	1008.7	-5.2	-6.6	90	2.2	0.4	4.5	11
3-Feb	3:00	3-Feb	12:00	43-59 N	155-03 E	s/c	310	14.5	1008.7	-4.0	-7.2	79	2.2	2.3	4.3	10
	6:00		15:00	44-02 N	154-58 E	s/c	310	16.1	1009.7	-4.4	-7.2	81	2.1	1.0	3.9	9
	9:00		18:00	44-03 N	155-00 E	o	310	16.7	1010.9	-2.8	-9.5	60	2.0	0.0	4.5	8
	12:00		21:00	44-21 N	154-59 E	o	310	14.6	1010.4	-2.9	-10.1	57	1.6	0.1	6.0	9
	15:00	4-Feb	0:00	44-30 N	154-59 E	bc/s	300	13.9	1009.9	-4.0	-8.0	74	1.7	0.2	3.4	10
	18:00		3:00	44-30 N	154-59 E	s	300	12.0	1008.8	-3.7	-7.7	74	1.7	0.0	3.2	10
	21:00		6:00	44-00 N	155-00 E	c	300	13.3	1008.4	-2.4	-9.3	59	2.1	0.0	4.0	16
4-Feb	0:00		9:00	43-59 N	154-58 E	c	310	10.3	1008.2	-2.6	-9.5	59	2.1	0.0	2.9	10
	3:00		12:00	44-01 N	154-58 E	c	330	10.7	1006.7	-4.0	-7.5	77	2.1	1.6	3.0	10
	6:00		15:00	44-00 N	154-59 E	c	340	10.8	1006.5	-3.9	-7.9	74	2.2	2.0	3.3	11
	9:00		18:00	43-59 N	154-59 E	c	330	12.1	1007.0	-3.4	-11.6	53	2.2	0.0	2.9	10
	12:00		21:00	43-30 N	155-00 E	c	330	11.4	1007.2	-2.8	-9.3	61	2.6	0.3	3.1	10
	15:00	5-Feb	0:00	43-30 N	154-16 E	c	320	12.6	1007.7	-2.8	-9.1	62	1.9	0.0	3.0	9
	18:00		3:00	43-21 N	153-19 E	o	320	15.1	1009.2	-2.1	-9.6	57	2.3	0.3	3.5	11
	21:00		6:00	43-10 N	152-22 E	o	320	15.6	1011.7	-2.7	-8.4	65	2.3	0.6	2.9	10
5-Feb	0:00		9:00	43-00 N	151-26 E	o	310	13.4	1014.4	-3.3	-9.5	62	2.1	0.1	2.8	9
	3:00		12:00	42-49 N	150-28 E	o	300	10.5	1013.9	-3.0	-7.6	70	1.9	0.3	2.8	11
	6:00		15:00	42-38 N	149-30 E	o	320	15.4	1014.6	-2.8	-10.0	57	2.1	0.2	2.7	10
	9:00		18:00	42-26 N	148-34 E	o	320	12.3	1016.9	-2.3	-9.8	56	2.9	0.2	2.4	8
	12:00		21:00	42-14 N	147-37 E	o	330	12.3	1017.9	-1.6	-9.9	53	2.3	0.0	2.0	10
	15:00	6-Feb	0:00	42-05 N	146-39 E	bc	340	9.7	1018.6	-0.9	-8.5	57	2.7	0.0	1.2	11
	18:00		3:00	41-54 N	145-39 E	bc	350	9.4	1018.5	0.3	-6.5	60	9.6	0.0	1.5	10
	21:00		6:00	41-43 N	144-38 E	o	30	6.1	1019.0	0.1	-6.6	61	3.9	0.0	1.2	6
6-Feb	0:00		9:00	41-35 N	143-39 E	bc	320	2.4	1018.9	0.0	-5.9	64	6.3	0.0	0.8	5
	3:00		12:00	41-35 N	142-53 E	o	10	4.1	1016.9	-0.4	-7.7	58	3.9	0.0	0.7	9
	6:00		15:00	41-35 N	142-08 E	o	60	2.7	1014.4	0.4	-6.4	60	6.4	0.0	0.5	10
	9:00		18:00	41-35 N	141-24 E	c	80	3.1	1013.0	1.3	-5.0	63	9.2	0.0	0.5	11
	12:00		21:00	41-28 N	141-19 E	c	130	4.8	1011.0	2.3	-4.0	63	7.0	0.0	0.4	8
	15:00	7-Feb	0:00	41-28 N	141-18 E	c	90	6.3	1008.0	2.3	-3.8	64	8.3	0.0	0.4	7
	18:00		3:00	41-28 N	141-18 E	bc	80	7.3	1006.9	2.2	-3.2	68	9.7	0.0	0.5	5
	21:00		6:00	41-29 N	141-17 E	o	60	7.9	1006.0	1.3	-2.3	77	10.7	0.0	0.7	4

Table3.1.2-4

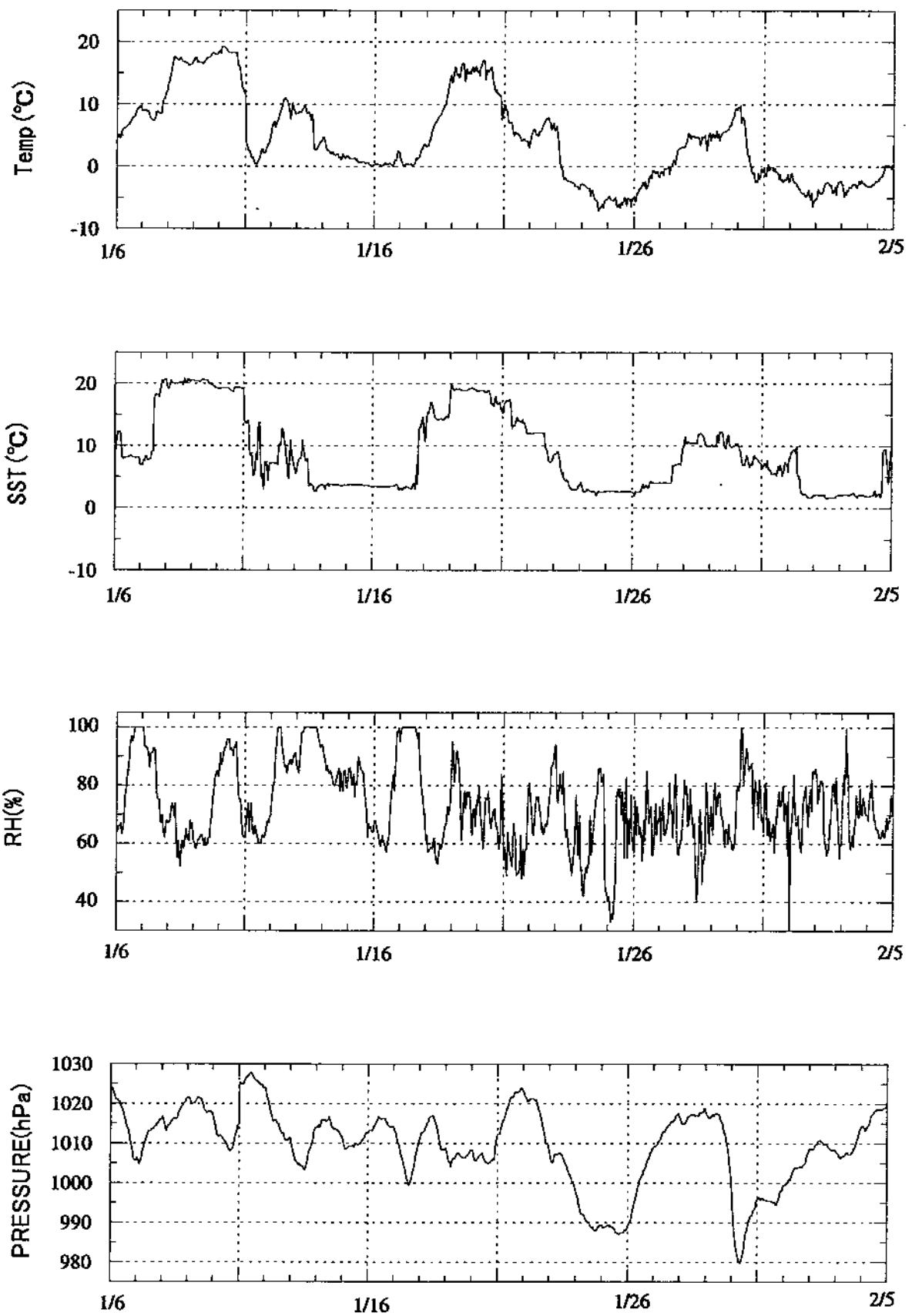
Temp (°C)
20
10
0
-10
1/6
1/16
1/26
2/5
SST (°C)
20
10
0
-10
1/6
1/16
1/26
2/5
RH(%)
100
80
60
40
1/6
1/16
1/26
2/5
PRESSURE(hPa)
1030
1020
1010
1000
990
980
1/6
1/16
1/26
2/5

Fig 3.1.1

3.2 Temperature and salinity measurement and water sampling: CTD/CWS

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(1) Introduction

As a basic property of the water mass in the study area, temperature and salinity were measured with CTD (SBE911plus; Sea-Bird Electronics, Inc.) and seawater sampling was conducted with Carousel Water Sampler (CWS: SBE32; Sea-Bird Electronics, Inc.) in order to obtain the samples for chemical analysis. In this section, we describe as for the CTD/CWS observations in MR00-K01 cruise from 6 January 2000 to 7 February 2000 on R/V MIRAI.

(2) Measured Items

Temperature and Salinity were measured from sea surface to 5,300 m in maximum (Large system) or 6,000 m (Small system). Seawater was sampled with CTD/ CWS at 16 stations. The 72 water-sampling casts in total were for the chemical analysis of general water properties, carbon, trace metals, radio isotope, etc.

(3) Observation Methods

(a) CTD/CWS systems

Two CTD/CWS water sampling system were used through this cruise. One was the CTD (SBE911plus; Sea-Bird Electronics, Inc.) with the 30-liters 24-positions Carousel Water Sampler (SBE32; Sea-Bird Electronics, Inc.), called Large-CTD/CWS. Another one was the CTD and CWS like Large CTD/CWS, but with 12-liters 12-positions water sampler, called Small-CTD/CWS. 12 bottles of 12-liters Niskin were Niskin-X External Spring Water Samplers (General Oceanics, Inc.) which especially modified and cleaned for the trace metal analysis. The sensors attached on each CTD were temperature sensor, conductivity sensor, pressure sensor and altimeter. In addition, Large-CTD/CWS was also with D.O. sensor. Specifications of the sensors were listed below:

CTD/CWS type	Sensor	Serial No.
Large-CTD/CWS	Temperature	31524
	Conductivity	41202
	Pressure	51190
	Oxygen	130540
	Altimeter	206 (Benthos 2110-1)
Small-CTD/CWS	Temperature	32453
	Conductivity	42240
	Pressure	79492
	Altimeter	396 (Datasonics PSA-900D)

(b) Operation during Observation

Large-CTD/CWS was deployed and recovered with the A-frame in the stern of R/V MIRAI, and Small-CTD/CWS was with another small frame installed on starboard side, called the Gallows. The CTD raw data was acquired on real time by using a SEASAVE utility of software SEASOFT (Ver. 4.232) provided by Sea-Bird Electronics, Inc. and stored on the hard disk of a personal computer set in After Wheel-house. Water sampling was made during up cast by sending a fire command from the computer. Detail information during a cast such as date/time, station/cast/file names, location at the start/bottom/end of observation, water sampling layers and events were recorded in CTD cast log sheets. These were summarized in CTD Cast Table or CTD Bottle List shown in Appendix.

After a cast, the Large-CTD/CWS was lifted down from upper deck to the Water Drawing Room on 2nd deck and seawater was drawn from the bottles.

(c). CTD data processing

The CTD raw data was processed by using SEASOFT (Ver. 4.232) on another computer. Procedure of the data processing and used utilities of SEASOFT were as following:

DATCNV: Converts the binary raw data to output on physical units. Output items are depth, pressure, temperature, potential temperature, salinity, density (sigma-t), oxygen, conductivity, descent rate. Simultaneously, this utility selects the CTD data when bottles closed to output on another file: *.BTL.

SECTION: Select a range of data based on either scan number or pressure. Write out

selected rows of converted data to a new file.

WILDEDIT: Marks wild points by setting their values to the bad value specified in the input .CNV header. The first pass of WILDEDIT is used to obtain an accurate estimate of the true standard deviation of the data. The second pass is used to mark the values good or bad.

SPLIT: 0 Splits the data made by DATCNV into up and down cast data.

BINAVG: Calculates the averaged data in every 1 m.

ROSSUM: Edits the data of sampled water to output a summary file. These data were shown in tables in Appendix CTD Bottle List.

SEAPLOT: Display the vertical profiles of averaged temperature, salinity, sigma-t, and oxygen data on CRT and print out.

Profiles for deepest cast in every station are shown in Fig. 3.2. (from Fig. 3.2.1. to Fig. 3.2.16).

(4). Management of the CTD data

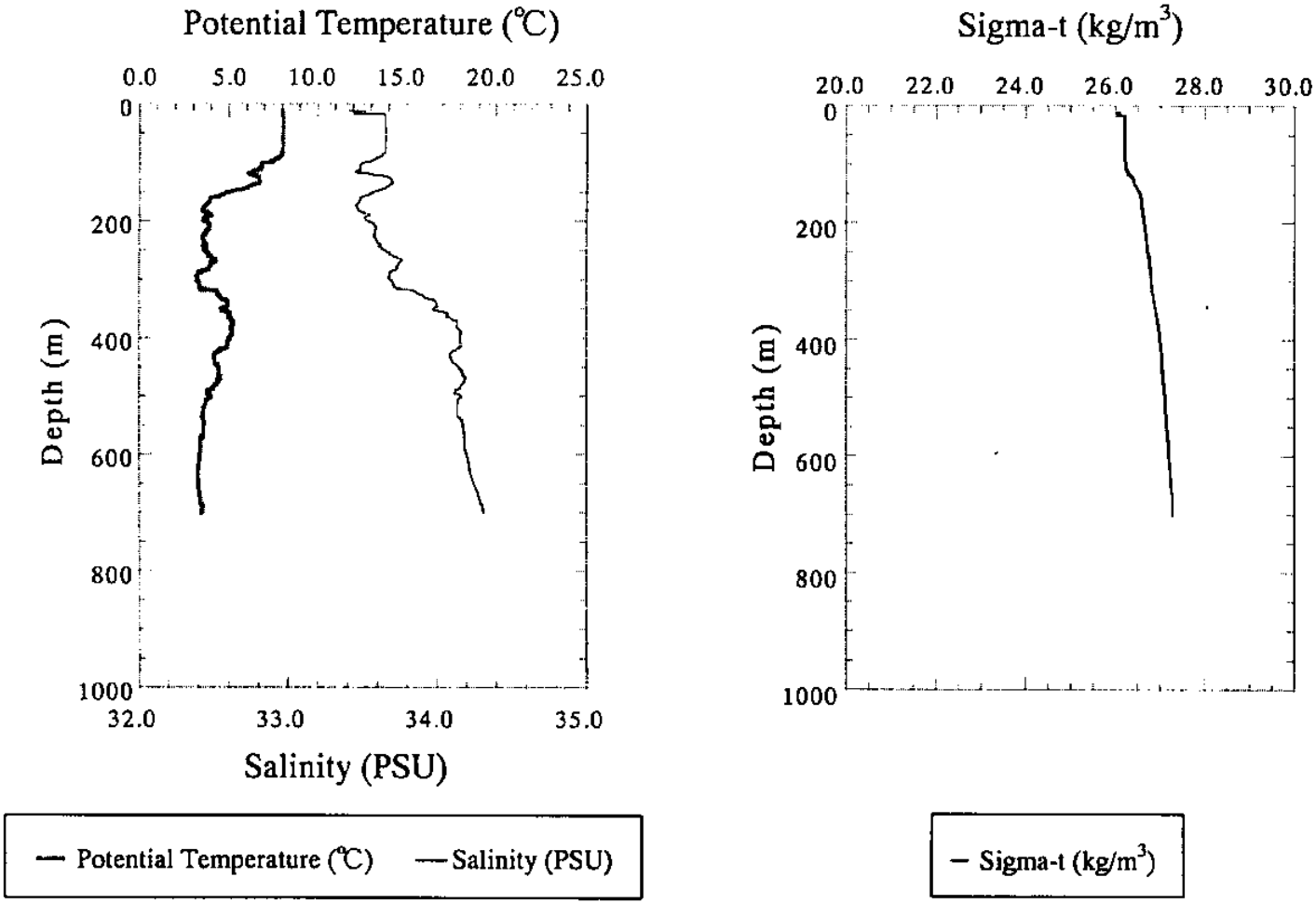
A file name of each cast consists of station name, CTD/CWS type and cast number, e.g., 0001L01. After SPLIT utility was used, up/down identification was added. As a result of above on-board processing, 9 files were made for 1 cast, such as .DAT, .CON, .HDR, .BL, .ROS, .BTL, d*.CNV, u*.CNV *.CNV files.

All of raw and processed CTD data files were copied into 3.5 inches magnetic optical disks (MO disks)

CTD Cast Table in MR00-K01 cruise

* GMT

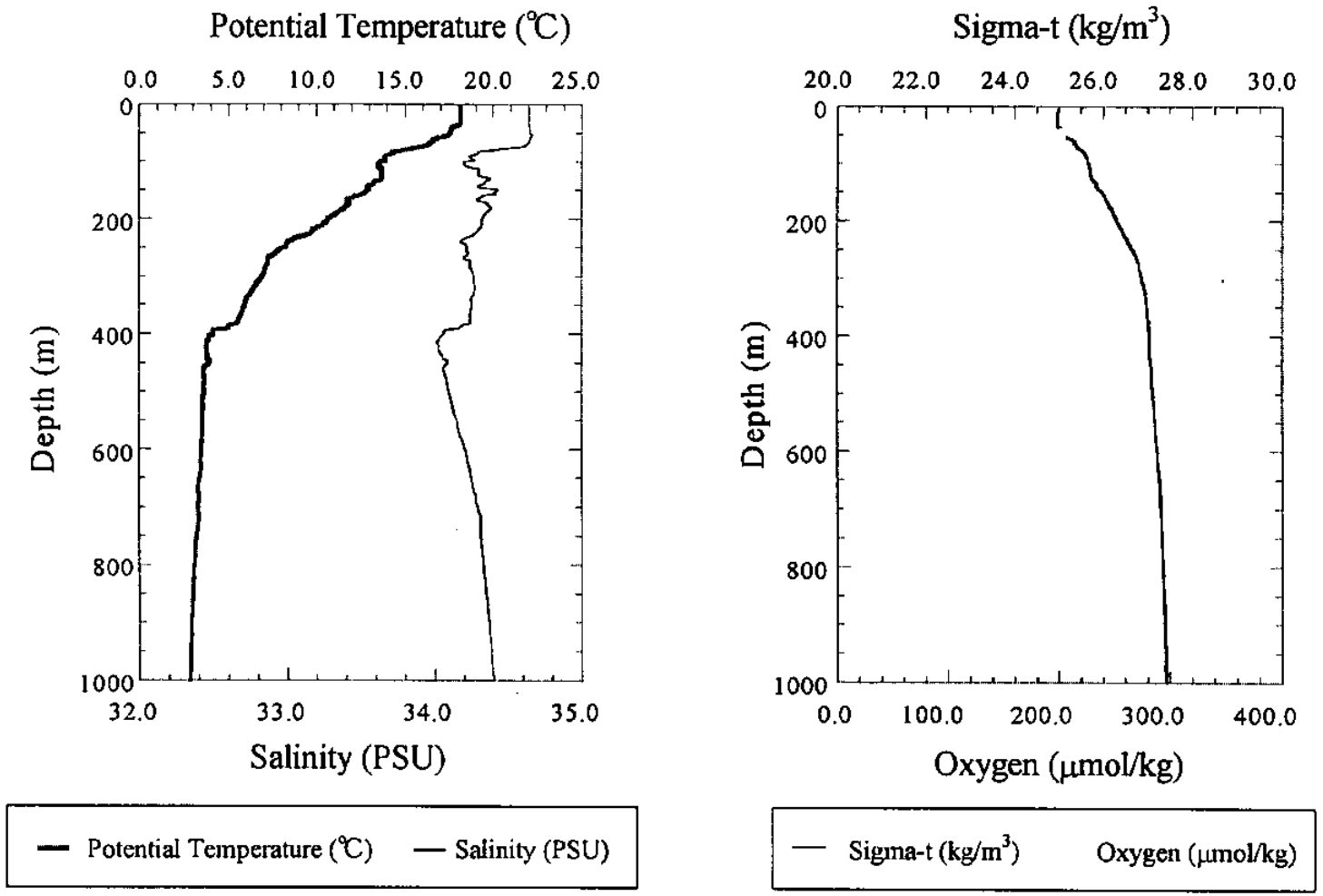
Stn.	Cast No.	File Name	Date	Start-Time*	Bottom-Time*	End-Time*	Max Layer	Remarks
1	1	0001L01	2000/1/6	9:05	9:13	9:33	300	
	2	0001L02		10:08	10:17	10:33	700	
	3	0001S01	2000/1/7	1:03	1:26	1:49	700	
	4	0001S02		2:25	2:32	2:49	200	
21	1	0021S01	2000/1/7	13:23	13:30	13:45	200	
	2	0021S02		14:31	14:55	15:25	1000	
	3	0021L01		15:44	16:27	17:19	1000	
20	1	0020S01	2000/1/8	5:44	5:59	6:23	500	
	2	0020L01		6:34	-	7:19	733	Canceled at 733 m
	3	0020S02		8:22	9:56	11:03	3000	
	4	0020S03		11:57	12:04	12:21	200	
19	1	0019S01	2000/1/8	23:00	23:13	23:37	500	
	2	0019L01	2000/1/9	0:43	1:12	1:53	3000	System Trouble in Up Casting
		19L01_2		-	-	3:33	513	Up Cast Only (513 m)
	3	0019S02		4:34	6:34	8:32	6000	
18	1	0018S01	2000/1/10	1:46	1:58	2:21	500	
	2	0018L01		2:37	3:39	5:14	3000	
	3	0018S02		5:46	7:35	9:35	6000	
2	1	0002L01	2000/1/13	1:24	1:32	1:57	300	
	2	0002S01		2:15	2:26	2:46	500	
	3	0002L02		2:59	3:52	5:12	3000	
	4	0002S02		5:37	6:33	7:32	3000	
4	1	0004L01	2000/1/16	0:43	1:01	1:29	300	
	2	0004S01		2:27	2:35	2:49	200	
	3	0004S02		3:38	5:27	7:22	5100	
	4	0004S03		17:57	18:05	18:18	200	
	5	0004L02		21:18	21:35	22:02	300	
	6	0004L03		22:43	23:19	23:59	600	
	7	0004S04	2000/1/17	0:20	0:34	1:00	500	
	8	0004L04		6:23	6:48	7:28	800	
	9	0004L05		12:19	13:52	15:41	5100	
16	1	0016S01	2000/1/19	11:44	11:56	12:16	500	
	2	0016L01		12:32	13:47	14:59	3000	
	3	0016S02		15:22	17:00	18:38	5400	
17	1	0017S01	2000/1/20	6:28	7:36	8:35	3000	
14	1	0014S01	2000/1/23	0:59	2:08	3:16	3000	
	2	0014S02		4:04	4:10	4:24	200	
	3	0014S03		5:14	5:54	6:25	2000	
	4	0014S04		6:46	7:50	8:51	3000	
	5	0014S05		10:00	10:12	10:34	400	
	6	0014L01		11:06	11:13	11:33	300	
	7	0014L02		12:20	12:35	12:59	500	
6	1	0006L01	2000/1/25	22:32	22:49	23:14	300	
	2	0006S01	2000/1/25-1/26	23:33	23:46	0:09	500	
	3	0006L02	2000/1/26	0:24	1:57	3:40	5300	
	4	0006S02		4:40	4:46	4:58	200	
	5	0006S03		5:44	7:21	9:01	5300	
	6	0006S04		10:27	10:31	10:35	50	
	7	0006L03		11:00	11:09	11:36	300	
	8	0006S05		12:27	12:37	12:48	200	
	9	0006S06		17:57	18:02	18:07	200	System Trouble in Up Casting
		06S06_2		18:08	-	18:17	60	Up Cast Only (60 m)
7	1	0007S01	2000/1/27	23:00	23:07	23:18	200	
	2	0007S02	2000/1/27-1/28	23:50	23:55	0:07	200	
	3	0007S03	2000/1/28	0:56	1:52	2:50	3000	
	4	0007L01		3:07	4:06	5:16	3000	
	5	0007L02		7:36	7:45	-	300	System Trouble in Water Sampling
		07L02_3		7:48	-	8:04	300	
	6	0007L03		8:53	8:57	9:15	200	
8	1	0008S01	2000/1/29	5:37	5:42	5:56	200	
	2	0008L01		6:11	7:33	9:15	5300	
	3	0008S02		9:51	10:37	11:32	3000	
	4	0008S03	2000/1/30	2:33	2:38	2:52	200	
	5	0008L02		3:08	3:15	3:38	300	
	6	0008S04		3:57	4:02	4:14	200	
	7	0008L03		4:29	4:53	5:29	1000	
	8	0008S05		17:57	18:03	18:14	200	
5	1	0005S01	2000/2/3	17:25	18:03	18:49	2000	
15	1	0015S01	2000/2/3	21:20	21:34	21:53	500	
	2	0015L01		23:13	23:20	23:43	300	
	3	0015S02	2000/2/4	0:35	0:40	0:55	200	
	4	0015L02		1:10	1:30	2:08	800	
	5	0015L03		5:16	6:43	8:20	5100	
	6	0015S03		8:49	8:56	9:08	200	
3	1	0003S01	2000/2/4	11:23	12:00	12:41	2000	



Stn.01 (0001L02)

Fig. 3.2.1 CTD vertical profile (Stn.01)

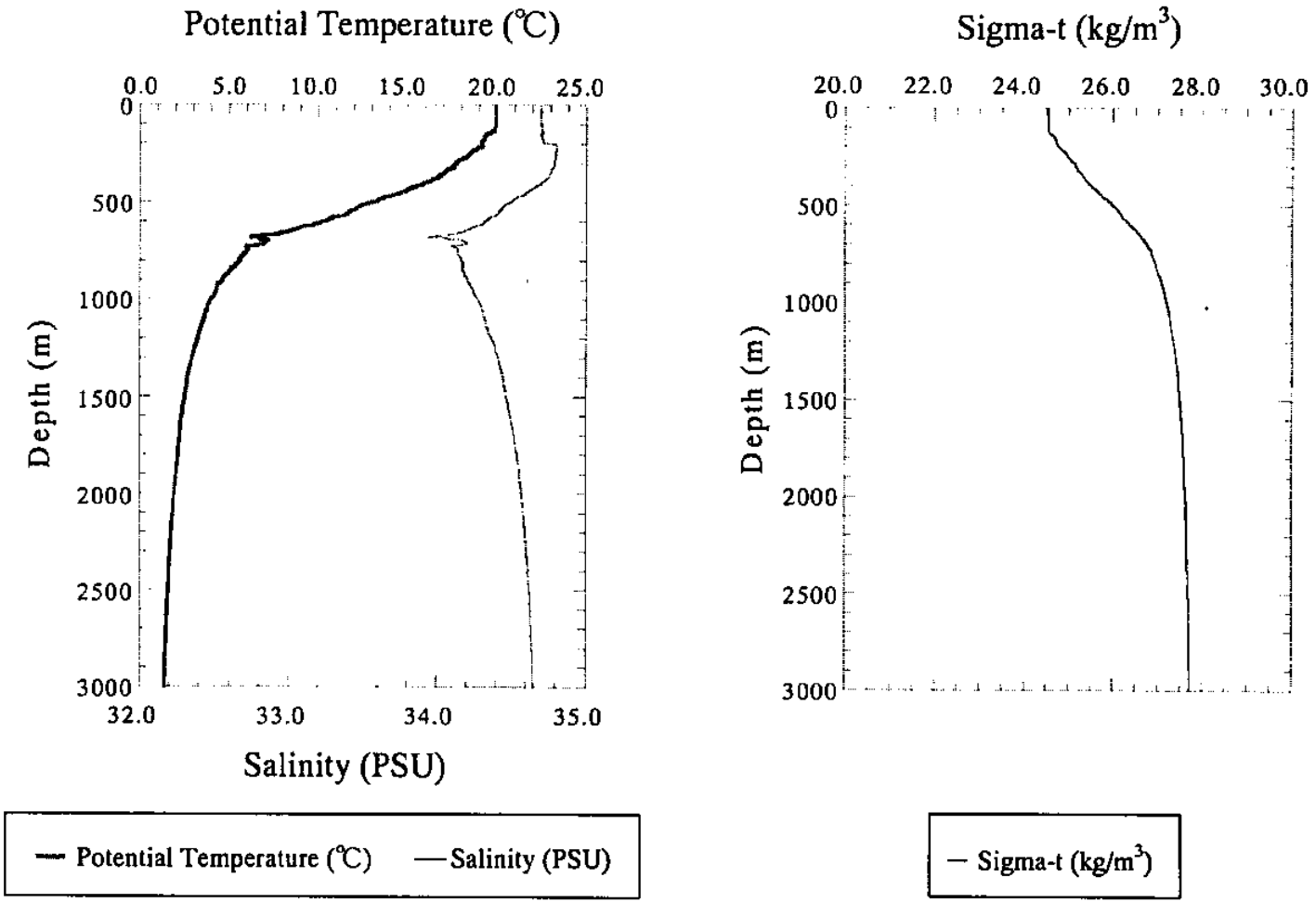
MWJ



Stn.21 (0021L01)

Fig. 3.2.2 CTD vertical profile (Stn.21)

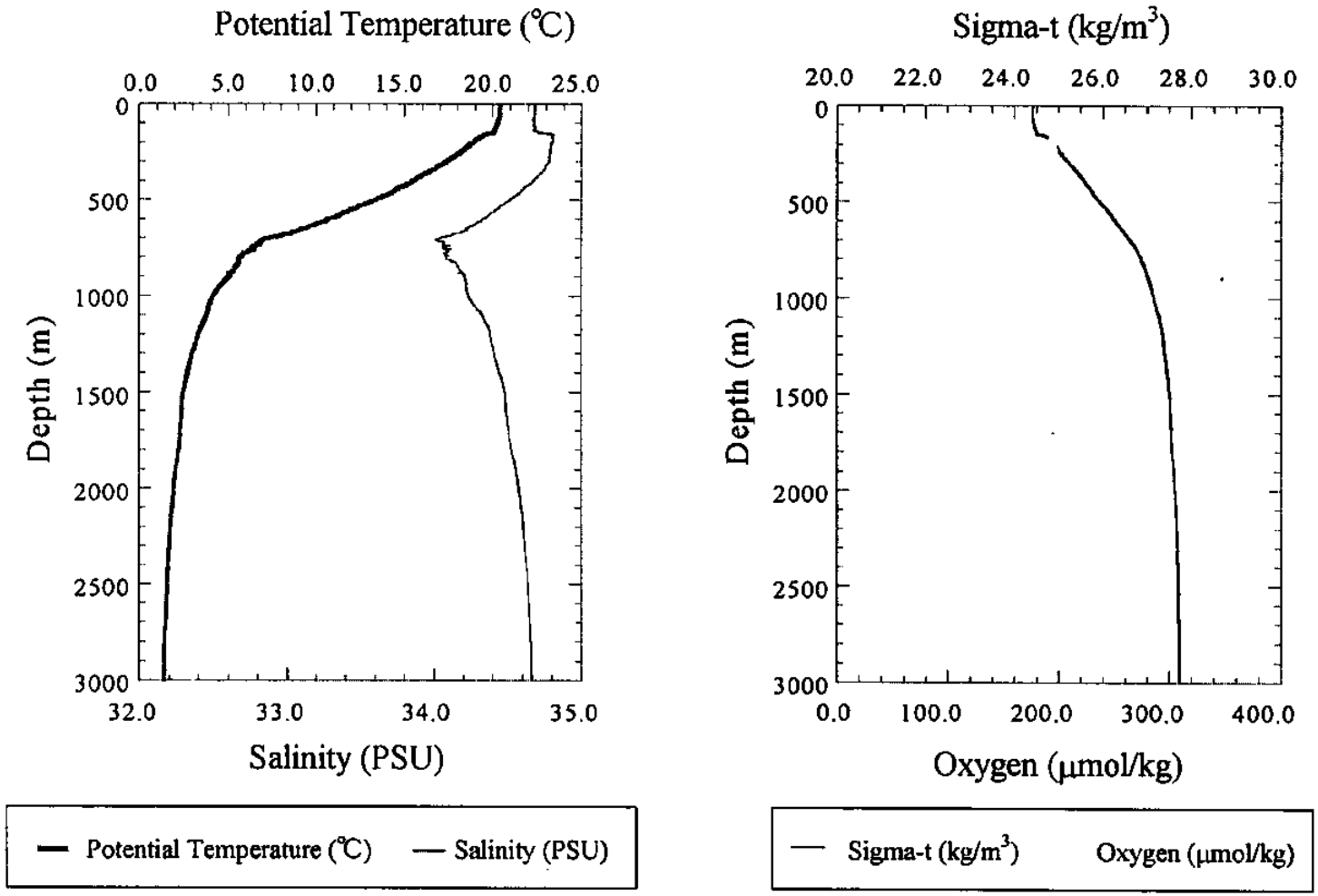
MWJ



Stn.20 (0020S02)

Fig. 3.2.3 CTD vertical profile (Stn.20)

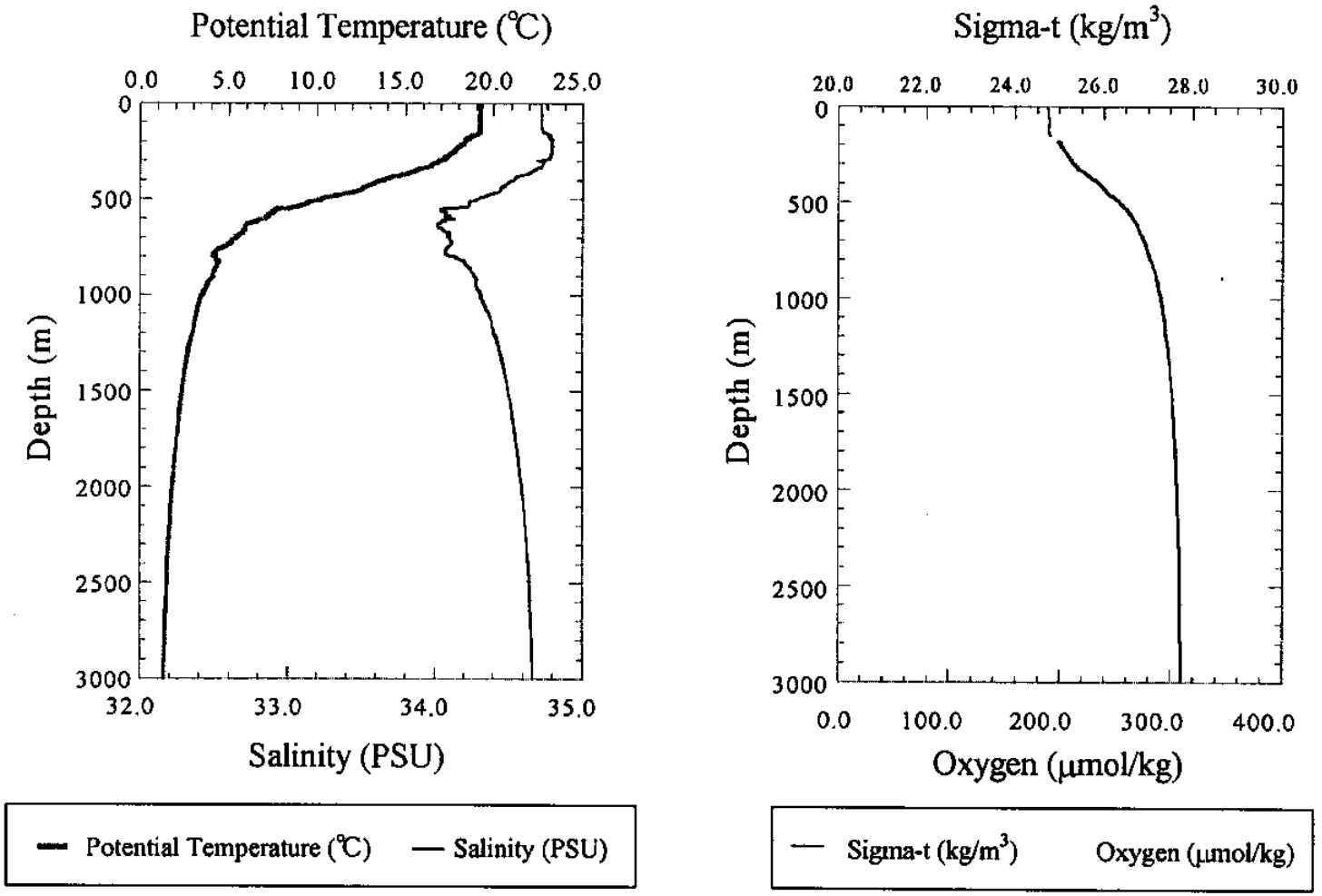
MWJ



Stn.19 (0019L01)

Fig. 3.2.4 CTD vertical profile (Stn.19)

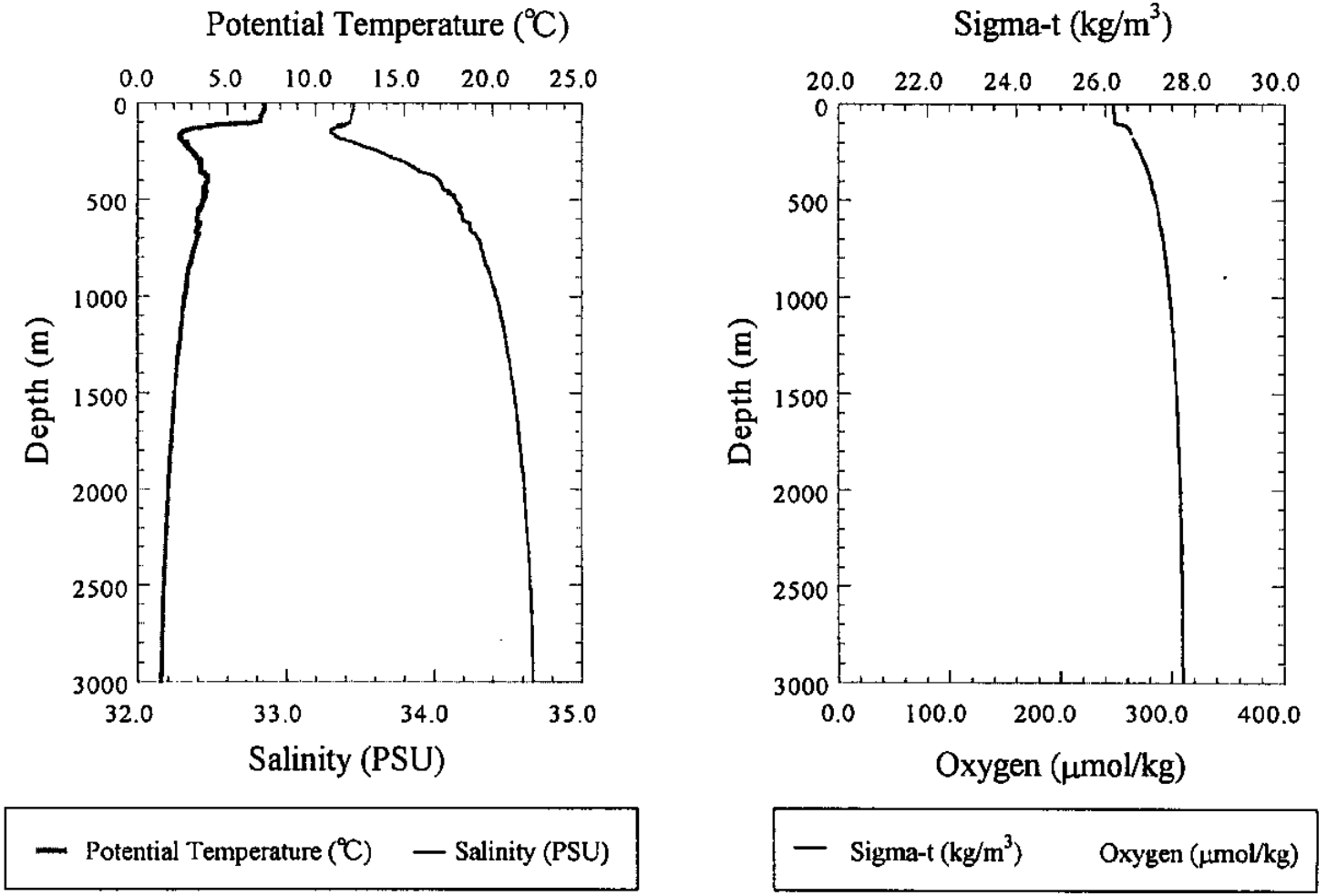
MWJ



Stn.18 (0018L01)

Fig. 3.2.5 CTD vertical profile (Stn.18)

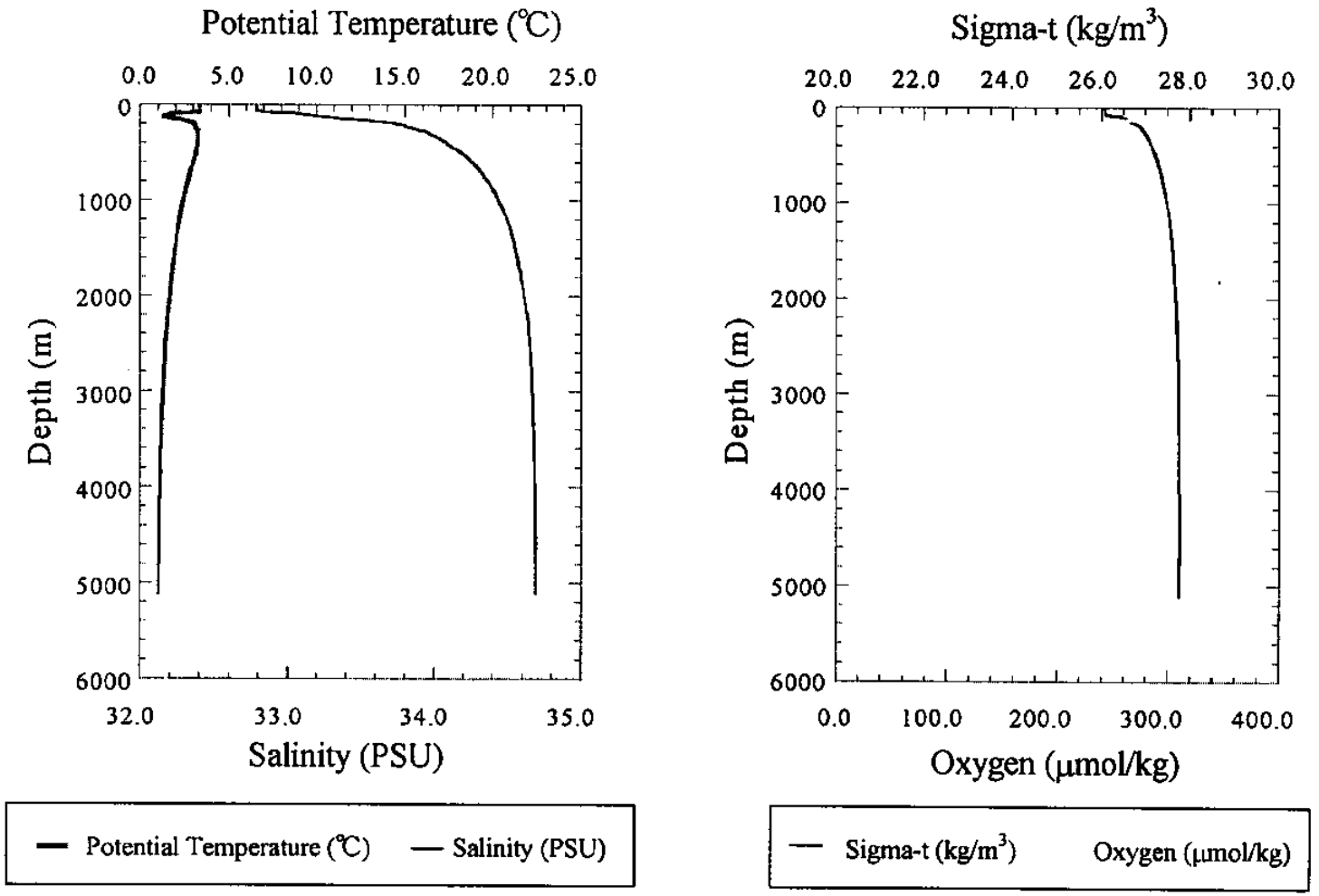
MWJ



Stn.02 (0002L02)

Fig. 3.2.6 CTD vertical profile (Stn.02)

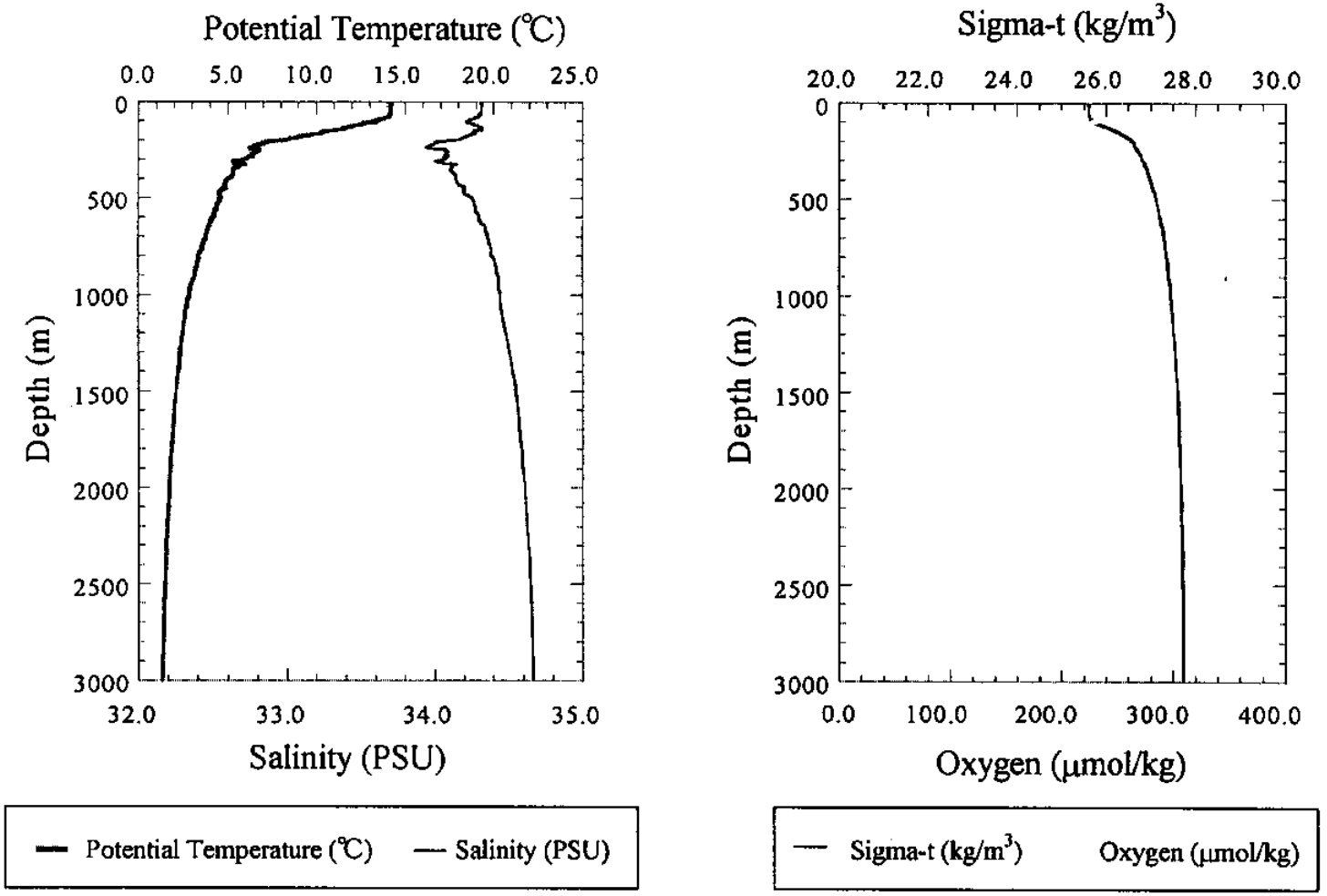
MWJ



Stn.04 (0004L05)

Fig. 3.2.7 CTD vertical profile (Stn.04)

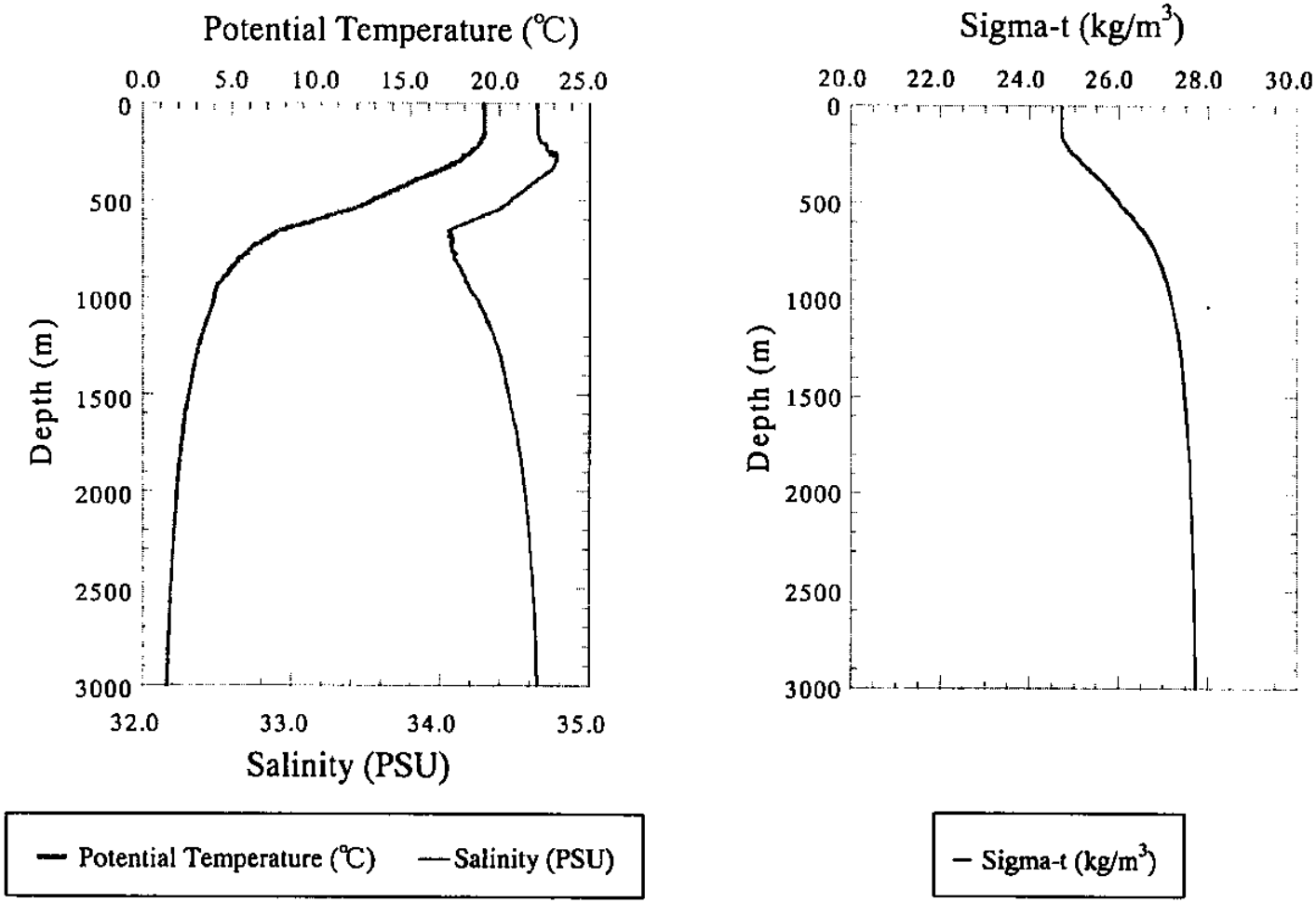
MWJ



Stn.16 (0016L01)

Fig. 3.2.8 CTD vertical profile (Stn.16)

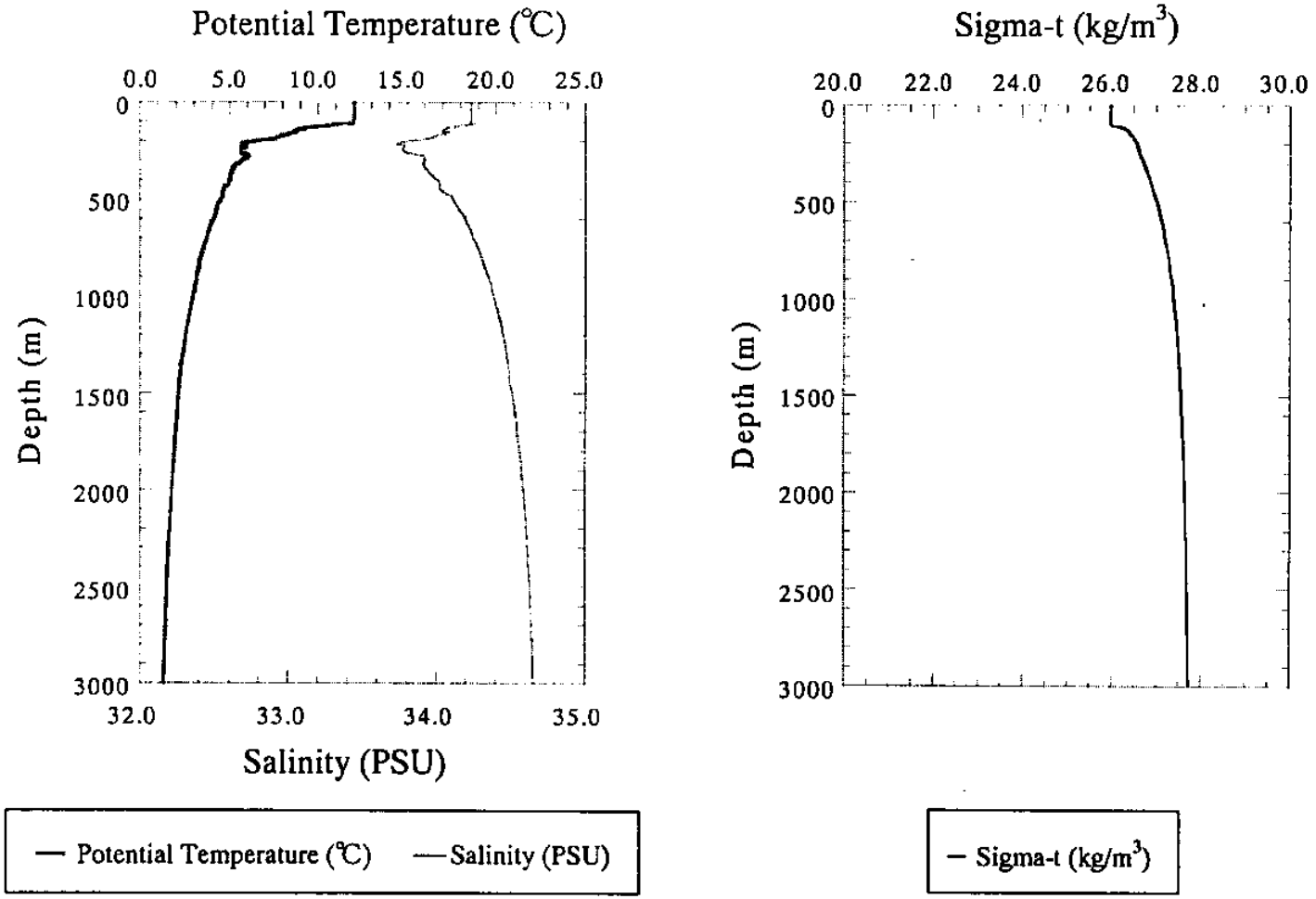
MWJ



Stn.17 (0017S01)

Fig. 3.2.9 CTD vertical profile (Stn.17)

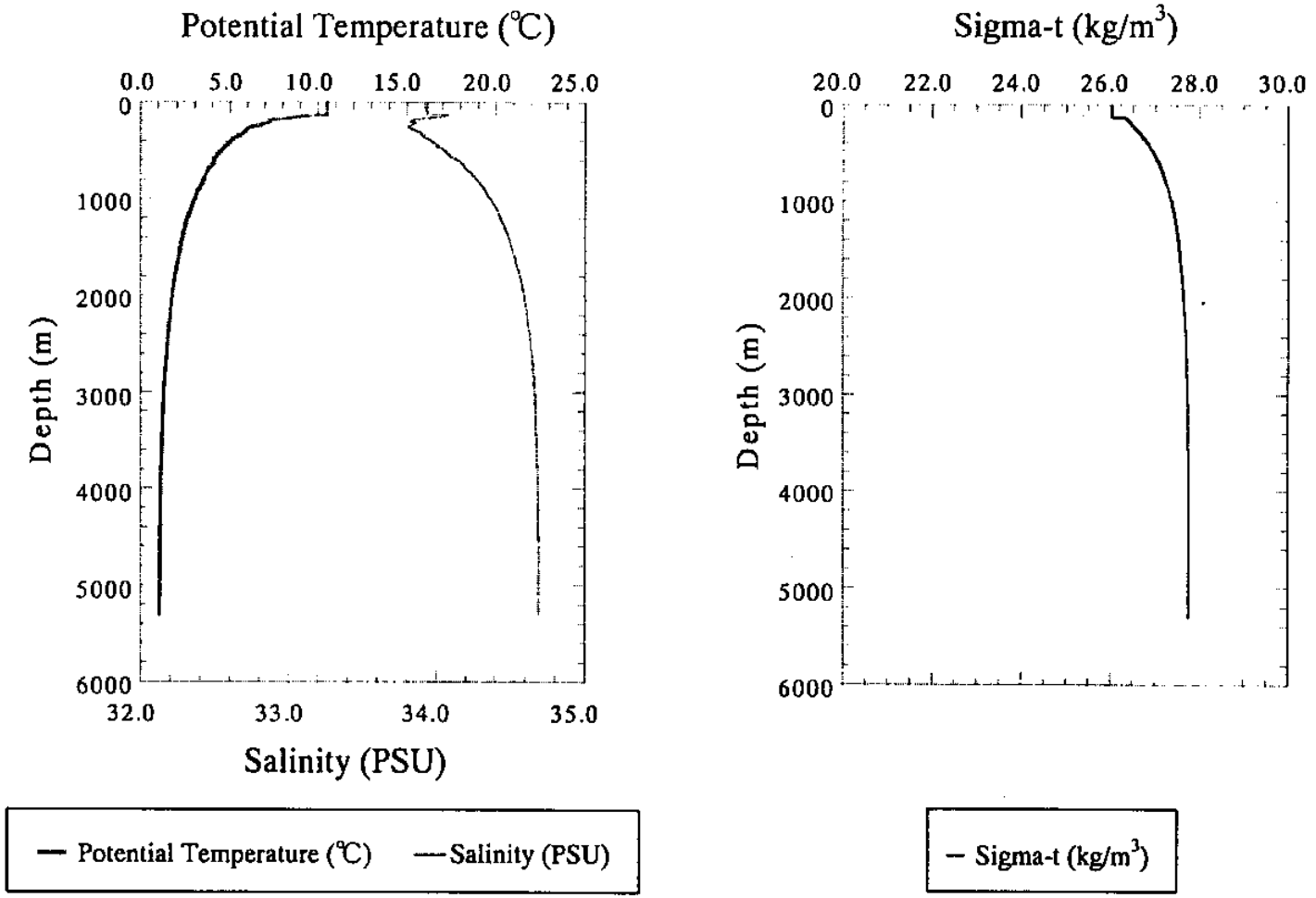
MWJ



Stn.14 (0014S04)

Fig. 3.2.10 CTD vertical profile (Stn.14)

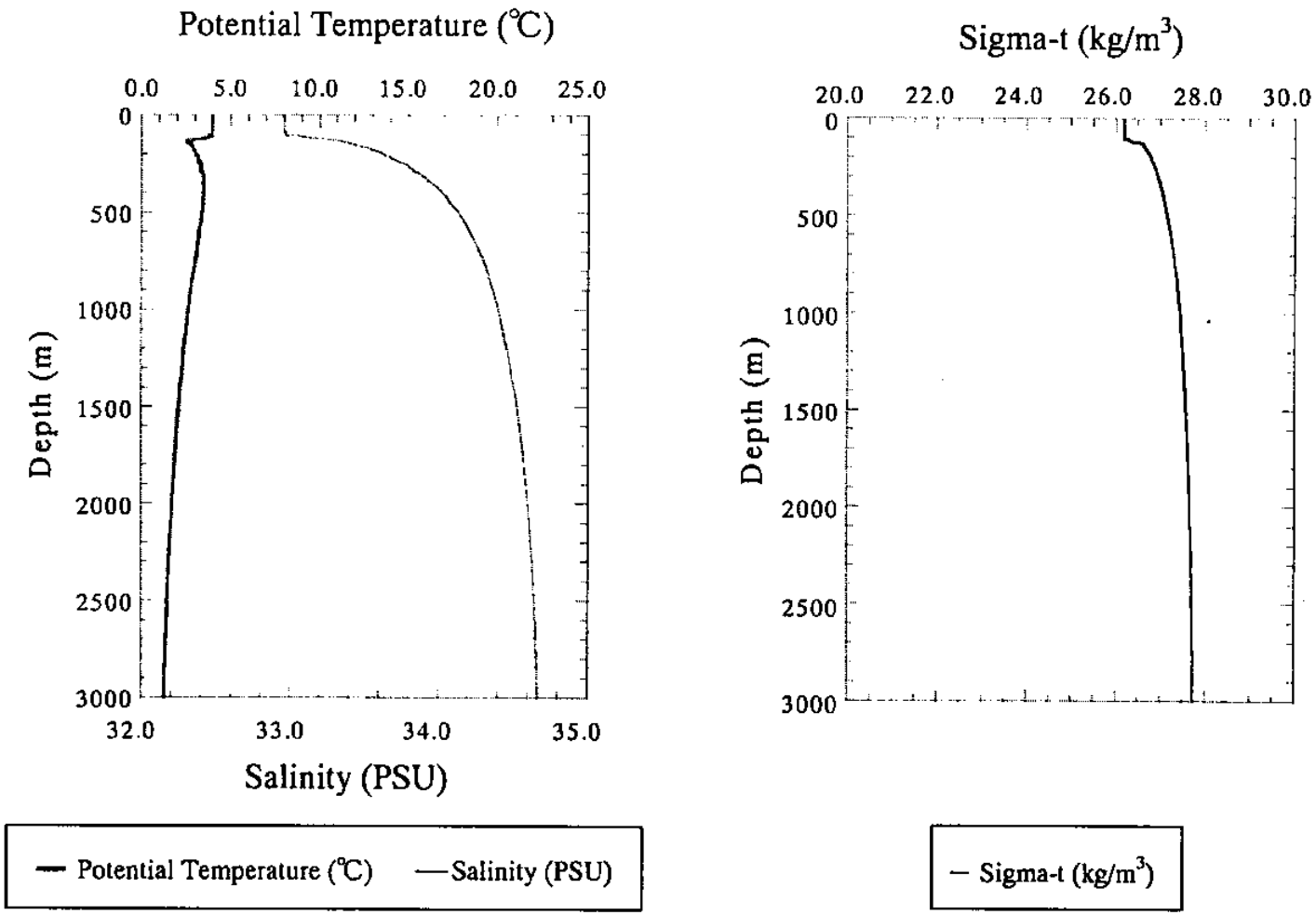
MWJ



Stn.08 (0008L01)

Fig. 3.2.11 CTD vertical profile (Stn.08)

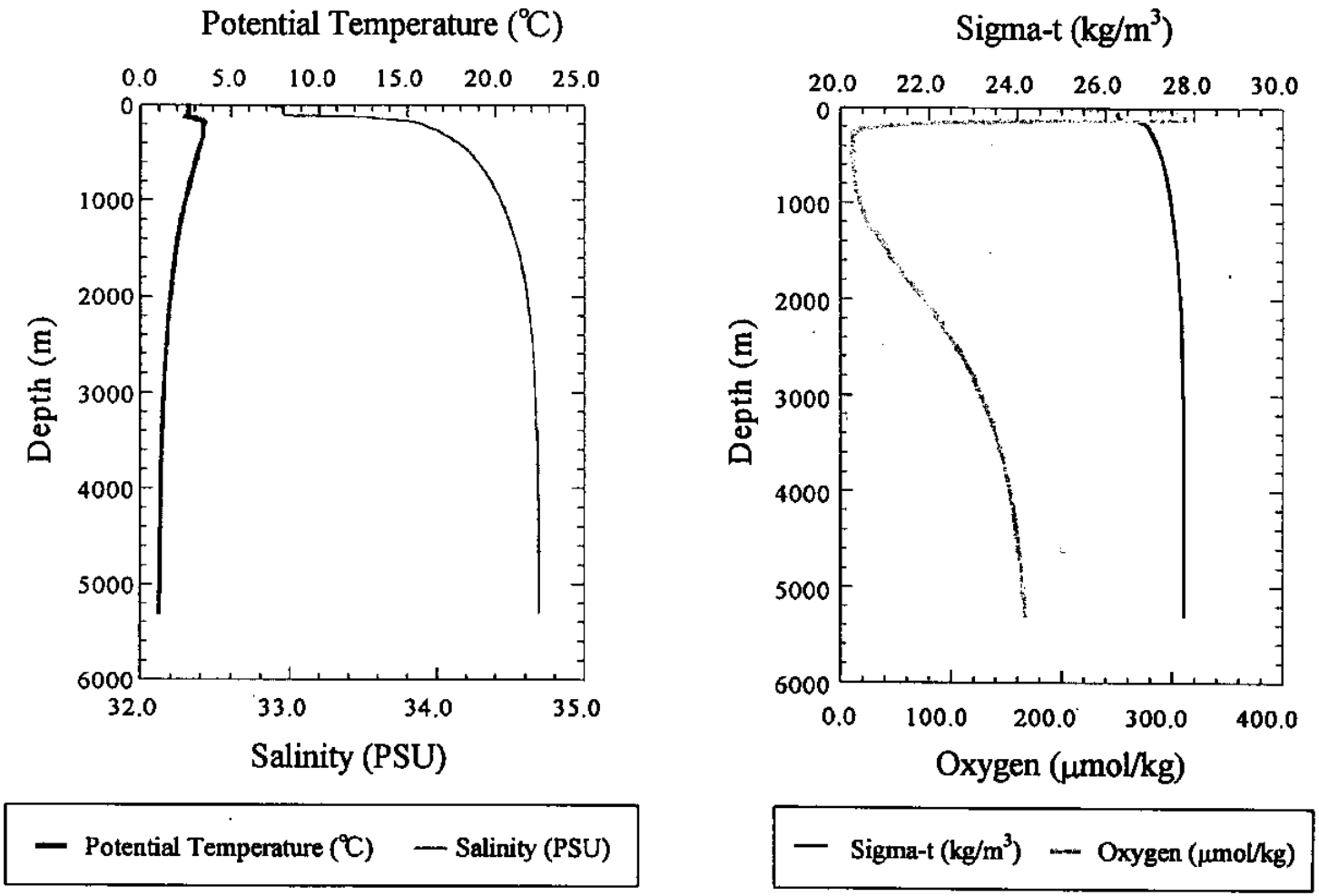
MWJ



Stn.07 (0007L01)

Fig. 3.2.12 CTD vertical profile (Stn.07)

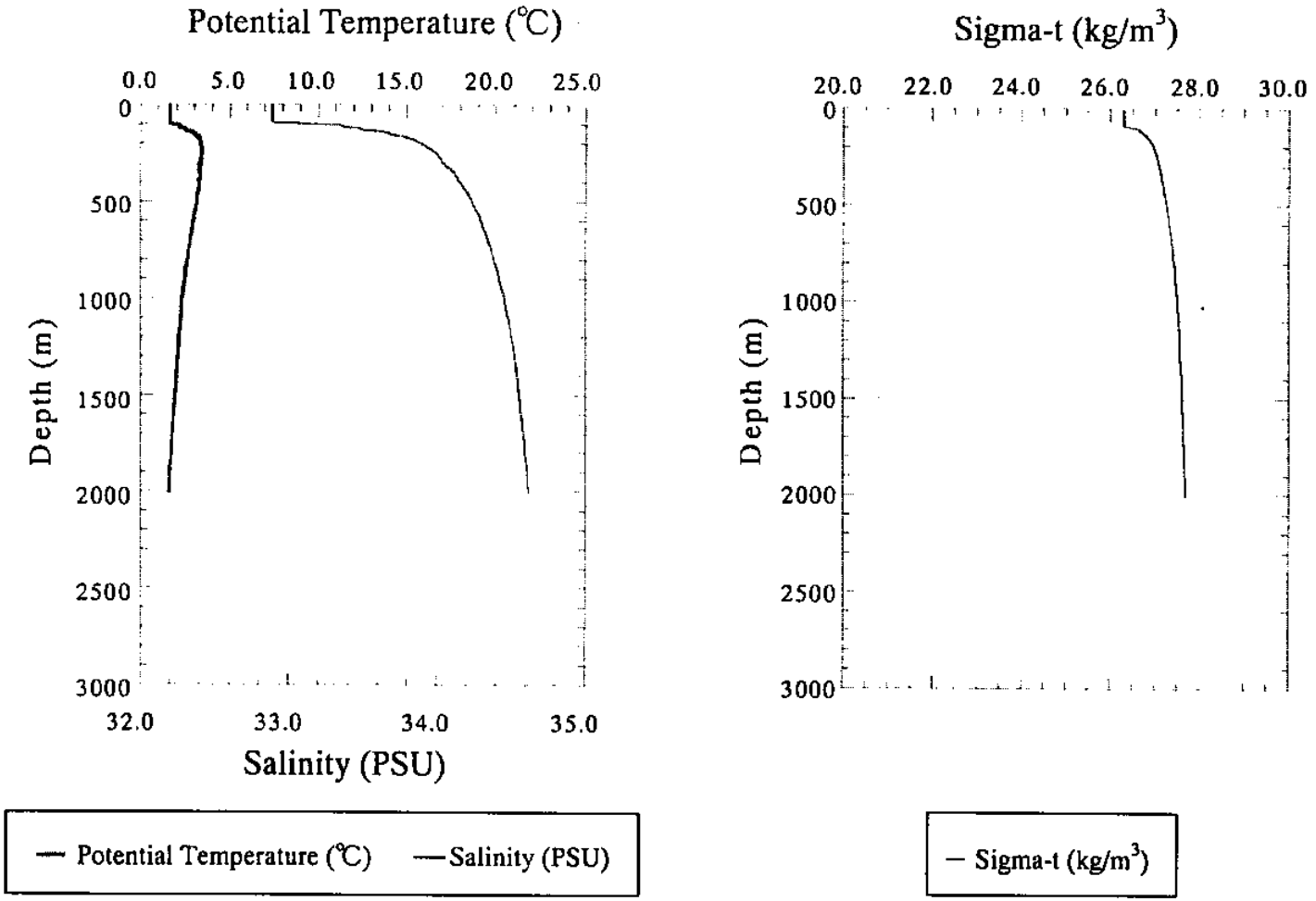
MWJ



Stn.06 (0006L02)

Fig. 3.2.13 CTD vertical profile (Stn.06)

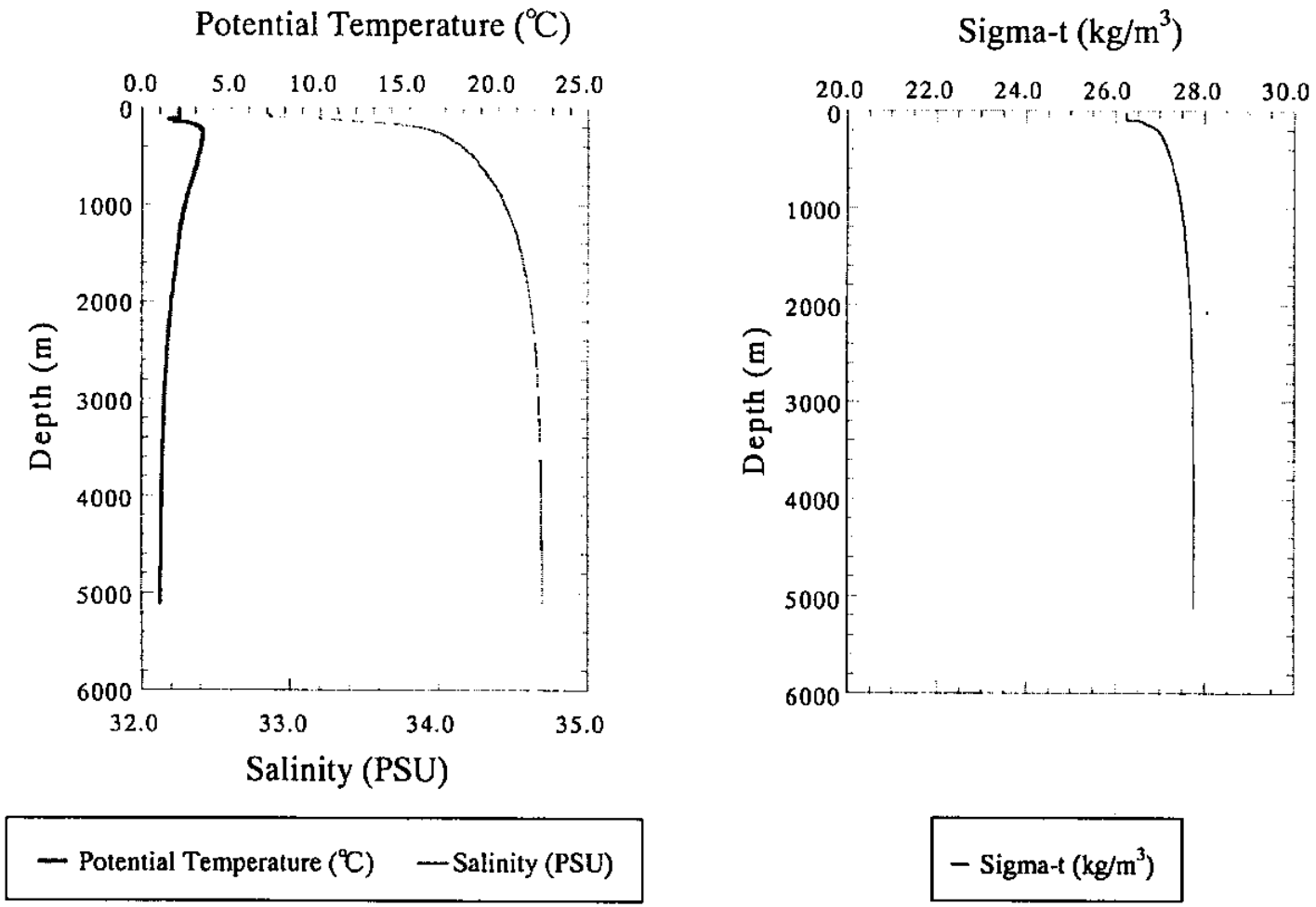
MWJ



Stn.05 (0005S01)

Fig. 3.2.14 CTD vertical profile (Stn.05)

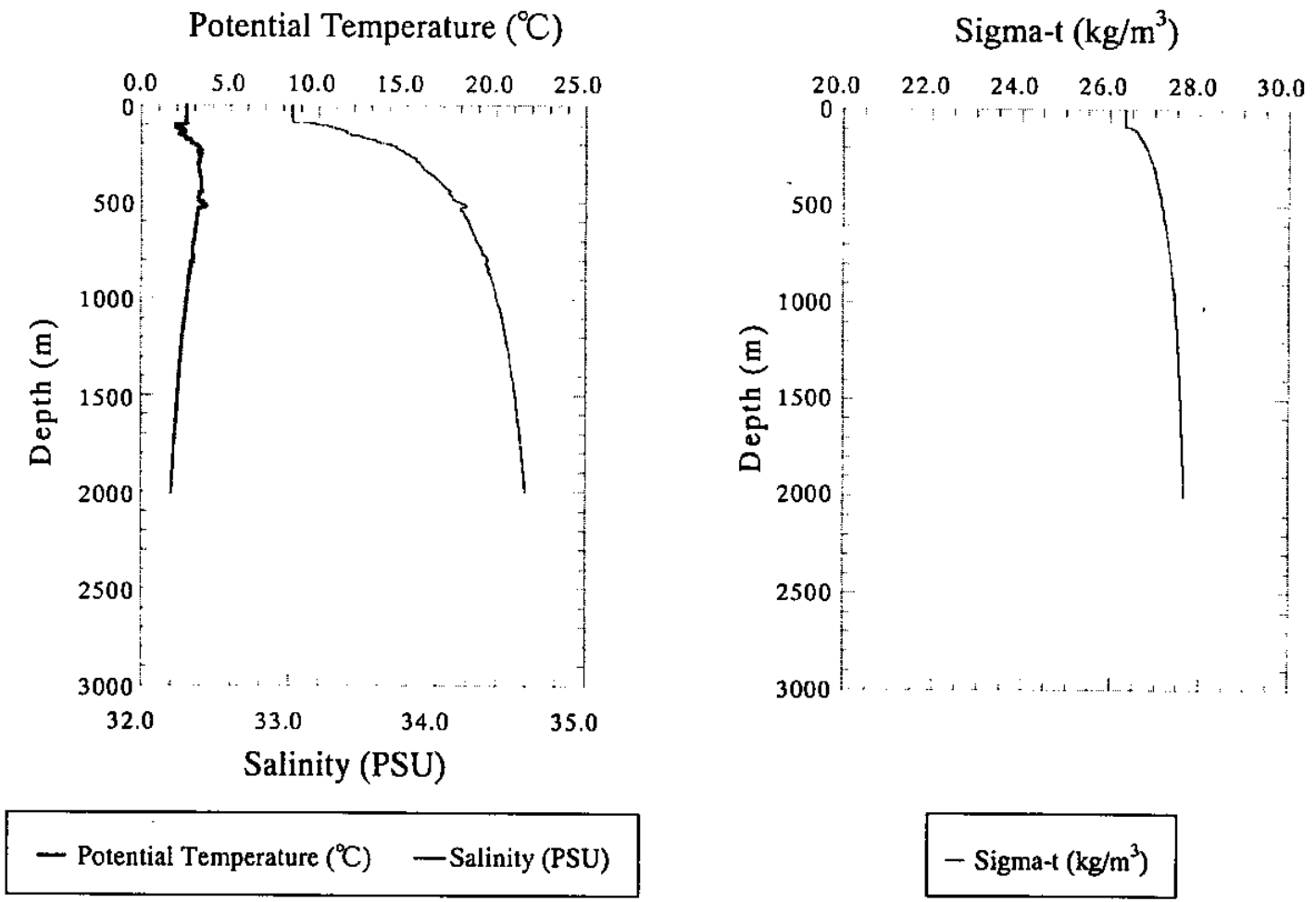
MWJ



Stn.15 (0015L03)

Fig. 3.2.15 CTD vertical profile (Stn.15)

MWJ



Stn.03 (0003S01)

Fig. 3.2.16 CTD vertical profile (Stn.03)

MWJ

3.3 Dissolved oxygen, nutrients, and salinity

3.3.1 Dissolved oxygen

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Introduction

Dissolved oxygen is one of the major parameters for deciding the seawater characteristic on oceanography. In this cruise, we used the methods of dissolved oxygen determination is based on WHP Operations and Methods (Culberson, 1991, Dickson, 1994).

Methods

A. Instruments and Apparatus

Glass bottle: Glass bottle for D.O. measurements consist of the ordinary BOD flask (ca.180 ml) and glass stopper with long nipple, modified from the nipple presented in Green and Carritt (1966).

Dispenser: Eppendorf Comforpette 4800 / 1000ml
OPTIFIX / 2 ml (for $MnCl_2$ & NaOH / NaI aq.)
Metrohm Model 725 Multi Dosimat / 20 ml (for KIO_3)

Titorator: Metrom Model 716 DMS Titrino / 10 ml of titration vessel
Metrom Pt Electrode / 6.0403.100 (NC)

Software: Data acquisition and endpoint ealuation /

B. Methods

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

(b-1) Sampling

Sea water samples for dissolved oxygen measurement were collected from 30L Niskin bottles to calibrated dry glass bottles. During each sampling, 3 bottle volumes of seawater sample were overflowed to minimize contamination with atmospheric oxygen and the seawater temperature at the time of collection was

measured for correction of the sample volume. After the sampling, $MnCl_2$ (ap.) 1ml and NaOH / NaI (aq.) 1ml were added into the glass bottle, and then shook the bottle well. After the precipitation has settled, we shook the bottle vigorously to disperse the precipitate.

(b-2) D.O. analysis

The samples were analyzed by 2 sets of Metrohm titrator with 10ml piston burette and Pt Electrode using whole bottle titration. Titration was determined by the potentiometric methods and the endpoint for titration was evaluated by software of Metrohm, "The Brinkmann Titrino Workcell".

Concentrations of D.O. were calcurated by equation (8) and (9) in WHP's Operations and Methods manual (Culberson, 1991). Salinity value of the equation (9) was used from the value of salinity of CTD. However, the amount of D.O. in the reagents was reported 0.0017 ml at 25.5 deg-C (Murray et.al., 1968), we used the value (=0.0027 ml at 21 deg-C) measured at 1995 WOCE cruise of R/V Kaiyo. D.O. concentrations we caluculated were not corrected by seawater blank. We prepared and used one batch of 5 liter of 0.07N thiosulfate solutions and 5 liter of 0.0100N standard KIO3 solutions (JM991216).

Preliminary Result

(3-1) Compared KIO_3 standards with CSK standard solution.

After this cruise, we compared our standards with CSK standard solution (Lot. DLG8365) which is the commercially available standard solution prepared by Wako Pure Chemical Industries, Ltd. The results are shown in table 3.3.1-1.

Table 3.3.1-1. Comparison of each standards

Titrator	KIO_3 Lot No.	Nominal Normality	Average Titer (ml)	Standard Deviation	n
#A	DLG8366	0.0100	1.394	0.0007	5
	JM991216	0.010017	1.397	0.0006	5
#B	DLG8366	0.0100	1.399	0.0006	5
	JM991216	0.010017	1.403	0.0006	5

(3-2) Reproducibility

In this cruise, 426 samples for D.O. samples were collected and 96 pairs (22.5%) of total samples were analyzed as “duplicates” which were collected from same Niskin bottle. Results of each stations are shown in Fig.3.3.1(1) - (4)

References

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

Culverson, 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 sea water by Winkler titration, in WHP Operations and Methods, Woods Hole., ppl-14.

Green, E.J. and D.E.Carritt (1996), An Improved Iodine Determination Flask for Whole-bottle Titrations, Analyst, 91, 207-208.

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.

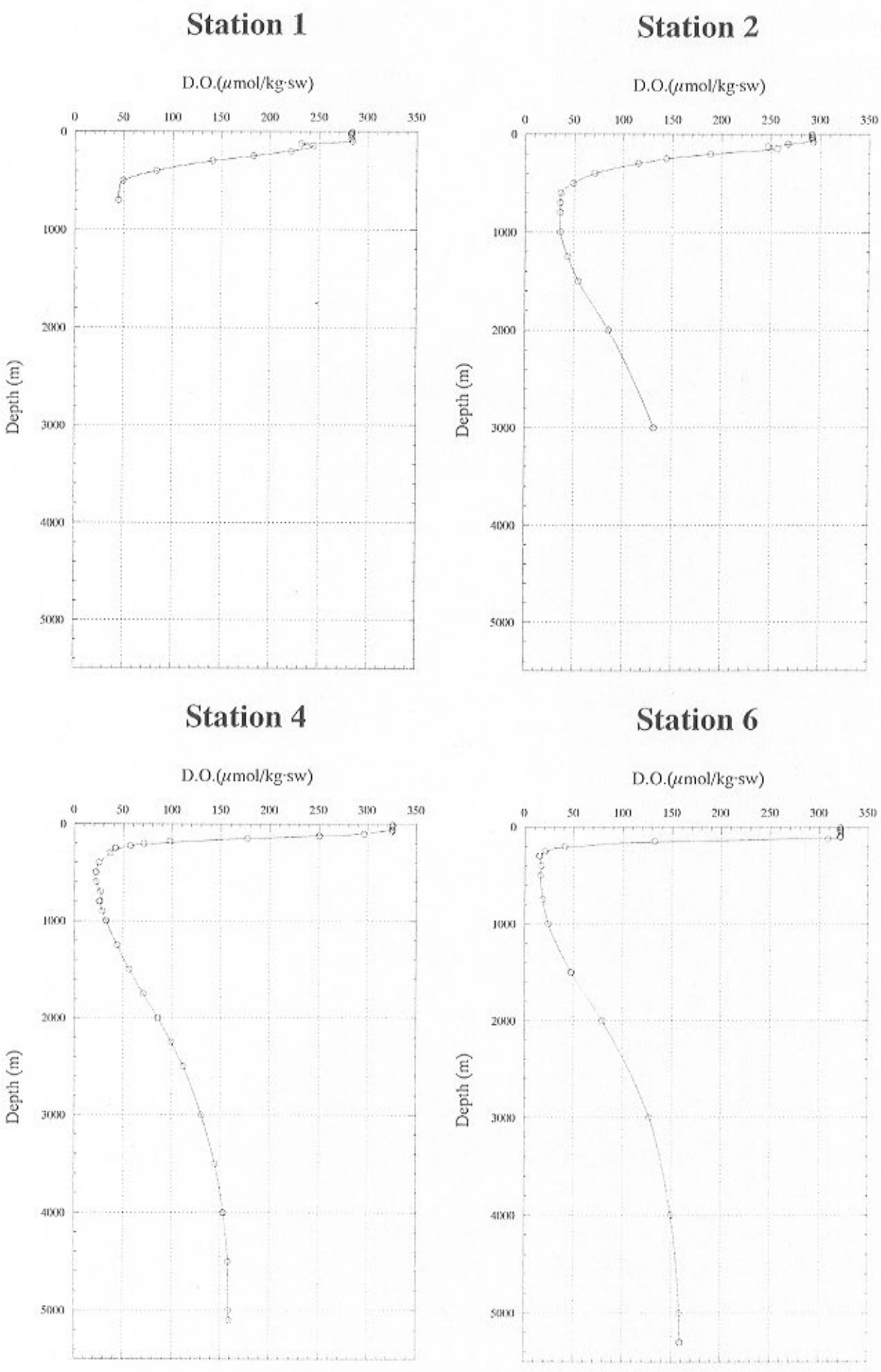


Fig.3.3.1(1) Vertical profile is each station.

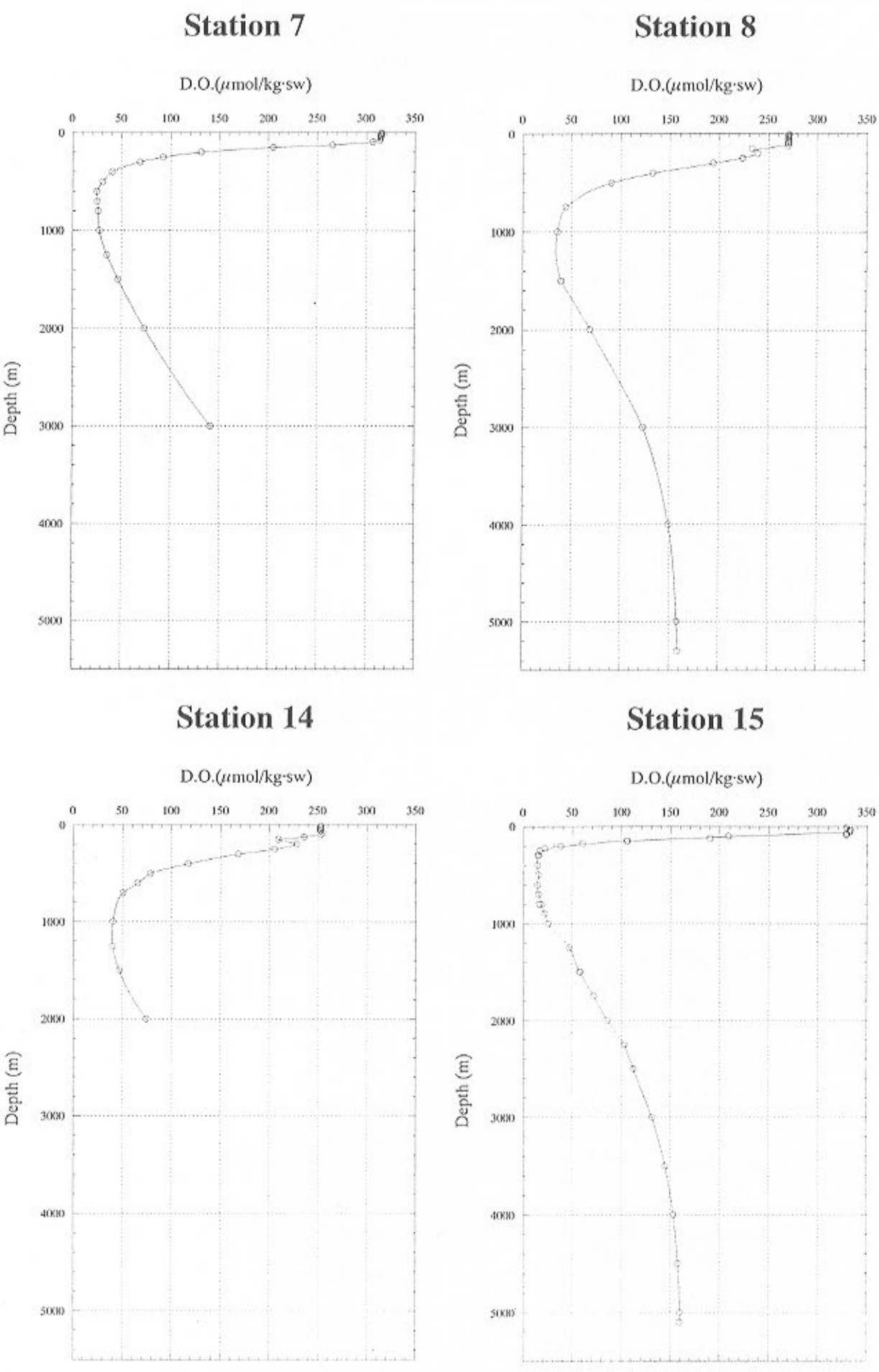


Fig.3.3.1(2) Vertical profile is each station.

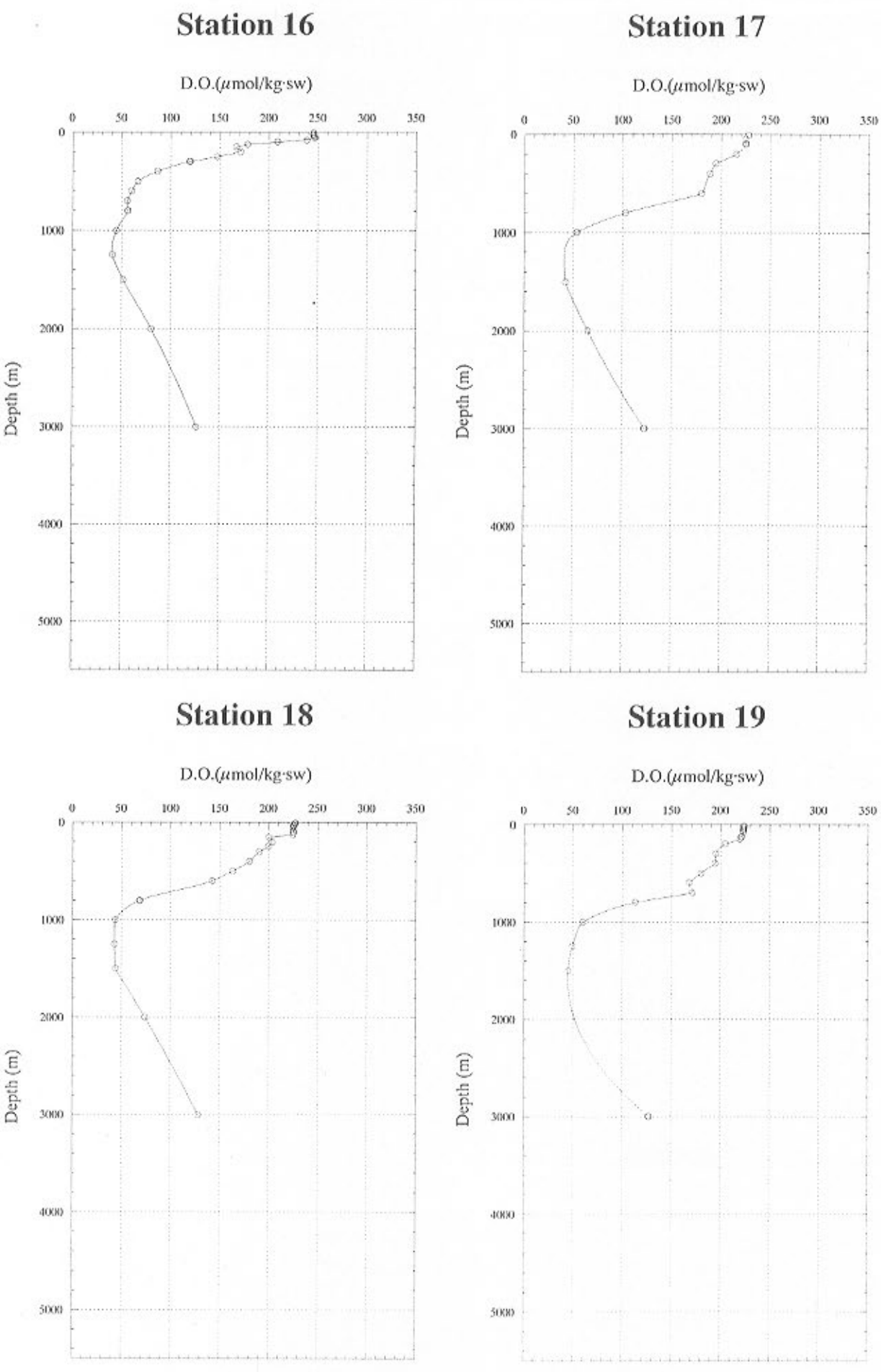


Fig.3.3.1(3) Vertical profile is each station.

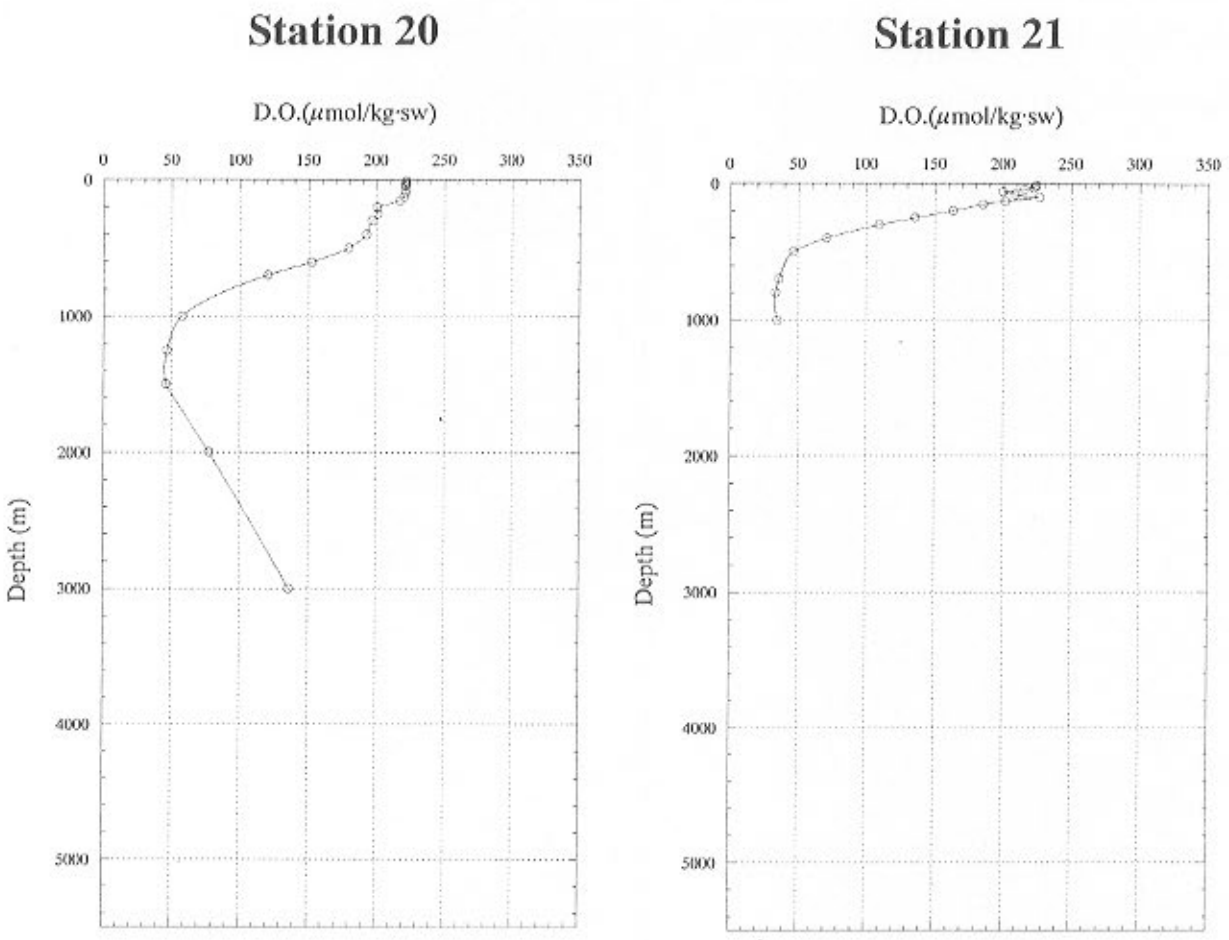


Fig.3.3.1(4) Vertical profile is each station.

3.3.2 Nutrient measurements of sea water sample

Kenichiro SATO[*1], Ichiro YAMAZAKI[*1] and Chizuru SAITO[*2]
*1: MWJ *2: JAMSTEC

(1) Objective

The vertical and horizontal distributions of the nutrients are one of the most important factors on the primary production. During this cruise nutrient measurements will give us the important information on the mechanism of the primary production or seawater circulation.

(2) Instruments and Methods

The nutrients analyses were performed on BRAN+LUEBBE continuous flow analytical system Model TRAACS 800 (4 channels). The laboratory temperature was maintained between 20-25 deg C.

Nitrite: The nitrite is determined by diazitizing with sulfanilamide and coupling with N-1-naphthyl- ethylenediamine (NED) to form a colored azo dye which is measured at 550 nm using 5 cm length cell.

Nitrate: Nitrate in seawater is reduced to nitrite, which is determined by the method described above. Nitrite initially present in the sample is corrected.

Silicate: The standard AAII molybdate-ascorbic acid method was used. Tempreture of the sample was maintained at 45-50 deg C using a water bath to reduce the reproducibility problems encountered when the samples were analyzing at different temperatures. The silicomolybdate produced is measured spectrophotometrically at 630 nm using a 3 cm length cell.

Phosphate: The method by Murphy and Riley (1962) was used with separate additions of ascorbic acid and mixed molybdate-sulfuric acid-tartrate. Tempreture of the samples were adjusted to be 45-50 deg C using a water bath. The phospho-molybdate produced is measured at 880 nm using a 5 cm length cell.

a. Sampling Procedures

Samples were drawn into polypropylene 100 ml small mouth bottles. These were

rinsed twice before filling. The samples were analyzed as soon as possible. Five ml sample cups were used for analysis.

b. Low Nutrients Sea water (LNSW)

Ten containers (20L) of low nutrients sea water were collected in early 1999 at equatorial Pacific and filtered with 0.45mm pore size membrane filter (Millipore HA). They are used as preparing the working standard solution.

(3) Preliminary results

a. Precision of the analysis

We have made the repeat analysis of two layers' (about 125 m and 1250 m depths) samples at each station. At those repeat analysis range of CV (concentration average to standard deviation) were 0.53 to 1.5 % in upper layer and 0.15 to 0.31 % in deeper layer except nitrite.

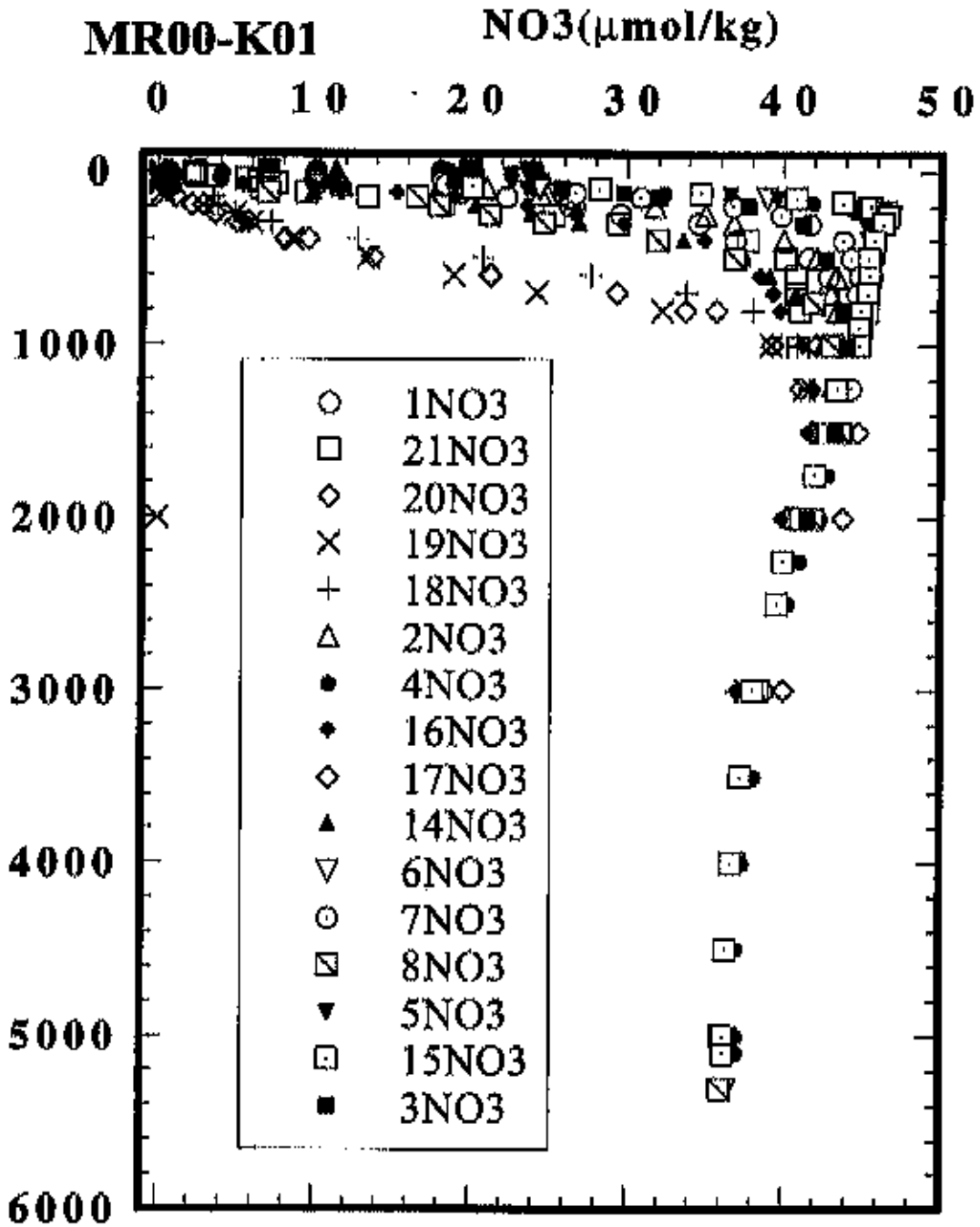
b. Distribution of nutrients

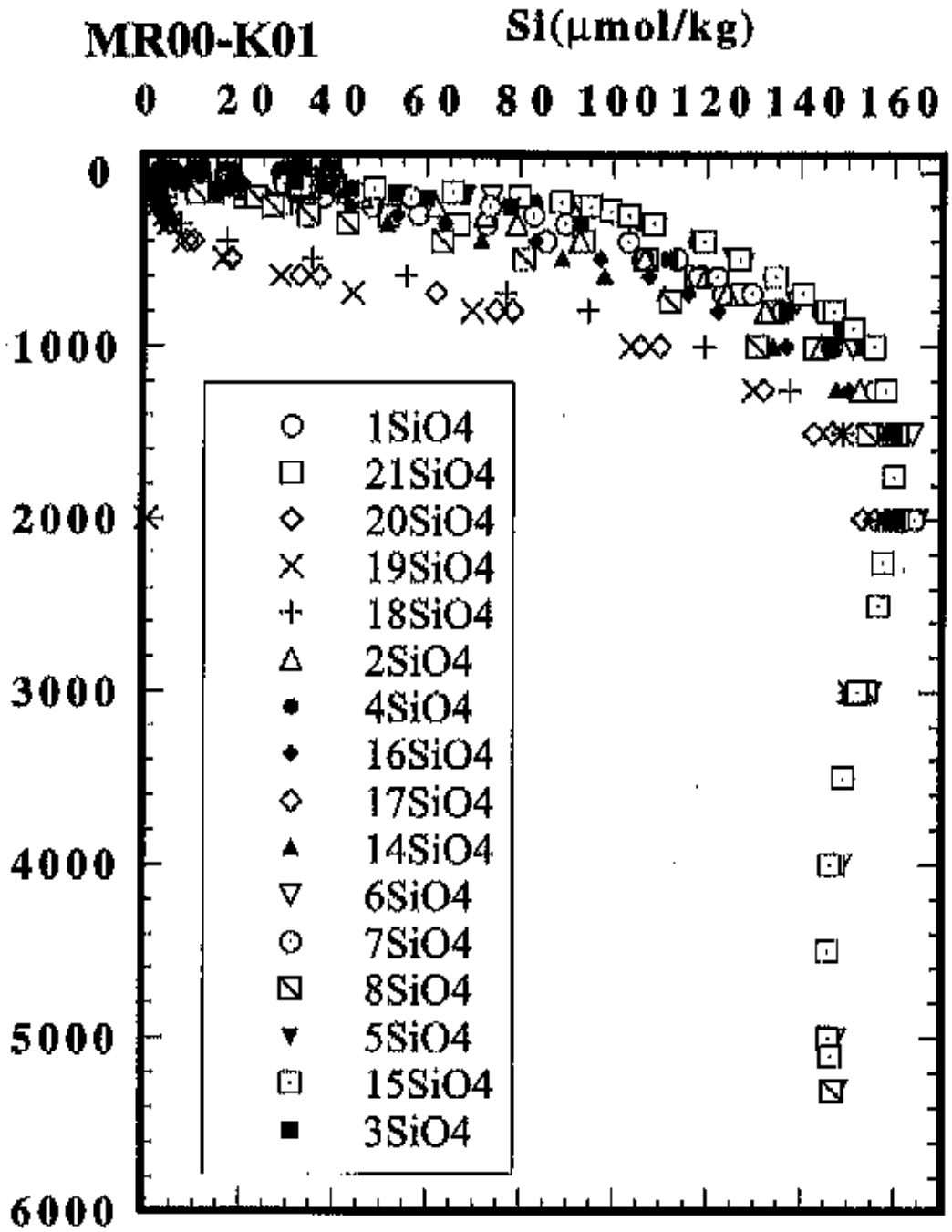
The results are shown in Appendix.

In this cruise we got valuable results in western North Pacific in winter season.

The highest seasurface nutrient concentrations were observed in stn.6 (50N). Early in February, surface layer nutrient concentrations at stn. 5 (slightly southern part of station KNOT) were almost same as stn.6 (50N), so it might be northern surface water advanced southward near stantion KNOT. But it didn't reach station KNOT, yet. Anyway we are looking forward to analyzing the severe winter season's data.

These data are stored in MO disk in Ocean Research Department in JAMSTEC.


MR00-K01
NO3(μmol/kg)
0
10
20
30
40
50
0
1000
2000
3000
4000
5000
6000
1NO3
21NO3
20NO3
19NO3
18NO3
2NO3
4NO3
16NO3
17NO3
14NO3
6NO3
7NO3
8NO3
5NO3
15NO3
3NO3


MR00-K01
Si(μmol/kg)
0 20 40 60 80 100 120 140 160
0
1000
2000
3000
4000
5000
6000
1SiO4
21SiO4
20SiO4
19SiO4
18SiO4
2SiO4
4SiO4
16SiO4
17SiO4
14SiO4
6SiO4
7SiO4
8SiO4
5SiO4
15SiO4
3SiO4

3.3.3. Salinity measurements

Fujio KOBAYASHI and Shinya NAGAOKA
(Marine Works Japan Ltd.)
Chizuru SAITO and Makio HONDA
(Japan Marine Science and Technology Center)

(1). Method

Salinity was measured with the laboratory salinometer (Model 8400B AUTOSAL; Guildline Instruments Ltd.), which was modified by addition of an Ocean Science International peristalitic-type sample intake pump and Hewlett-Packard quartz thermometer model 2804A with two 18111A quartz probes. One probes measured at room temperature and the other probe measure at a bath temperature. The resolution of the quartz thermometer was set to 0.001 ℃. Data of both the salinometer and the thermometer was collected simultaneously by a personal computer. A double conductivtiy ratio was defined as median of 31 times readings of the salinometer. Data collection started after 5 seconds and it took about 10 seconds to collect 31 reading by a personal computer.
The salinometer was operated in the air-conditioned ship's laboratory at bath temperature of 24.

1. Salinity Sample Bottles

The bottles in which the salinity samples are collected and stored are 250 ml brown glass bottles with screw caps.

2. Salinity Sample Collection and Temperature Equilibration

Each bottles was rinsed three times with sample water and was filled to the shoulder of the bottle. Its cap was also thoroughly rinsed. Salinity samples were stored more than 24 hours in same laboratory where the salinity measurement was made.

3. Standardization

The salinometer AUTOSAL was standardized before and after sequence of measurements by use of IAPSO Standard Seawater batch P136 whose conductivity ratios were 0.99996.

4. Sub-Standard Seawater

We also used sub-standard seawater which was deep-sea water filtered by use of

Millipore filter (pore size of 0.45 m) and stored in a 20 liter container made of polyethylene. It was measured every 5 samples in older to check the trend.

(2). Results

The results are shown in Appendix.

(3). Management of the salinity data

All of raw and processed salinity data files were copied into 3.5 inches magnetic optical disks (MO disks).

3.4 Carbonate chemistry

3.4.1. pH measurements

Andrey Andreev, JAMSTEC

Method and Instruments

pH (-log [H^+]) of the seawater was measured by potentiometric method in the closed cells at the temperature 25^0 C (pH_{25}). Different types of the electrode cells were applied.

One cell (A) was the cell with liquid junction or 'salt bridge' (saturated solution of KCl)

Ag, AgCl| solution of KCL || test solution |H^+ -glass –electrode (A).

The measurement of EMF of the cell (A) was conducted by pH/Ion meter (model PHM95), pH and Ag/AgCl reference electrode of the 'Radiometer' company. The temperature of the test solution was monitored by temperature sensor (Radiometer) within 0.1^0C. To calibrate the electrodes the TRIS (0.04 m TRIS+ 0.04 m TRISHCL) (pH_T=8.0936 pH unit at the t=25^0C, DelValls and Dickson, 1998) and AMP (0.04 m AMP + 0.04 m AMPHCL) (pH_T=6.786 pH unit at the t=25^0 C, Dickson and Goyet, 1996) in the synthetic seawater (S=35 psu) (Total hydrogen scale) were applied.

The pH was calculated by following equation

$$pH = pH(standard) + F (Es - Et) / RT \cdot \ln (10) \quad (1)$$

where (Es – Et) is the difference in EMF of standard and test solutions, RT· ln (10)/F is Nernst constant (59. 16 mv/pH unit at the temperature 25^0 C).

The main problem of the measurement by cell (A) it is problem of the residual liquid junction potential (LJP) which arise on the interface of 'salt bridge' and test solution (additional term in the equation 1). The value of LJP is different in the buffer and test solution and it also depends on the speed sample mixing in the cell and the level of the KCl solution in the reference electrode.

To measure pH we also used (B1) + (B2) cells:

Ag, AgCl| solution of KCL || test solution $|H^+$ -glass –electrode (B1),

Ag, AgCl| solution of KCL || test solution |Cl –ion-selective –electrode (B2)

with common reference Ag, AgCl electrode.

In pH measurements using the (B1)+(B2) cells we applied the pH/ISE meter (model 920A), pH, chloride- ion- selective and Ag/AgCl reference electrodes of the 'Orion' company. For the calibration of electrodes the TRIS and AMP in the synthetic seawater were used.

The difference in EMF between (B1) and (B2) cells is determined by cell without transfer

Cl-ion–selective electrode | test solution | H^+- glass – electrode (C)

The pH of test solution (seawater) can be calculated from the measured values of EMF of the cell (C) by equation

$$PH = pH(standard) + F(Es- Et)/RT\cdot\ln(10) + \log[(mCl)s/(mCl)t] + \log[(\gamma H)s/(\gamma H)t] + \log[(\gamma Cl)s/(\gamma Cl)t] \quad (2)$$

where (mCl) and (γCl) are the molality and activity coefficient of chloride ion in the standard (s) and test (t) solutions, (γH)s and (γH)t are the coefficient of activity of hydrogen ion in the standard and test solutions.

The (mCl) in the test solution (seawater) can be computed from salinity (S) by equation:

$$mCl = 15.60 \cdot S / (1000 - 1.00511 \cdot S) \quad (3)$$

The EMF of (A) and (C) cells is determined by the activity of hydrogen ion than concentration. The coefficient between activity and concentration (coefficient of activity) depends on salinity. In the measurements of the pH by (A) cell it used to be assumed that $\log[(\gamma H)s/(\gamma H)t$ is equal to 0. The ratio between $\gamma_{\pm}HCl$ $(\sqrt{\gamma H \cdot \gamma Cl})$ in the buffer solutions and in the seawater (equation 2) can be derived using ion-interaction models. Using this approach we can calculate the pH of seawater from EMF measurements by (B1)+ (B2) cells.

Preliminary results.

The values of pH_{25} measured by cell (A) are presented in the cruise data report.

Fig. 3.4.1.1. shows pH_{25} versus T (where T is the temperature of the seawater) in the upper 250 meters water layer of the Northwestern Paific. The pH_{25} of the seawater is increasing with temperature due to mainly decrease in solubility of carbon dioxide. In the 2 - 11^0C temperature interval the relationship between pH and temperature can be expressed by following equation

$$pH_{25} = a + 0.025 \cdot T \quad (4)$$

Fig. 3.4.1.3 shows the vertical profiles of pH_{25} in the Northwestern Pacific (station 16 (37.3^0 N, 147.3^0 E), station KNOT1 (station 5) (44^0 N, 155^0 E), station 6 (50^0 N,165^0 E), station 7 (45^0 N, 165^0 E) and station KNOT2 (station 15) (44^0 N, 155^0 E). In the bottom water layer (4000 – 5500 m depth interval) the distribution of pH_{25} was quite uniform. The water characteristics at station KNOT2 and station 6 were presented by Western Subartic Gyre water with lowest values of pH (and dissolved

oxygen) in the intermediate layer of the Northwestern Pacific. Station KNOT1 was under influence of the Oyashio water. The salinity and temperature in the intermediate layer at this station was lower than at station KNOT2 and station 6 and the pH (and dissolved oxygen) was higher than at station KNOT2 and station 6 (Fig. 3.4.1.3).

The temperature-salinity indices of waters at station 7, located in the Subarctic frontal zone were similar to those at station 6 and station KNOT2. The difference between these water masses can only be seen from salinity -pH (dissolved oxygen, nutrient and dissolved inorganic carbon) diagrams (Fig. 3.4.1.2). The water at station 7 presented a ìnew formedî subarctic water. Two steps mixing, first, the mixing of ìoldîwestern subartic Pacific water with the Okhotsk Sea water (thus formed the Oyashio water, which is more colder and fresher than subarctic Pacific water) and then the mixing of Oyashio water with subtropical water lead to the significant increase of pH (and concentration of dissolved oxygen) in the intermediate layer of subarctic Pacific.

REFERENCES

Dickson, A. G. and Goyet C. (Eds.). Handbook of Methods for the Analysis of the Various Parameters of the Carbon Dioxide System in Seawater, ORNL/CDIAC-74. 1994. 107 p.

DelValls T.A. and Dickson A.G. The pH of buffers based on 2-amino-2-hydroxymethyl-1,3- propanediol (‘tris’) in the synthetic sea water. 1998. V.45, P. 1541- 1554.

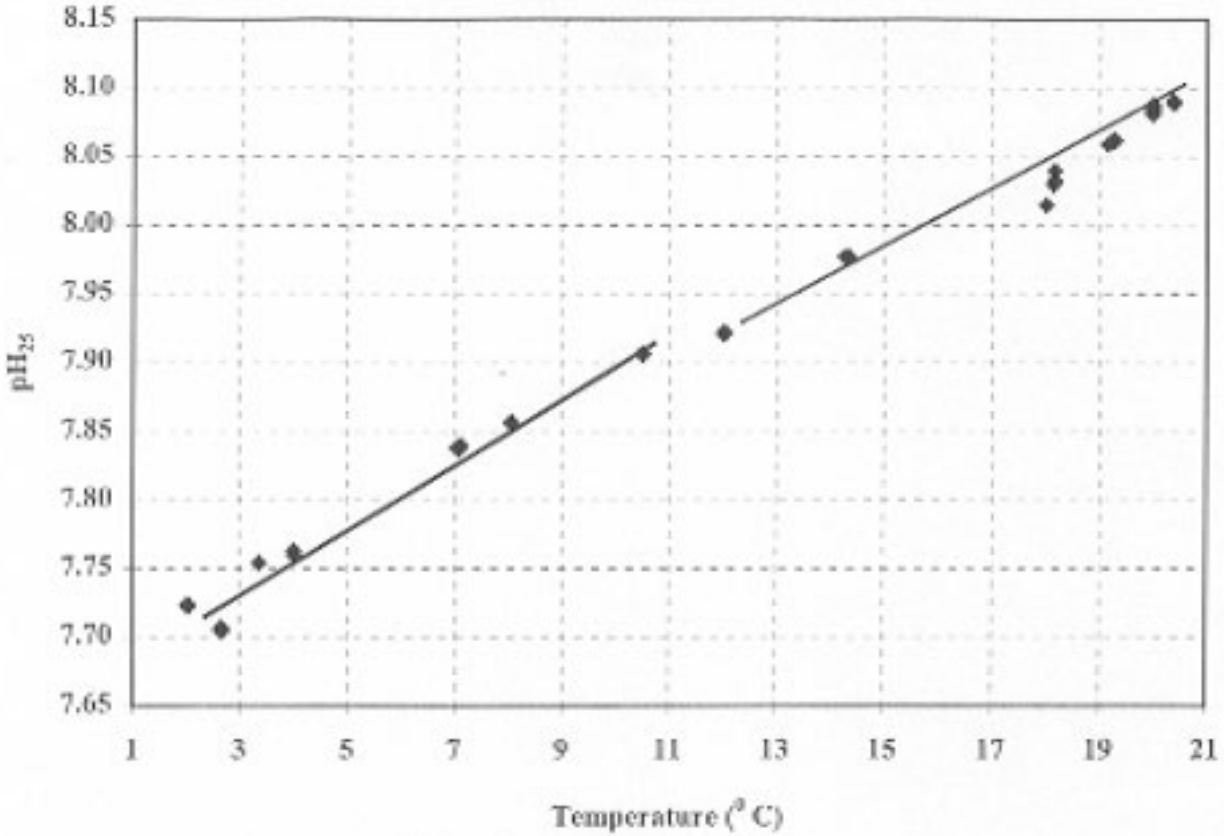


Fig.3.4.1.1. pH_{25} versus temperature in the upper 250 m layer.

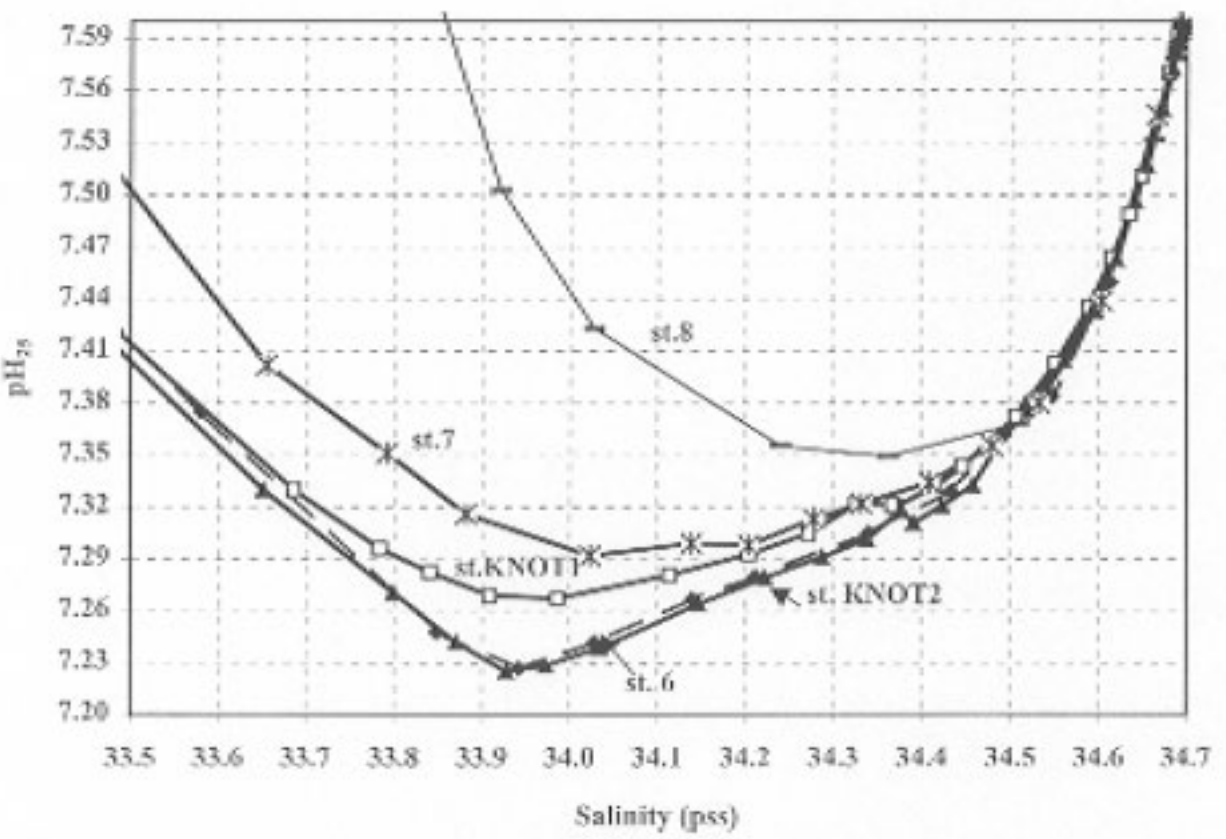


Fig.3.4.1.2. pH_{25} versus salinity.

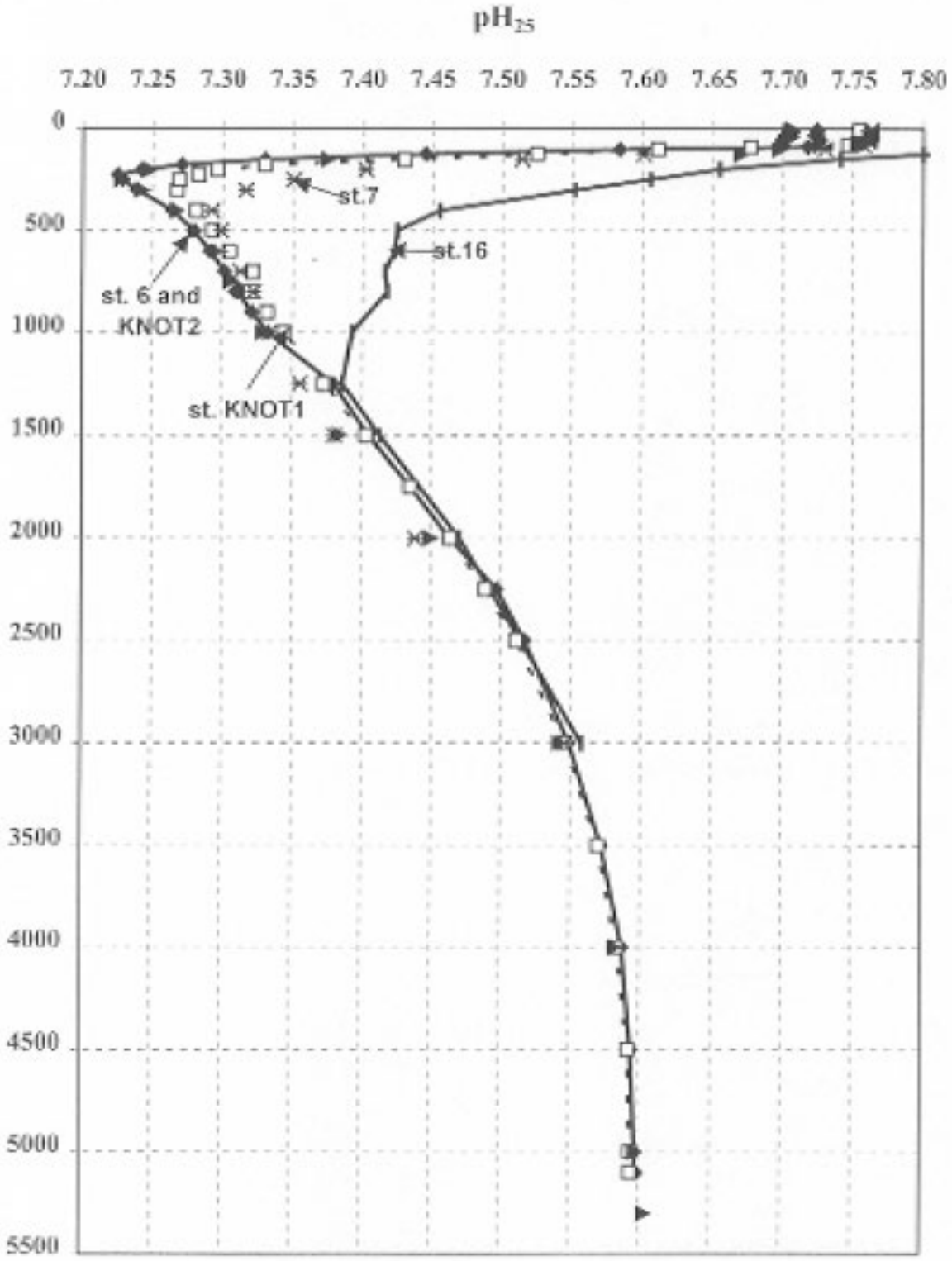


Fig. 3.4.1.3. Vertical distribution of pH_{25}.

3.4.2 Total dissolved inorganic carbon

Yuichiro Kumamoto (JAMSTEC), Kazuhiro Hayashi (MWJ)

Global warming caused by green house gas such as CO_2 has become much attention all over the world. In order to verify carbon cycle in the northwestern North pacific, total dissolved inorganic carbon (TDIC) was measured with analytical instruments installed on R/V MIRAI.

3.4.2.1 Bottle sampling

Concentration of TDIC in seawater collected at the stations 1, 2, 4, 6, 7, 8, 14, 15, 16, 17, 18, 19, 20, and 21 was measured by a coulometer (Carbon Dioxide Coulometer Model 5012, UIC Inc.). A volume of seawater (35 cm^3) was taken into a receptacle and 2 cm^3 of 10 percents (v/v) phosphoric acid was added. The CO_2 gas evolved was purged by CO_2 free nitrogen gas for 12 minutes at the flow rate of 140 cm^3 $min.^{-1}$ and absorbed into an electrolyte solution. Acids formed by reacting with the absorbed CO_2 in the solution were titrated with hydrogen ions using the coulometer. Calibration of the coulometer was carried out using sodium carbonate solutions (0-2.5mM). The coefficient of variation of 3 replicate determinations was approximately less than 0.1 percents for 1 sigma. All the data were referenced to the Dickson's CRM and shown in the Appendix. Figure 1 shows vertical distributions of TDIC at St. 4 (St. KNOT) and St.15 (St.KNOT2).

3.4.2.2 Continuous surface seawater sampling

Concentration of TDIC in surface seawater water collected by a pump from 4 m depth was continuously measured every 40 minutes by a coulometer (Carbon Dioxide Coulometer Model 5012, UIC Inc.). A volume of seawater (35 cm3) was taken into a receptacle and 2 cm^3 of 10 percents (v/v) phosphoric acid was added. The CO_2 gas evolved was purged by CO_2 free nitrogen gas for 12 minutes at the flow rate of 140 cm^3 $min.^{-1}$ and absorbed into an electrolyte solution. Acids formed by reacting with the absorbed CO_2 in the solution were titrated with hydrogen ions using the coulometer. Calibration of the coulometer was carried out using sodium carbonate solutions (0-2.5mM). The coefficient of variation of 3 replicate determinations was approximately less than 0.1 percents for 1 sigma. All the data were referenced to the Dickson's CRM and stored in a MO disk at JAMSTEC, Yokosuka.

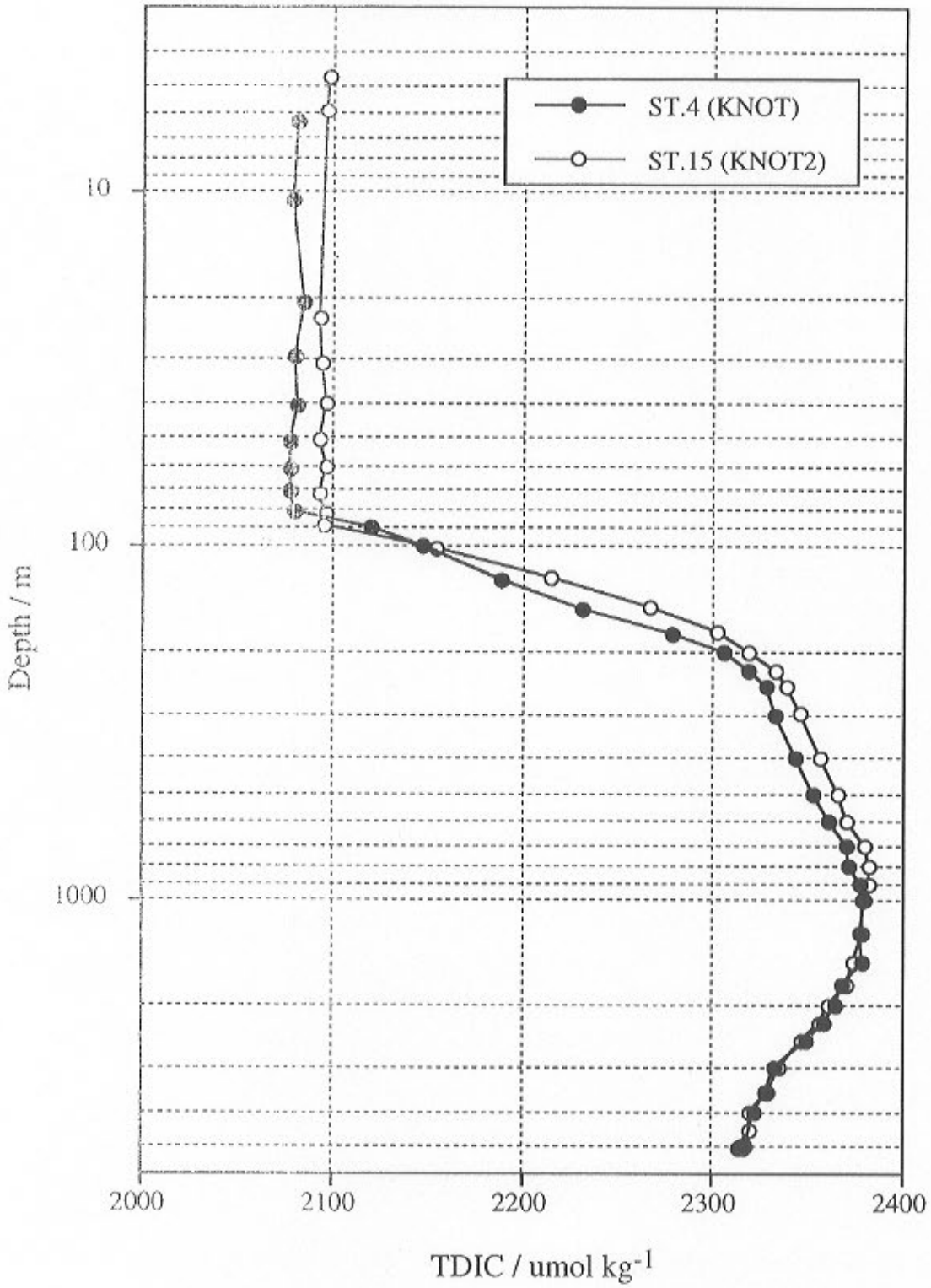


Figure 1: Vertical distributions of TDIC at St. 4 (St. KNOT) and St.15 (St.KNOT2) of the MR00-K01 cruise.

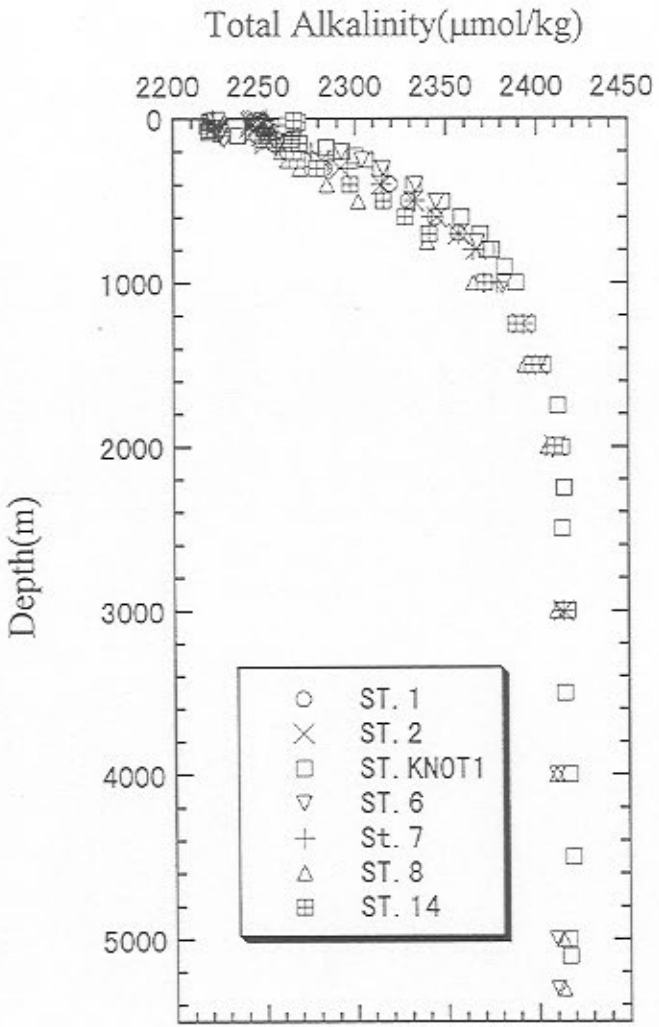
3.4.3 Total Alkalinity

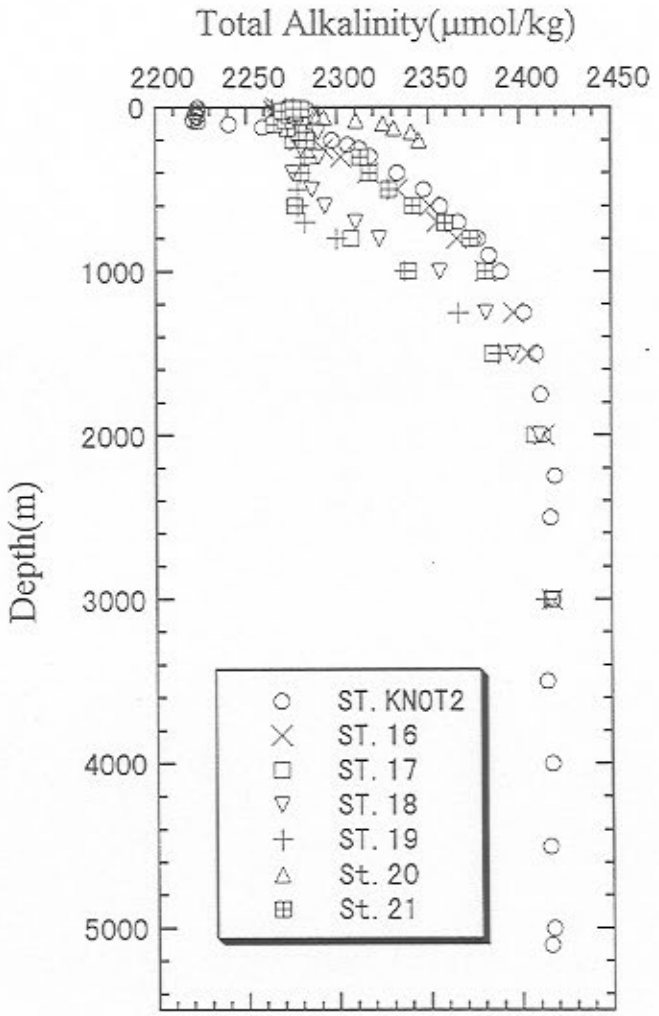
Akihiko Murata (JAMSTEC)
Fuyuki Shibata (MWJ)
Miko Kitada (MWJ)

Samples were drawn from 12 L drawn from 12 L NiskinTM bottles into 250 ml polyethylene bottles. Bottles were rinsed twice and filled from the bottom, overflowing a volume while taking care not to entrain any bubbles. The bottles were then sealed by a screw cap with an inner cap and stored at room temperature for maximum of 24 hours prior to analysis.

The total alkalinity titration system consists of a titrator (Radiometer, TitraLabTM, TIM900) and an autoburette (Radiometer, ABU901). The titration was made by adding HCl (0.1N) to seawater past the carbonic acid point. Glass (Radiometer, REF201) and reference (Radiometer REF201) electrodes were used to measure emf. The repeatability of measured total alkalinity was 0.15 % on average. All the values reported are set to the Dickson's CRM.

Vertical profiles of total alkalinity were shown in Fig. 3.4.3.1


Total Alkalinity(μmol/kg)
2200 2250 2300 2350 2400 2450
0
1000
2000
3000
4000
5000
Depth(m)
ST. 1
ST. 2
ST. KNOT1
ST. 6
St. 7
ST. 8
ST. 14


Total Alkalinity(μmol/kg)
2200 2250 2300 2350 2400 2450
0
1000
2000
3000
4000
5000
Depth(m)
ST. KNOT2
ST. 16
ST. 17
ST. 18
ST. 19
St. 20
St. 21

3.4.4 Carbon isotopes

Yuichiro Kumamoto (JAMSTEC), Kazuhiro Hayashi (MWJ)

In order to study the role of surface water and intermediate water in carbon cycle in the western North pacific, seawater for radio and stable carbon isotopes of TDIC was collected by the hydrocast at the stations 1, 2, 4, 6, 7, 8, 14, 16, 17, 18, 19, 20, and 21 and the underway (continuous) surface seawater sampling. Seawater was collected in a 250 ml glass bottle. Then a head-space of 2 % of the bottle volume was left by removing seawater sample with a plastic pipette. Saturated mercuric chloride ($HgCl_2$) of 0.05 cm^3 was added as preservative. Finally, the bottle was sealed using a greased ground glass and a clip was secured. We collected about 380 seawater samples during this cruise. All the samples were stored in a laboratory of JAMSTEC Mutsu Branch in Mutsu City. In the laboratory, TDIC will be extracted as CO_2 and converted to graphite for measurements of stable and radio carbon isotopes, respectively.

3.4.5 Study of carbon system at the station KNOT

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(1) Purpose

The time series observation at station KNOT (Kyodo Northwest Pacific Ocean Time series) began in June 1998. This is one of the activities of JGOFS-Japan and JGOFS-NPTT (North Pacific Task Team). The station KNOT is located at 44˚N, 155˚E in the southwestern part of western subarctic gyre. This area is characterized by high biological production in spring and deepening of surface mixed layer in winter season by strong surface cooling. The purpose of this study is to understand the seasonal variation of carbon system at KNOT and its around area.

(2) Methods

Sampling

We collected samples for on board measurements of total carbon dioxide (TC), total alkalinity (TA) and dissolved oxygen. Water samples were collected with CTD rosette systems attached with Niskin bottles of 30 l or 12 l capacity. Sample waters for TC/TA were drawn from Niskin samplers into the 250 ml glass bottles with plastic screw cap (Schott Duran). Sample wataers for dissolved oxygen were drawn into the 200 ml glass bottles (Rigo-sha) and added 1 ml of manganous chloride solution and 1ml of potassium iodide * sodium hydroxide solution and capped by glass stick.

Analysis

TC and TA in seawater were determined by the methods similar to DOE (1994) with new automatic measurement system (KIMOTO ELECTRIC Co., LTD.). This system contain two devices, a device for extraction of carbon dioxide and a device for determination of TA by titration, each in a 50x60x40cm console. This system is coupled to a CO_2

coulometric detector (model 5012, supplied by UIC Coulometrics Inc.), an Autoburette (ABU901, supplied by RADIOMETER Co., LTD.), two cooling units to maintain the sample water at constant temperature, and a personal computer. All procedures except exchange of the samples and rinsing of TA titration cell are operated automatically. Sample water for TC analyses were controlled at constant temperature (10˚C). A known volume (about 30 ml) of seawater sample is dispensed into the stripping chamber and acidified with 8.5 % reagent grade phosphoric acid, converting all carbonate species to free CO_2. The evolved CO_2 is then extracted from seawater using ultra high purity nitrogen gas (99.9995 %) for 10 minutes at a rate of 200 ml/min. The CO_2 gas is absorbed by a coulometer cell solution, containing ethanolamine, dimethylsulfoxide and thymolphthalein indicator, and quantified by coulometric titration. Seawater based reference materials were prepared by Hokkaido University used for calibration. The precision was 0.1%, which was obtained from 10 replicate determinations on board the ship once a day. TA was determined by potentiometric titration. Sample water for determination of TA was controlled at constant temperature (20˚C). A known volume (about 100 ml) of seawater sample is dispensed into closed titration cell containing two glass electrodes, a thermometer and a capillary tube that supplies acid from a burette. Sample seawater was titrated with 0.2 N hydrochloric acid past the carbonic acid endpoint. TA was calculated from titration data by the non-linear least-squares approach (DOE, 1994). The precision was 0.1%, which was obtained from 10 replicate determinations on board the ship once a day.
Dissolved oxygen were analyzed by Winklar method. The precision was 0.2 ˚mol/kg.

(3) Results

All the data of TC, TA and dissolved oxygen are shown in appendix tables. All the data is preliminary and will be corrected.
The concentration of TC in the surface mixed layer at KNOT was 2418 ˜mol/kg (Salinity normalized to 35) in 18 January and increased to 2425 ˜mol/kg in 4 February. The concentration of TC in 4 February are highest value throughout the past time series observation at KNOT. This is because of the entrainment of deeper water to the surface due to the strong vertical mixing. We will discuss about the factor which cause the seasonal variability of carbon system in the surface water at KNOT and adjacent area, such as air-sea exchange, biological production, horizontal advection and entrainment of deep water.

(4) Collected samples for on shore measurements

We collected water samples for on shore measurements of TC/TA, nutrient, salinity, iron, ^{13}C (CO_2), ^{18}O (H_2O), methane, halocarbons, and barium at KNOT and around station.

The details about these samples were listed in inventory information.

Reference

DOE (1994): Handbook of methods for the analysis of the various parameters of the carbon dioxide system in seawater; version 2.0, A. G. Dickson and C. Goyet, editors, U. S. Department of Energy CO_2 Science Team Report.

Table 3.4.5.1 Results of on borad measurements of total dissolved inorganic carbon (TC), total alkalinity (TA) and dissolved oxygen (DO) by CREST / KNOT group.

St. 19 routin		St. 4 routin shallow			deep			St. 14 routin shallow			deep		
No.	DO μmol/kg	No.	TC μmol/kg	TA μmol/kg	No.	TC μmol/kg	TA μmol/kg	No.	TC μmol/kg	TA μmol/kg	No.	TC μmol/kg	TA μmol/kg
1	128.0	1			1	2319.8	2423.7	1	2245.8	2301.1	1		
2		2	2373.1	2376.6	2	2317.8	2424.3	2	2142.1	2263.5	2	2370.0	2414.0
3	47.0	3	2369.2	2367.6	3	2322.7	2426.9	3	2119.4	2268.6	3	2386.8	2405.4
4	49.9	4	2362.6	2359.0	4	2328.1	2422.4	4	2064.1	2268.3	4	2378.0	2394.5
5	61.6	5	2351.1	2340.9	5	2330.5	2392.9	5	2047.2	2267.9	5	2361.9	2377.5
6	114.1	6	2331.2	2322.6	6	2339.3	2429.8	6	2046.4	2269.2	6		
7	171.3	7	2322.6	2310.6	7	2353.9	2428.1	7	2050.8	2263.1	7	2335.7	2352.5
8	168.5	8	2313.3	2306.9	8	2362.4	2426.4	8	2044.7	2269.1	8	2304.7	2333.3
9	180.4	9	2303.9	2297.3	9	2369.7	2423.5	9	2049.0	2269.2	9	2292.5	2321.8
10	194.9	10	2290.2	2290.0	10	2371.5	2422.0	10	2048.3	2269.6	10		
11	195.6	11	2233.6	2268.6	11	2381.8	2413.1	11	2048.4	2268.0	11	2197.0	2286.3
12		12	2185.6	2256.0	12	2385.2	2409.6	12	2047.7	2268.2	12	2174.0	2272.2
13	204.5	13	2145.3	2239.8	13	2384.0	2398.0						
14	220.2	14	2113.4	2232.5	14	2383.4	2390.7						
15	221.5	15	2086.2	2224.9	15	2375.8	2385.5						
16		16	2081.3	2229.3									
17	223.3	17	2082.9	2223.9									
18	223.8	18	2081.8	2222.9									
19	223.4	19	2080.5	2223.1									
20	223.7	20	2082.2	2223.5									
21	224.3	21	2082.6	2224.6									
22	224.7	22	2081.3	2223.6									
23	224.2	23											
24	224.6	24											

St. 6 routin			St. 5 routin				St. 15 routin shallow			deep			St. 3 routin			
No.	TC µmol/kg	TA µmol/kg	No.	TC µmol/kg	TA µmol/kg	DO µmol/kg	No.	TC µmol/kg	TA µmol/kg	No.	TC µmol/kg	TA µmol/kg	No.	TC µmol/kg	TA µmol/kg	DO µmol/kg
1	2317.0	2420.0	1	2360.5	2420.2	93.4	1			1	2318.0	2422.7	1	2368.7	2420.2	81.2
2	2320.1	2424.2	2	2375.4	2414.2	59.5	2	2371.9	2374.8	2	2315.9	2422.5	2	2384.7	2410.6	51.1
3	2324.3	2426.5	3	2384.1	2418.2	38.1	3	2370.2	2366.4	3	2317.3	2422.5	3	2381.8	2389.3	34.9
4	2338.6	2425.4	4	2378.4	2385.0	30.9	4	2360.2	2361.4	4	2318.5	2423.6	4	2371.6	2376.6	34.6
5	2373.6	2415.8	5	2367.2	2359.0	17.4	5	2353.6	2342.1	5	2329.0	2425.3	5	2338.5	2344.8	43.8
6	2387.4	2412.8	6	2346.6	2328.2	27.3	6	2340.0	2324.0	6	2336.7	2427.2	6	2307.3	2307.5	74.5
7	2385.8	2392.1	7	2326.0	2306.4	47.9	7	2337.6	2313.3	7	2345.5		7	2266.3	2285.7	127.7
8	2377.1	2377.0	8		2284.8	115.9	8	2333.6	2309.4	8	2353.4	2424.1	8	2211.6	2266.3	204.5
9	2360.1	2353.9	9	2236.1	2269.1	170.8	9	2320.5	2304.4	9	2366.9	2422.6	9	2187.0	2257.3	238.7
10	2355.0	2342.4	10	2120.4	2233.1	314.2	10	2306.0	2295.5	10	2370.0	2419.1	10	2148.9	2245.9	283.6
11	2349.8	2326.1	11	2108.0	2229.7	326.6	11	2274.6	2282.7	11	2374.6	2416.0	11	2101.5	2234.7	323.6
12	2341.6	2314.4	12	2109.4	2230.1	327.1	12	2221.5	2265.1	12	2383.2	2408.0	12	2098.0	2235.8	324.3
13	2321.2	2302.8					13	2154.3	2243.5	13	2386.2					
14	2258.6	2301.2					14	2093.8	2227.0	14	2383.0	2392.0				
15	2123.4	2235.6					15	2095.1	2226.9	15	2381.0	2384.6				
16	2107.0	2230.3					16	2091.8	2228.3							
17	2107.5	2230.1					17	2094.4	2228.5							
18	2104.6	2229.8					18	2095.9	2226.9							
19	2102.6	2230.0					19	2093.6	2226.8							
20	2111.3	2227.5					20	2092.0	2229.1							
21	2106.6	2226.5					21	2093.7	2227.6							
22	2108.1	2229.1					22	2094.3	2227.0							
23	2107.3	2226.4					23									
24	2106.4	2228.6					24									

3.5 Alkenone

Naomi Harada (Ocean Research Department, JAMSTEC)

1. Objectives

Long-chain unsaturated alkylketones (alkenone) contained in sediment have for long, been investigated as a robust proxy of past thermometer. These compounds are notably biosynthesized by a group of haptophyte algae, in particular the coccolithophorid *Emiliania huxleyi* (*E. huxleyi*). The alkenone thermometer is based on the unsaturation ratios of the C37 alkenones, primarily UK'37 index. The UK37 index is defined as the ratio of (C37:2) / (C37:2 + C37:3), where C37:2 and C37:3 are methyl ketones with two and three double bonds, respectively.

In order to estimate the past alkenone temperature using sediment core, a calibration equation is necessary. Most precise calibration is an empirical equation introduced by a relationship between UK37 index and SST in the modern field where the sediment core was collected.

In this study, therefore, to obtain a calibration from a relationship between the UK37 index and sea water temperatures at some depths where the alkenone producers live, sea water samples (ca. 10 litters each) were collected at five stations (St.1, KNOT, 6, 7, 8) during MR00-K01 cruise.

2. Sampling procedure on board

Sea water samples were collected in a plastic bottle at five water depths: 10m, 50m, 100m, 150m, 200m using a compact CTD rosette system equipped on the right side of MIRAI. Niskin bottles were cleaned by a method for trace metal before the observation. Each water sample in the plastic bottle was stored under 4˜C in MIRAI.

3. Analytical procedure on shore

E. huxleyi and *G. oceanica* which are alkenone producers, are concentrated on nuclepore filter by aspiratory filtration. These nuclepore filters are treated by organic solvent extraction, and then every extracted alkenone in the solvent is derivatized. The derivatized alkenone sample is introduced into a gas chromatography equipped with a FID detector and a capillary column. Integrated area (indicated as voltage) of each alkenone compound is used for calculation of the UK37 value.

4. Future analysis

There are only a few investigations about seasonal variation of the relationship among alkenone flux, alkenone temperatures and species composition of alkenone producers. For the northwestern North Pacific, any above investigation has not been reported. Yet, it is recognized that seasonal variation of alkenone flux and temperature in the upper layer can provide valuable information for understanding the past change of alkenone recorded in deep sediment. Therefore, in order to obtain the new knowledge about alkenones in the modern northwestern North Pacific, we would like to present a data set of alkenone flux and alkenone temperature from samples of time series sediment trap. In addition, we would like to compare the alkenone temperature range with the distribution of alkenone producers and actual temperature. Investigations concerning these modern alkenone data might contribute to the alkenone to be better proxy as a thermometer.

3. 6 Phytoplankton Pigment

3.6.1 Chlorophyll a concentration and absorption coefficient

Kousei Sasaoka
Faculty of Fisheries, Hokkaido University

(1) Introduction

The geochemical cycles in the ocean plays an important role in the earth environment changes. In particular, the Subarctic North Pacific Ocean is one of the highest biological productivity region in the world, and has considerable remarks as one of the key areas recently. Understanding the role of biological pump in the ocean, and monitoring variability of the chlorophyll distribution is very important to clarify the geochemical cycles. The recent development of satellite ocean color remote sensing and its application to the observation of the temporal and spatial variability of chlorophyll distribution over broad area with synoptic scales has provided us with a unique tool to study these features. St. KNOT (Kyo-do North Pacific Time Series) was established in June 1998 as the Japan JGOFS time series station for the biogeochemical study. Since then, ship observation has been carried out frequently in this station. Now, we can compare ship data with satellite data for one and half year.

The objectives of this study is to clarify the temporal, spatial variability and vertical structure of chlorophyll a distribution, and to validate and to develop bio-optical algorithm for new series ocean color sensors, such as Sea-viewing Wide Field-of-view Sensor (SeaWiFS) and Global Imager (GLI) in the subarctic North Pacific Ocean. Therefore, we measured *in situ* bio-optical parameters, including upwelled spectral radiance, downwelled spectral irradiance, phytoplankton pigment concentrations (fluorometric method), and particle absorption coefficient.

(2) Methods

Water samples for chlorophyll a (Chl-a), pheopigment and absorption coefficient determinations were collected using Niskin bottles attached to a rosette on the CTD. Chl-a samples were collected at all stations by routine or in-vitro casts (Nagoya Univ. group) from surface to 200m depth and absorption coefficient samples were gathered at the stations from surface to 100m depth, which were carried optical measurements (Described 3.14).

Chl-a samples were collected in 250ml dark bottles and filtered through a Whatman GF/F filter on board. Filtering Volume was 200ml. Filtered samples were extracted in 6

ml of N,N-dimethylformamide, under cold and dark conditions for later analysis. Chl-a and phaeophytin were determined by the fluorometric method (Parsons et al., 1984) with a Turner Designs Fluorometer (Model:10-AU). Chl-a obtained by the CTD casts, summarized in Table. 1, and vertical profiles of chl-a concentration are shown in Fig. 1. We will compare of these chlorophyll data sets and SeaWiFS data sets in future study.

The absorption coefficients samples were collected in 4000ml dark bottles and between 1000 and 3000 ml filtered on to a 25 mm Watman GF/F glass-fiber filters under low vacuum pressure (<100 mmHg) on board.

We will measure the absorption coefficients of phytoplankton (aph) and detritus (ad) using the modified glass fiber technique with methanol treatment (Kishino *et al.,* 1985), and then we will calculate a chlorophyll normalized specific absorption spectra, a*ph to divide aph by Chl-a concentration. In future study, we are going to use these chlorophyll a and absorption coefficients for the model parameter to estimate primary production from satellite ocean color data.

(3) Preliminary result

Table 1. Chlorophyll *a* (mg/m^3) obtained by CTD casts.

CTD Cast	Bottle No.	Depth	Chl-a
1/6	Bucket	0	0.723
St.1	23	10	0.660
Large CTD/RMS	22	20	0.239
Routine	21	30	0.585
0001L02.DAT	20	40	0.599
	19	50	0.737
	18	60	0.691
	17	80	0.634
	16	100	0.409
	15	125	0.033
	14	150	0.017
	13	200	0.008
1/8	Bucket	0	0.536
St.21	23	10	0.478
Large CTD/RMS	22	20	0.334
Routine	21	30	0.412
0021L01.DAT	20	40	0.291
	19	50	0.153
	18	60	0.107
	17	80	0.090
	16	100	0.077
	15	125	0.081
	14	150	0.032
	13	200	0.043
1/8	Bucket	0	0.418
St.20	12	5	0.423
Small CTD/RMS	11	10	0.374
0020S03.DAT	10	20	0.331
	9	30	0.346
	8	40	0.259
	7	50	0.363
	6	60	0.343
	5	80	0.369
	4	100	0.314
	3	125	0.251
	2	150	0.115
	1	200	0.022
1/9	Bucket	0	0.452
St19	24	5	0.518
Large CTD/RMS	23	10	0.559
Routine	22	20	0.628
0019L01.DAT	21	30	0.585
	20	40	0.527
	19	50	0.662
	18	60	0.490
	17	80	0.412
	16	100	no data
	15	125	0.193
	14	150	0.156
	13	200	0.004
1/10	Bucket	0	0.351
St.18	24	5	0.582
Large CTD/RMS	23	10	0.498
Routine	22	20	0.490
0018L01.DAT	21	30	0.484
	20	40	0.441
	19	50	0.444
	18	60	0.325
	17	80	0.435
	16	100	0.366
	15	125	0.472
	14	150	0.030
	13	200	0.025

CTD Cast	Bottle No.	Depth	Chl-a
1/13	Bucket	0	0.642
St.2	24	5	0.798
Large CTD/RMS	23	10	0.850
Routine	22	20	0.820
0002L02.DAT	21	30	0.621
	20	40	0.725
	19	50	0.924
	18	60	1.059
	17	80	0.804
	16	100	0.132
	15	125	0.043
	14	150	0.016
	13	200	0.008
1/16	Bucket	0	0.590
St.4 (KNOT)	11	5	0.694
Small CTD/RMS	10	19	0.677
0004S01.DAT	9	50	0.769
1/17	Bucket	0	0.544
St.4 (KNOT)	16	5	0.619
Large CTD/RMS	15	10	0.657
0004L03.DAT	14	20	0.449
	13	30	0.547
	12	40	0.579
	11	50	0.573
	10	60	0.622
	9	80	0.112
	8	100	0.022
	7	125	0.018
	6	150	0.017
	5	200	0.010
1/19	Bucket	0	0.481
St.16	24	5	0.657
Large CTD/RMS	23	10	0.697
Routine	22	20	0.544
0016L01.DAT	21	30	0.634
	20	40	0.723
	19	50	0.559
	18	60	0.593
	17	80	0.524
	16	100	0.031
	15	125	0.015
	14	150	0.015
	13	200	0.042
1/20	Bucket	0	0.363
St.17	12	10	0.320
Small CTD/RMS	11	50	0.279
Routine	10	100	0.276
0017S01.DAT	9	200	0.037

Table 1. (Continued)

CTD Cast	Bottle No.	Depth	Chl-a
1/23	Bucket	0	0.475
St.14	12	5	0.481
Small CTD/RMS	11	10	0.469
0014S02.DAT	10	20	0.469
	9	30	0.446
	8	40	0.461
	7	50	0.524
	6	60	0.403
	5	80	0.510
	4	100	0.527
	3	125	0.017
	2	150	0.005
	1	200	0.006
1/26	Bucket	0	0.409
St.6	12	5	0.435
Small CTD/RMS	11	10	0.418
0006S02.DAT	10	20	0.452
	9	30	0.380
	8	40	0.363
	7	50	0.458
	6	60	0.452
	5	80	0.504
	4	100	0.372
	3	125	0.068
	2	150	0.008
	1	200	0.012
1/28	Bucket	0	0.461
St.7	24	5	0.458
Large CTD/RMS	23	10	0.490
Routine	22	20	0.418
0007L01.DAT	21	30	0.504
	20	40	0.446
	19	50	0.380
	18	60	0.395
	17	80	0.464
	16	100	0.256
	15	125	0.058
	14	150	0.020
	13	200	0.029
1/29	Bucket	0	0.697
St.8	24	5	0.890
Large CTD/RMS	23	10	0.881
Routine	22	20	0.711
0008L01.DAT	21	30	0.783
	20	40	0.680
	19	50	0.841
	18	60	0.795
	17	80	0.732
	16	100	0.547
	15	125	0.746
	14	150	0.012
	13	200	0.007
1/30	Bucket	0	0.720
St.8	12	5	0.786
Small CTD/RMS	11	10	0.498
0008S03.DAT	10	20	0.674
	9	30	0.680
	8	40	0.547
	7	50	0.786
	6	60	0.726
	5	80	0.780
	4	100	0.783
	3	125	0.173
	2	150	0.016
	1	200	0.008

CTD Cast	Bottle No.	Depth	Chl-a
2/4	Bucket	0	0.616
St.15 (KNOT)	12	5	0.734
Small CTD/RMS	11	10	0.648
0015S02.DAT	10	20	0.850
	9	30	0.636
	8	40	0.778
	7	50	0.602
	6	60	0.809
	5	80	0.755
	4	100	0.045
	3	125	0.035
	2	150	0.053
	1	200	0.021

3.6.2 The measurement of phytoplankton pigments by HPLC

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Institute for Hydrosheric-Atomospheric Sciences, Nagoya University

(1)Introduction:

The FRRF we described above has three assumptions. One is the numeral ratio of PSII reaction centers to Chl*a* molecules. The PSII/ Chl*a* ratio for eukaryotes and prokaryotes are different, and normally 0.0020 and 0.0033, respectively. In order to determine the ratio in our study area, we made an attempt to calculate the contribution of Chl*a* abundance to eukaryotic and prokaryotic phytoplankters using phytoplankton pigment signatures determined by high-performance liquid chromatography (HPLC). Our HPLC method is fundamentally based on JGOFS protocols, and can obtain the concentrations of chlorophylls and carotenoids in the study area.

(2)Method:

Water samples were collected from 10, 20, 40, 60, and 80 m depths at all stations by Niskin bottles. Surface samples were obtained using a plastic bucket. Samples were immediately transferred into polycarbonate bottles, and filtered by 25mm GF/F filters at vacuum (<100mmHg). These filter samples were stored in a deep freezer (-80^{O}C) until analysis on land.

Station Number	CAST name
St.1	0001L02.DAT
St.2	0002L02.DAT
St.4(KNOT)	0004S01.DAT
St.6	0006S02.DAT
St.7	0007L01.DAT
St.8	0008S03.DAT
St.15(KNOT)	0015S02.DAT
St.18	0018L01.DAT
St.19	0019L01.DAT
St.20	0020S03.DAT

(3)Future plan

We will analyze the phytoplankton pigments at Nagoya University.

3.7 TRACE METAL
- Behavior of iron in the Northwestern North Pacific Ocean -

Shigeto Nakabayashi and Makio Honda
(Japan Marine Science and Technology Center)

(1) Introduction

Fe is one of the major elements in the earth's crust. However, its concentration in seawater is extremely low. This low concentration is attributed to the fact that solubility of thermodynamically stable Fe(III) is very low. In other wards, Fe in seawater readily hydrolyzes to form insoluble colloidal hydrous ferric oxides, settling down to the bottom. Because of this high reactivity, its residence time in the ocean is one of the shortest, which is on the order of few hundreds years in deep water and several weeks in surface water.

Usually an element with a long residence time does not respond to the sudden change of input or output. However, an element with a short residence time like Fe changes its concentration in the seawater according to the change of input or output, so that it is a very good tracer for short term phenomenon.

Fe is supplied from river and atmosphere to the ocean surface. However, because of its rapid removal from seawater, riverine dissolved Fe is readily removed within estuary, so that influence of riverine input to the open ocean surface may not be recognized. Therefore the airborne dust has been proposed as a major source of dissolved Fe to the open ocean surface. On the other hand, in deep waters other sources of dissolved Fe have been proposed as the partial release of Fe from resuspended sediment particles including colloid, and the diffusion from the pore water in the sediment.

Fe has been also known as an essential micro-nutrient for the phytoplankton growth in the ocean. Due to its extremely low solubility, however, the concentration becomes so low that phytoplankton growth is subdued where its supply is limited. Thus, the fate of Fe in seawater is closely related to the biological activity. It is very important to know the behavior of Fe in the ocean for the study of the global biogeochemical cycles of carbon and its related elements.

The Northwestern North Pacific Ocean is characterized by upwelling of deep water, high nutrients, high primary production and complicated water mass structure (i.e. intermediate water), among others. And also large aeolian input of terrigeneous material to the area is expected. Generally, in the North Pacific the dominant source of the terrigeneous material is Asian dust. Because they can supply Fe over the surface water, they have

significant impact on the phytoplankton growth. In addition, seasonal and geographical changes of these features are drastic. This complexity has prevented us from knowing exactly to what extent it plays a role in the global material cycles, which is a main goal of this project. One of the objectives of this study is to clarify the role of Fe in the phytoplankton growth in the Northwestern North Pacific. The other objective is to evaluate the transport and transformation processes of terrigeneous material and intermediate water in these regions using Fe as a tracer.

(2)Methods

Water samples were collected vertically at 13 stations using acid-cleaned new type 12 l Niskin-X sampling bottles (General Oceanics) attached to CTD-RMS. As mentioned above, Fe in the seawater is extremely low, so we have to take special care before, while and after taking water samples. Sampling bottles with internal closing mechanism may also be prone to contamination, however this new type sampling bottle has its stainless steel spring closures mounted externally. This method of mounting the springs is ideal for applications such as trace metal analysis where the inside of the sampling bottle must be totally free of contaminants. In addition, inside the sampling bottles were coated with Teflon to avoid contamination. Teflon stopped cock, Teflon air vent screw cock and biton o-ring were also used for the bottles. Moreover the steel hydrowire was sheathed in plastic heat-shrink tubing for 10 m above the rosette as an effort to minimize contamination from the hydrowire. CTD parameters were measured on the down and up casts, and water samples taken on the up cast. Sampling locations are listed in Table 1.

Sample bottles were of acid-cleaned low density polyethylene and were handled and stored in polyethylene bags. Water samples for total Fe (100 ml) and other trace metals (250 ml) were kept in a freezer (-40˜C) immediately after sampling. Samples for dissolvable Fe(III) (100 ml) and calibration (only 50 m, 1000 ml x 2) were adjusted to pH 3.2 with formic acid-ammonium format buffer solution without filtration and were kept in a refrigerator (4˜C) until the measurements. All procedures were done in a class 100 laminar flow cabinet to avoid contamination.

(3)Future plane

Fe(III) will be measured by automated analytical method using a combination of selective column extraction and luminol-hydrogen peroxide chemiluminescence detection method. It will be clarify the behavior of iron in the Northwestern North Pacific during this

cruise. Fe has been known as an essential micro-nutrient for the phytoplankton growth in the ocean. Due to its extremely low solubility, however, the concentration becomes so low that plankton growth is subdued where its supply is limited. Thus, the fate of Fe in seawater is closely related to the biological activity. It is very important to know the behavior of Fe in the ocean for the study of the global biogeochemical cycles of carbon and its related elements.

Table 1. Sampling locations for Fe study.

Date	Station	Depth, m
1/ 7	St. 1	5, 10, 20, 30, 40, 50, 60, 80, 100, 125, 150, 200, 250, 300, 400, 500, 600, 700
1/ 7	St. 21	5, 10, 20, 30, 40, 50, 60, 80, 100, 125, 150, 200, 250, 300, 400, 500, 600, 700, 800, 1000
1/ 8	St. 20	5, 10, 30, 50, 70, 100, 150, 200, 250, 300, 400, 500, 600, 700, 800, 1000, 1250, 1500, 2000, 3000
1/ 8	St. 19	5, 10, 30, 50, 70, 100, 150, 200, 250, 300, 400, 500, 600, 800, 1000, 1500, 2000, 2500, 3000, 3500, 4000, 4500, 5000, 6000
1/10	St. 18	5, 10, 30, 50, 70, 100, 150, 200, 250, 300, 400, 500, 600, 800, 1000, 1500, 2000, 2500, 3000, 3500, 4000, 4500, 5000, 6000
1/13	St. 2	5, 10, 30, 50, 70, 100, 150, 200, 250, 300, 400, 500, 600, 800, 1000, 1500, 2000, 2500, 3000
1/17 1/16	St. 4 (KNOT 1)	5, 10, 30, 50, 70, 100, 150, 200, 250, 300, 400, 500 600, 800, 1000, 1500, 2000, 2500, 3000, 3500, 4000, 4500, 5000, 5100
1/19	St. 16	5, 10, 30, 50, 70, 100, 150, 200, 250, 300, 400, 500, 600, 800, 1000, 1500, 2000, 2500, 3000, 3500, 4000, 4500, 5000, 5400
1/23	St. 14	5, 10, 20, 30, 40, 50, 60, 80, 100, 125, 150, 200, 250, 300, 400, 500, 600, 700, 800, 1000, 1250, 1500, 2000, 3000
1/26	St. 6 (50˜ N)	5, 10, 30, 50, 70, 100, 150, 200, 250, 300, 400, 500, 600, 800, 1000, 1500, 2000, 2500, 3000, 3500, 4000, 4500, 5000, 5300

1/28	St. 7	5, 10, 20, 30, 40, 50, 60, 80, 100, 125, 150, 200, 250, 300, 400, 500, 600, 700, 800, 1000, 1250, 1500, 2000, 3000
1/29	St. 8 (40˜ N)	5, 10, 20, 30, 40, 50, 60, 80, 100, 125, 150, 200, 250, 300, 400, 500, 600, 700, 800, 1000, 1250, 1500, 2000, 3000
2/ 3	St. 15 (KNOT 2)	5, 10, 30, 50, 70, 100, 150, 200, 250, 300, 400, 500

3.8 GAS exchange

3.8.1 Dissolved CFCs (CFC-11 and CFC-12) measurement

Ayako Fukunaga
(Hokkaido University)

Introduction

CFCs are useful chemical tracers to study on the water circulation in the ocean and air-sea gas exchange. In this study, we purposed to obtain the distributions of CFCs in the northern North Pacific in wintertime and to study formation of North Pacific Intermediate water and air-sea gas exchange.

Method

(a) Sampling

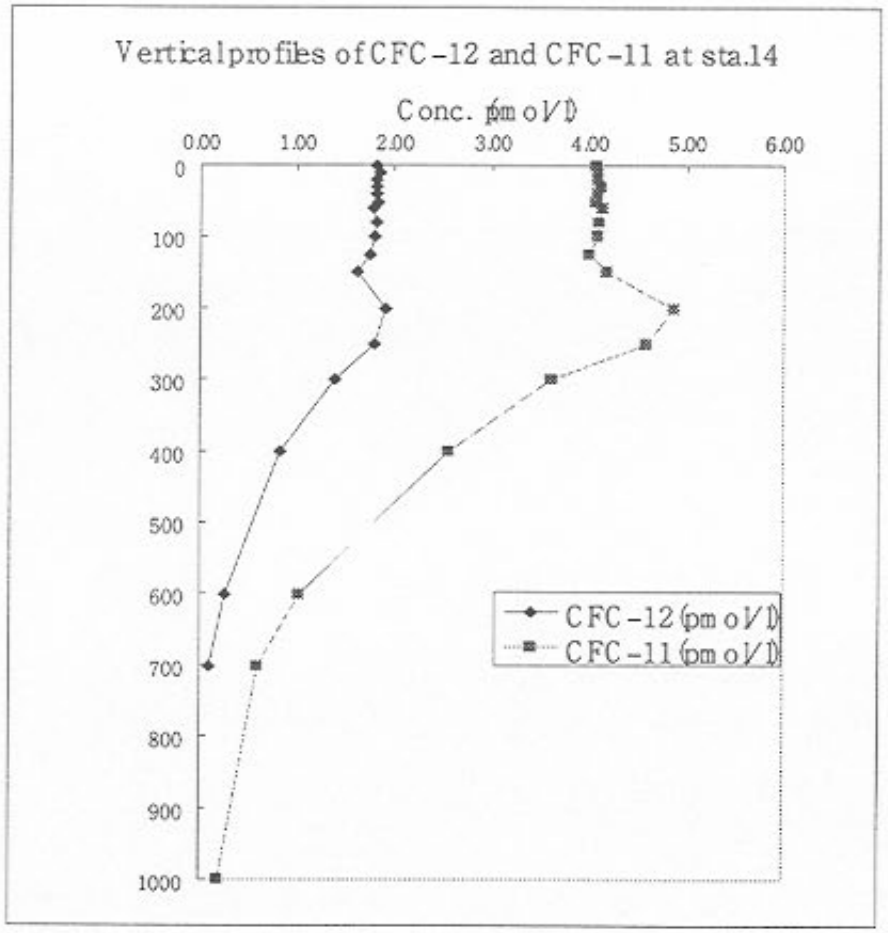
Water samples were collected at 11 stations; Station 1, 4, 6, 7, 8, 14, 15, 16, 18, 19 and 21. About 100 ml sea water collected from 0 m to 3000 m depth was transferred to a glass cylinder from 12 l Niskin bottles attached to CTD-RMS for analysis of CFCs.

(b) Analysis

Concentrations of CFCs were determined on board immediately. CFCs dissolved in seawater were stripped and preconcentrated using purge-and-trapping system jointed with ECD-GC. This procedure was based on that described in Bullister and Weiss (1988).

(3) Results

Vertical profile at station 4 in this cruise is shown in Fig. 3.8.1-1. It is not completed, these data need more adjustment.



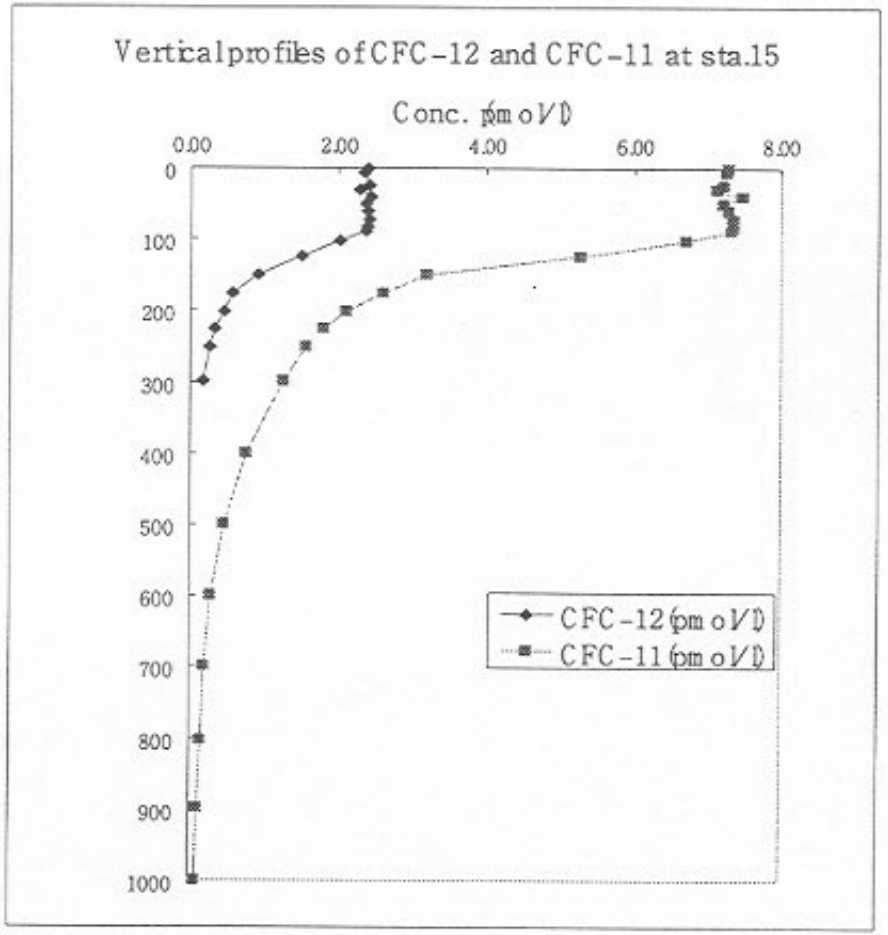


Fig. 3.8.1-1 Vertical profiles of CFCs at station 14 and 15

3.8.2 Role of bubbles in the surface water in gas exchange at air-sea interface by measuring N_2, O_2 and Ar gasses dissolved in the surface seawater

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Introduction

It is essential to estimate the amount of carbon dioxide absorbed into the ocean for the present global carbon dioxide issue. One of key factors in this matter is the gas transfer velocity at are-sea interface, which is usually or practically expressed as a function of wind speed. The mechanism, however, is not sufficiently made clear. Especially, the role of bubbles is well not known. Bubbles are enormously produced under heavy storms during fall and winter, when the observation is usually difficult. R/V Mirai is so big that we may be able to make such observation by measuring N_2/O_2/Ar ratios in the surface water.

Sampling & Gas extraction

Seawater samples were collected with Niskin bottles. Each sample was collected in a 100ml-glass bottle with a tygon rubber stopper. At the sampling, seawater was allowed to overflow more than four times the bottle volume in order to avoid air contamination. A 100l aliquot of saturated $HgCl_2$ solution was added to each sample to avoid biological change after sampling and it was stored in cold water before the analysis. A gas chromatographic system equipped with a TCD was used to make shipboard measurements of dissolved argon, oxygen and nitrogen in seawater. Helium (purity99.9999) was used as a carrier gas. A flow controller was used to flow the carrier gas at a constant flow rate of 20ml/min. The helium carrier gas was dried and purified passing through a helium purifier (VALVO. Co., Model HP2) before it was introduced into the analysis system. A sample bottle was connected to the system with a six-way rotary valve. By applying helium pressure to the sample water, the sample seawater flowing continuously was taken into a sample loop. Its volume was about 2.5ml. The sample water was transferred to a stripping chamber of a glass cylinder with a coarse glass flit at its bottom. The dissolved gases were stripped with the helium carrier gas and carrier to a subsequent column. The gases evolved was transferred to an injection loop by trapping with Molecular Sieve 5A at a liquid nitrogen temperature. The

adsorbent column was heated for 1minute at 100 and the gases re-evolved was introduced a separation column to determine N_2, O_2 and Ar simultaneously. The separation column was immersed in a dry ice-ethanol bath (-72) to separate O_2 and Ar completely, followed by warming the column to an ambient temperature to desorb N_2. The retention times were 5.7, 7.5, 13.5 minutes, respectively, for Ar, O_2, and N_2 at a flow rate of 20ml/min. The accuracy was 0.3% for all the three gases.

Future Plan

The obtained data during this cruise will be discussed with the aid of data sets (S, T, DIC, AOU, CFCs, Rn, nutrients, etc). To compare the obtained N_2/Ar ratio with the theoretical ratio at an equilibrated state, we can evaluate the effect of bubbles. We use the N_2 and Ar saturation anomalies to derive the contributions of air injected into seawater and gases changed by biological processes. If bubbles produced by breaking waves at the air-sea interface are injected, the observed gas ratios (N_2/Ar) should be modified, because the ratios of air bubbles are much different those of equilibrated dissolved gases. We can utilize the O_2/Ar ratios to estimate the biological activity in the surface ocean. Furthermore, if we can sample the water dissolving babbles, the water should be supersaturated and the gas composition should be different from that equilibrated one. We plan to observe quantitatively the situations under different weather conditions.

3.8.3 O_2, N_2, Ar, Ne

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University of Washington

3.8.3.1 Gas concentration measurements

I collected samples to determine oxygen, nitrogen, argon and neon concentrations in the mixed layer at stations 4 (KNOT), 6, 7, 14 and 15 (KNOT), with a deep profile at station 4 only. Our group determines primary production from oxygen mass balance. We have measured oxygen, nitrogen and argon from samples collected on four previous KNOT time series cruises. Oxygen concentrations are affected by biological and physical processes. The non-biological gases (N_2, Ar and Ne) are used to correct for the physical effects on O_2 such as gas exchange, bubbles and mixing through the thermocline. Then we can calculate how much of the O_2 is due to biological production, and therefore how much organic carbon was produced (Emerson *et al.*, 1997). My research project looks at how bubbles from breaking waves affect gas concentrations. I tried to sample right after storms whenever possible to see the bubble effect.

O_2 samples were analyzed on board by Winkler titration, using a visual endpoint. Comparison between our O_2 method and those of Dr. Nojiri' s group and JAMSTEC shows a large discrepancy of several ˜mol/kg. No discrepancy was found between our standards. The difference seems to be due to how the groups measure their blanks. UW measures the blank in seawater while JAMSTEC measures the blank in distilled water, leading to very different results.

Water for O_2, N_2, Ar (ONAR) analysis was collected in evacuated glass flasks. The flasks were half filled. The water was allowed to equilibrate with the headspace at a constant temperature for eight hours and then removed. Back in Seattle, the O_2/N_2 and O_2/Ar ratios will be determined on a mass spectrometer. The Winkler titration O_2 values are used to solve for total N_2 and Ar (Emerson *et al.*, 1999)

Ne samples were collected in two different ways to compare methods. 20 samples were collected in glass flasks, the same as ONAR samples. The necks of these samples were kept under constant vacuum to prevent air from getting in to the samples. 66 samples were collected in copper tubes.

Water was flushed through the copper tubes and then the ends were pinched shut with clamps. I will compare the results of these two methods to determine which method is most effective. Back in Seattle, Ne concentrations are determined using isotope dilution and a quadrupole mass spectrometer.

3.8.3.2 Video Whitecap Measurements

I am interested in finding a relationship between the amount of bubbles present and gas concentrations. I attached video cameras to railings just behind the bridge. They were pointed at the water surface just beyond the ship's wake. I collected an image every 15 seconds during daylight, alternating between the port and starboard side (two images from each side per minute). These images were digitized and stored on my computer. Later I will use a computer program to analyze each image and determine the amount of water covered by whitecaps. Many US defense satellites carry a Special Sensor Microwave / Imager (SSM/I) instrument. The percentage of the ocean covered by whitecaps might be measurable from space using SSM/I data (Asher *et al.*, 1998). I will compare my whitecap measurements from the video cameras to the measurements from the satellite and to my gas concentration measurements.

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3.8.4 CH_4, CO and N_2O
- Stable isotopic composition of CH_4, CO and N_2O in the ocean -

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Purpose

CH_4 and N_2O are important components of the global cycles and potent greenhouse gases. CO is also important to study atmospheric chemistry. The CH_4 production reaction both by methanogenic bacteria and inorganic processes, however, are strict obligate anaerobic or high temperature environment and should not be able to function in an aerobic, low temperature sea water column. In consequence, CH_4 dissolved in oxygenated open ocean water is limited to low concentrations, almost equal to, or less than, the air saturated value of about a few nmol per kg, and is mainly controlled by air-sea exchanges of CH_4 at the surface and aerobic bacterial consumption within the water column. In and around the ocean, however, anoxic and/or high temperature sources locally supply CH_4 into the ocean. In consequence, the concentration of CH_4 increases vertically, horizontally and sometimes temporally in an oceanic water column. Typical surface ocean waters, for example, are slightly supersaturated with dissolved CH_4 relative to atmospheric equilibrium, which has been termed the oceanic methane paradox. In order to estimate the global fluxes of CH_4 into and from the ocean and to study the geochemical, geological and geophysical characteristics of each CH_4 sources (such as chemical and isotopic feature, flux, temporal variation), we must clarify the origins of CH_4 in the ocean. Most previous studies of the marine geochemistry of CH4, however, have been limited by the lack of carbon isotopic data, because of the low concentration of CH_4 as stated above.

Analysis

Isotope-ratio-monitoring gas chromatography/mass spectrometry (irm-GC/MS) systems can reduce drastically the size of the sample

needed for isotopic analyses. These systems quantitatively convert CH_4 and CO, which are separated by gas chromatography and used Schutze reagent, to CO_2, and deliver the CO_2 continuously to the ion source of the isotope ratio mass spectrometer, using helium as a carrier gas. These systems thereby increase the speed and decrease the amount of sample needed for analyses. Recent reports have documented the ability of irm-GC/MS systems to generate accurate and precise isotopic data for a variety of samples including geolipids, anaerobic incubator headspace gases, synthetic and atmospheric CH_4, hotspring and volcanic gases and pore water and nearshore waters. In laboratory studies, we have developed an analytical system for measuring the content and carbon isotopic composition of CH_4 and CO in seawater samples. The system consists of He-sparging and trap extraction and purification, cryo-focussing concentration, convert to CO_2, water removal and continuous carbon isotopic ratio measurements using a mass spectrometer. The N_2O system consists of He-sparging and trap extraction and purification, gas chromatographic separation, water removal and continuous isotopic ratio measurements using a mass spectrometer. By using the system, we will study the content and carbon isotopic composition of CH_4, CO and N_2O dissolved in open ocean waters of the Ocean. By using carbon isotopic data, we are attempting to clarify and characterize the source of CH_4, CO and N_2O in open ocean waters.

Sampling and Treatment

Each sea water sample was taken by ordinary Niskin bottle and slowly transferred into a ca. 120 ml glass vial. After about 1/2 volume of the sample sea water have overflowed, 1 ml of saturated $HgCl_2$ solution (1 %wt), which have been degassed just prior to use, was slowly added as a preservative and each vial was sealed with a gray butyl rubber stopper without air contamination and stored under room temperature until analysis. After the cruise, CH_4, CO and N_2O will be extracted and it will be measured by the method as stated above.

3.9 Radionuclides

3.9.1 Radionuclides by JAMSTEC

Hazime Kawakami (JAMSTEC)

(1) ^{234}Th

1) Purpose of the study

Particle-reactive radionuclide (^{234}Th) and their relationship with POC and PON in the northwestern North Pacific Ocean.

2) Sampling

Seawater sampling for ^{234}Th : 7 stations (Stn. 1, 2, KNOT, 14, 6, 7, 8). 12 depths (10m, 20m, 30m, 40m, 50m, 60m, 75m, 100m, 150m, 200m, 250m, 300m) at each station and 20 liters for each depth.

Seawater samples were filtered with 47mm GF/F filter on board immediately after water sampling.

3) Chemical analyses

Separations of U and Th were used by anion exchange method on board; All dissolved samples and particulate samples of Stn. 1 and 2. The rest of samples were separated in land-based laboratory.

Separated samples of Th were absorbed on 25mm stainless steel disks electrically, and were measured by ˜ -ray counter.

4) Preliminary result

The distributions of dissolved and particulate ^{234}Th will be determined as soon as possible after this cruise. This work will help further understanding of particle dynamics in the water column.

(2) ^{228}Ra/^{226}Ra

1) Purpose of the study

^{228}Ra/^{226}Ra ratios in seawater were important tracer for origin of seawater.

2) Sampling

Seawater samples for $^{228}Ra/^{226}Ra$ were taken from 16 stations at sea surface. 200 liters seawater were filtered through Mn fiber during about a day.

3) Chemical analyses

Mn fiber samples with ^{228}Ra and ^{226}Ra was solved with acid and Ba^{2+} solution were added to the solution. Added sulfuric acid, ^{228}Ra and ^{226}Ra were coprecipitated with barium sulfate. ^{228}Ra and ^{226}Ra in the settling were measured by ˜ -ray counter.

4) Preliminary result

The distributions of $^{228}Ra/^{226}Ra$ in the surface seawater will be determined as soon as possible after this cruise. This work will help further understanding of current dynamics at the sea surface.

3. 9. 2 Time-series observation of ^{234}Th, ^{210}Po and ^{210}Pb at KNOT station

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Yoko Shibamoto (National Institute for Resources and Environment)
Hisashi Narita (Graduate School of Hokkaido University)
Masashi Kusakabe (Japan Marine Science and Technology Center)

Introduction

Since export flux from surface layer to deeper layer is strongly related with biological production in the surface layer, it is predicted to have a large seasonal variation. To understand seasonal change of export flux from the surface layer, the time-series observations of particulate flux by drifting sediment traps and short lived natural radio nuclides have been conducted from June 1998. The flux observed by the drifting sediment traps should be corrected because of non-quantitative collecting efficiency due to shape of the trap and complicated hydrodynamics in the surface water. The short lived radio nuclides are good tracers for particulate materials. Therefore the vertical profiles of the nuclides are planned to use for correction of the export flux by the drifting traps as well as independent estimation of the flux from the nuclides profiles.

In this cruise, water samples from Stns. KNOT1, 6, 8 and KNOT2 were collected and analyzed on board of the ship in the same methods described in MR99K02 cruise report.

3.9.3 Rn measurement

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2: National Institute for Resources and Environment
3: JAMSTEC

(1) Introduction

Rn-222 (t1/2 = 3.84 days) has been used as an oceanographic tracer, for estimating diffusion coefficient of bottom water (Sarmiento *et al.*, 1976) and gas exchange rate through sea surface (Schink *et al.*, 1970), after Broecker (1965) described the basic handling and counting techniques. Because Rn-222 has a short half-life, its measurement must be done in a short period.

In this study, we have modified to the basic method. In order to estimate gas exchange rate in the northern North Pacific, the method is applied to determine the vertical profile distribution of Rn-222 in surface waters.

(2) Method

Sampling

Water samples were collected with 12-l Niskin bottles with CTD rosette multi sampler at St. KNOT, St. 2, St. 8, St. 20 and St. KNOT-2. The water from two 12-l Niskin bottles is allowed to flow into evacuated PVC bottles (*ca.* 25-l) through a quick-connect fitting on the top plate. This bottles was specially designed for radon extraction from 20-l sea water samples. In order to estimate overall precision, we collected 6 samples from same depth (550 m) at St. 17.

Rn extraction

Immediately after sampling, Rn extraction were done. We degassed three samples simultaneously circulating radon-free air at a flow rate of *ca.* 1l air/min by diaphragm pumps for each sample. After bubbling through the slurred sample, each gas stream passes over Soda lime, DrieriteTM (anhydrous $CaSO_4$, 10-20 mesh) and magnesium prechlorate (anhydrous reagent) to remove H_2O and CO_2. The gas streams flow into the separable trap kept at dryice-ethanol temperature. These traps are made of glass tubing (OD; 6 mm, ID; 3.5 mm) with inlet and exit Teflon needle valves, packed with active charcoal. After 60 min, pumps are turned off. The high-purity He (99.999%) flows at a rate of ca. 1l He/min for 5 min. After passing through the trap, the helium carrier is vented to the atmosphere. When

degassing is complete, the bypass valve is opened and the valves on the PVC bottles closed. The flow using high-purity He is continued more 5 min. Finally, the inlet and exit valves to all three sample traps are closed and the helium flow stopped. Those traps are removed from the radon stripping system and kept at dryice-ethanol temperature until next step.

Rn transfer

Rn-222 is transferred quantitatively to the counting cell in this step. The separable trap is connected to the transfer system with the Cajon fitting and evacuated. After closing the valve between the trap and the Swagelock male quick-connect (called the cell-fill valve), the counting cell connected to the quick-connect and evacuated. After opening the exit valve of the trap and the cell-fill valve, the trap heated for 30 min at 350 – C so that radon expands through the valves into the evacuated cell. Finally, any radon left in the trap is flowed into the counting cell by helium. The counting cell is removed from the system when the helium pressure reaches about 510 mm Hg. The time for flowing helium is about 100 sec. Using this system, the average time for stripping and transfer of 9 radon samples at each station is about 45 min per sample.

Ra extraction

Radium is extracted from the sea water after radon degassing is completed. Five litter sea water is passed through a column (column volume: 1.5 ml) packed with manganese-impregnated acrylic bead using micro tube pump. Flow rate is about 10 ml/min.

After all the sea water has passed through the column, the manganese bide will return to the lab for analysis. Activities of Ra-226 and its daughters will be measured by liquid alpha scintillation counter, after purification.

Rn counting, background and efficiency

The counting system used were supplied from Ludlum measurements Inc. and a Lucas-type cell from EDA Instruments Inc. The counting time for each sample is usually 360 min and run twice. The decay and growth collection for radon and the calculation of statistical counting error is due to the equation reported by Samineto *et al.* (1976). The counting error is normally below 2 %.

The background of 9 different cells range from 0.08 to 0.40 cpm. This difference may be due to Pb-210 build-up in the cells.

The total efficiency is determined for the all system by measuring a 27.92 dpm standard solution prepared by gravimetoric dilution from NBS radium standard. A total efficiency was 86.0 ± 1.5 %. This is an average value of four times run using 4 cells of all

for calibration. Although no significant difference may be observed among the cells and the separable traps, the total efficiency will be determined more in future.

(3) Results

Analytical precision

In order to estimate overall precision, we collected 5 samples from 500 m depth at St. 17. These samples should all have an identical radon content, because of each bottles fired within 5 m. Because of the separations between radium and radon were done within 5 hrs from sample collection, the effect of time correction is negligibly small for decay or growth from radium. Analysis showed a standard deviation in mean radon activity of 2.6 %. The results compare favorably with precessions obtained by best methods reported previously.

Rn-222 vertical profiles in surface water

Surface water results are corrected to the time the sample was removed from its environment. This is necessary since the radon deficiency in the surface water decay with the half-life of radon. After measuring Ra-226 in surface water in Lab, final results will be reported within 1 year.

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3.10 Primary production by CREST

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In western region of North Pacific Ocean time series survey was started since June 1998. In this region we have no data to estimated primary production by incubation experiments in winter season (January to March). Therefore we need to measure primary production of winter season by incubation experiments.

In this cruise, using ^{13}C as a tracer for inorganic ^{13}C uptake by phytoplankton photosynthesis, incubation experiments carried out in two type procedures (in-site and false in-site). Water samples were collected with Niskin X sampling bottles attached to CTD-RMS from 6 layers corresponding to 100, 34, 17, 8.5, 4, 0.9% of surface irradiance and drained into 250ml polycarbonate bottles. After addition of ^{13}C-$NaHCO_3$ those bottles were incubated for 24 hours. And particle matter was filtered onto precombusted (450, 4h) grass fiber filter (Whatman GF/F) after incubation. Primary production will be calculated with concentration and ^{13}C atom % of particle organic carbon (POC) determined by tracer. Incubation date and station are as follows.

Table 3. 11. 1 Incubation date, station and procedure

Date	Station	Procedure
10-Jan	St.18	false in-site
13-Jan	St. 2	false in-site
17-Jan	St. 4 (KNOT1)	in-site and false in-site
27-Jan	St. 6	false in-site
31-Jan	St. 8	false in-site
4-Feb	St. 15 (KNOT2)	false in-site

3. 11 Measurements of Primary production with simulated *in situ* incubations and in situ measurement by an FRRF.

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(1)Introduction:

In the study of material cycling in the oceans, it is of primary importance to know quantitatively the primary production in the oceans. This is because the function of oceanic "biological pump", playing a central role in the vertical transport of materials in the oceans, depends primarily on the primary productivity in the region.

Almost all of the measurements of primary production *in situ* are based on the incorporation of inorganic radiocarbon (^{14}C) into particulate organic matters or on changes in concentration of dissolved oxygen in the bulk fluid of an incubation bottle. These methods have been thought to measure the phytoplankton production close to net primary production from long-term incubations and close to the gross primary production from short-term incubations. The net primary production is defined, on a daily basis, as the residual fraction of the total phytoplankton's primary production (the gross primary production) corrected for respiratory losses by phytoplankton themselves. Ecologically the term "net primary production" means the amount of the production of organic matter, which is available to the higher trophic level organisms. Despite of the importance of the measurement of net primary productivity, there have been little consensus as to its measurement method in a rigorous sense. Operationally it is agreed that the *in situ* incubation for 24hrs give the reasonable estimate of net primary productivity, although there are a lot of technical problems associated with the sample incubations. In addition to that, requirement of the ship time for extended *in situ* incubations often makes the in situ measurements difficult.

(2)Methods:

Primary production measurements by FRRF

By using an FRRF, we tried to measure the gross primary production *in situ* by natural assemblage of phytoplankton without the bottle incubation. The theoretical background of this instrument is based on the variable fluorescence of phytoplankton (Fo and Fm) emitted from the photosystem II, a photosynthetic apparatus of phytoplankton, with varying physiological status (i.e. the photosynthetic rates) of phytoplankton. In this instrument, a saturation profile of fluorescence (from Fo to Fm) is traced with 100 subsaturating fast repetitive flashes (1 ms duration with 1 ms interval), and a decay profile

after the saturation is traced with 20 repetitive frashes (1 ms duration with 50 ms intervals). The absorption cross-section of photosystem II (PSII), the efficiency of photochemical conversion, and the rate of electron transport from PSII to photosystem I (PSI) are obtained from each saturation-decay profile measurement by iterative curve fitting of the model equation to the data.

The rate of gross photosynthetic oxygen evolution per unit Chl*a* [mol O_2 evolved (g Chl*a*) $^{-1}$ time^{-1}] were estimated by using the equation of Kolber and Falkowski (1993);

$$P^{B}_{O2}(Z)=E(Z)f(Z)n_{PSII}(Z)s_{PSII}(Z)q_{p}(Z)fe(Z),$$

where,

E(Z): Incident irradiance at Z m

f(Z): Fraction of potentially functioning PSII reaction centers in the dark (= fm/0.65, fm=Fv/Fm)

$n_{PSII}(Z)$: Ratio of PSII reaction centers (RC) to Chl*a* (=1RC/500 Chl*a*)

$s_{PSII}(Z)$: Functional absorption cross-section of PSII

$q_p(Z)$: Photochemical quenching

fe(Z): Actual quantum yield of electron transport.

The rate in the unit of oxygen is further converted to the Chl*a* -specific rates of carbon fixation ($P^{B}_{C}(Z)$) by using the following equation;

$$P^{B}_{C}(Z)= P^{B}_{O2}(Z)M_C/M_{Chla},$$

where,

M_C and M_{Chla} : Molecular mass of C and Chl*a*.

During the cruise MR-K00-1, the measurements of FRRF were conducted at the following stations 1, 2, 4, 6, 7, 8, 15, 18, 19 and 20 to a depth of 100 m in the morning from about 9:00 to 13:00.

Station Number	Date	Time	Depth	Remarks
St.1	1/7	12:10	100	No data
St.2	1/13	9:53	100	
St.4	1/16	11:06	100	
St.4	1/17	10:20	100	

St.6	1/26	13:14	100	
St.6	1/27	07:16	100	
St.7	1/28	09:27	100	
St.8	1/30	10:14	100	
St.15	2/4	9:07	100	
St.18	1/10	10:21	100	
St.19	1/9	8:54	100	
St.19	1/9	13:08	100	
St.20	1/8	14:20	100	

Primary production measurements by simulated *in situ* incubation

Sea surface water samples were collected into the clear polycabonate bottles by using a bucket at all station except large station (st.3, 6, and 8). At large stations we collected water samples from four layers with different light levels (100%, 31%, 9.6% and 0.9%) into the clear polycabonate bottles by using a bucket or NiskinX samplers. All bottles were immediately transferred into black polyethylene bags to shut off the light and were spiked with the final concentration 2.5mgC/L of $NaH^{13}CO_3$ solution. Samples were incubated in a cage at surface temperature for three hours. At large stations, samples were covered with screen mesh corresponding to the light levels of each sampling depth. After the incubation, samples were filtered by pre-combusted 25mm GF/F filters with vacuum (< 100mmHg) and stored in a deep freezer ($-80^{O}C$).

Station Number	CAST name	Incubation start time	Remarks
St.1		1/7 12:35~	Surface only
St.2		1/13 10:05~	Surface only
St.4	0004s01.DAT	1/16 12:35~	0, 5, 20, and 50m
St.6	0006s02.DAT	1/25 14:20~	0, 10, 23 and 60m
St.6		1/27 7:30~	Surface only
St.7		1/28 9:55~	Surface only
St.8	0008s03.DAT	1/30 12:30~	0, 5, 20 and 50m
St.15	0015s02.DAT	2/4 10:30~	0, 5, 10 and 50m
St.18		1/10 10:30~	Surface only
St.19		1/9 9:00~	Surface only
St.20		1/8 14:40~	Surface only

(3)Future plan

We will estimate the gross primary production from results of FRRF, and compare with results of simulated *in situ* incubation.

3.12 Drifting sediment trap experiment

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Sediment trap working group

(1) Introduction

As one of tactics to verify the role of oceanic biological pump in the control of global environment, time-series sediment trap experiments have been carried out all over the world ocean. However, time-series sediment traps have been usually deployed in the deep sea (> 1000 m) because of complication of hydrodynamics, swimmer, and vandalism in the shallower water. Therefore these sediment traps have not given us enough information about the mechanism of biological pump in the layer between photic zone and deep sea. In addition, collecting efficiency of moored sediment traps are significantly affected by hydrodynamics. In order to solve these problem, drifting sediment trap experiments have been also conducted to collect settling particles in the shallower depth although experimental period is limited.

For the better understanding of biological pump within the upper water column in winter season, we conducted short-termed drifting sediment trap experiment at st. 4 (KNOT), st. 6 (50N), and st. 8 (40N) in this cruise.

(2) Methods

1) Instrumentation

Sediment trap array consisted of eight individual transparent policarbonate cylinders with baffle (collection area: *ca.* 0.0038 m^2, aspect ratio: 620 mm length / 75 mm width = 8.27), which were modified from Knauer et *al.* (1979) and were deployed from *ca.* 20 m to 400 m. Figures 3.12.1 show mooring systems by JAMSTEC. Before deployment, each piece of sediment trap was filled with filtered surface sea water, which salinity was adjusted to *ca.* 39 PSU by addition of NaCl. Thermometer and depth sensor were attached on several sediment trap array. These sediment traps were lowered from surface floating package including surface floating buoy, GPS buoy, radar reflector, and flash light.

2) Experiments

Experiments were conducted three times in this cruise (Table 3.12.1). Two mooring systems were deployed near st. 4 (KNOT) and drifted. Other two experiments were

conducted around st. 6 (50N) and st. 8 (40N).

3) Drifting track

These mooring system drifted during *ca*. 24 ~ 48 hours around three stations (Table 3.12.1). During the experiment, the position of mooring system was monitored on board by GPS tracking system. Fig. 3.12.2 (a), (b), and (c) show tracks of drifting sediment trap mooring systems during three experiments. As can be seen in Fig. 3.12.2 (a), sediment trap mooring systems drifted drawing spiral pattern, which is indicative of that these drifting patterns were controlled by the small eddy. Although two mooring system and mooring system for in situ measurement of primary production changed these directions simultaneously, drifting distances or speed were different. These were attributed to the difference in the mooring length, *i.e.*, the shortest mooring system for primary productivity drifted the most largely. Fig.3.12.2 (b) and (c) show tracks of drifting sediment trap during experiment II and III. Drifting sediment trap moved to the northward around st. 50N, while the east word around st. 40N. Comparing to the track during experiment I, drifting pattern around st. 50N and 40N are more simple.

4) Variability in depth and water temperature during experiments

Several depth sensors and thermometers were installed on mooring system.

Fig. 3.12.3 (a), (b), (c) show the variability in depths and temperature of depth/temp sensors, which installed at 60 m and 390 m traps on JAMSTEC mooring system for each experiments. During the experiment I, depth of trap increased gradually from 62.5 m to 65 m at 60 m sediment trap (Fig. 3.12.3 a). This was the result of the extension of mooring rope took place during the first deploy. Water temperature changed significantly and increased with depth. Among three stations, water structure in the upper water column was relatively complicated. Depth of 390 m trap also increased from 422.5 m to 425 m. However water temperature was relatively constant with value of 3.3 deg-C. Comparing to the experiment I, water temperature was constant during the experiment II carried out around st. 50N (Fig. 3.12.3 b). Water temperature at 60 m trap depth was 2.8 deg-C and lower than that at 390 m depth (3.5 deg-C). During the experiment III, water temperature at 60 m trap depth (ca. 70 m) increased largely at the middle of experimental period (Fig. 3.12.3 c). It is likely that drifting sediment trap passed through different water mass.

4) Sample treatment

After recovery, sediment trap samples were treated according to procedures in Fig. 3.12.4 (a) and (b). Some samples were water sieved through a 1 mm nylon screen to remove

"swimmer" such as zooplankton and small fish. Samples less than 1 mm were sequentially filtered on GF/F filter or Nuclepore filter rinsing with small amount high pure water on board, and filter papers with settling particles were frozen in the refrigerator. Remains of sediment trap samples were freezed or stored in the refrigerator with preservative (formaline) for the future analysis.

(3) Future analysis

On board, any results were not obtained before the analysis on samples. These samples will be distributed to participants for the following various analysis.

1. Dry weight
2. Org-C, inorganic carbon, Total-N
3. Carbonate, Opal
4. Stable isotopes
5. Trace elements
6. Radionuclides
7. Microscopic analysis

Table 3.12.1 Drifting sediment trap experiment

Station	Deployment position	Deployment time	Recovery position	Recovery time	period (hours)
Experiment (I)					
KNOT					
(44N, 155E)	44-00.28N	2000/1/16 7:25	43-57.71N	2000/1/18 8:00	48.583
(JAMSTEC)	154-59.98E	(180m trap in)	154.59.20E	(180m trap out)	
KNOT	44-01.21N	2000/1/16 8:39	43-56.44N	2000/1/18 6:48	46.150
(44N, 155E)	155-00.69E	(100m trap in)	155-00.33E	(100m trap out)	
(CREST)					
- Mooring system for Primary Production -					
KNOT	43-59.92N	2000/1/17 5:28	43-59.84N	2000/1/18 5:56	24.467
(44N, 155E)	154-59.92E	(8.5% trap in)	154-59.84E	(8.5% trap out)	
(CREST)					
Experiment (II)					
50N	50-01.59N	2000/1/26 6:22	50-05.56N	2000/1/27 6:13	23.850
(50N, 165E)	164-59.72E	(160m trap in)	164-58.97E	(160m trap out)	
(JAMSTEC & CREST)					
Experiment (III)					
40N					
(40N, 165E)	39-59.93N	2000/1/29 14:02	40-01.63N	2000/1/30 16:04	26.033
(JAMSTEC & CREST)	165-0.62E	(160m trap in)	165-6.62E	(160m trap in)	

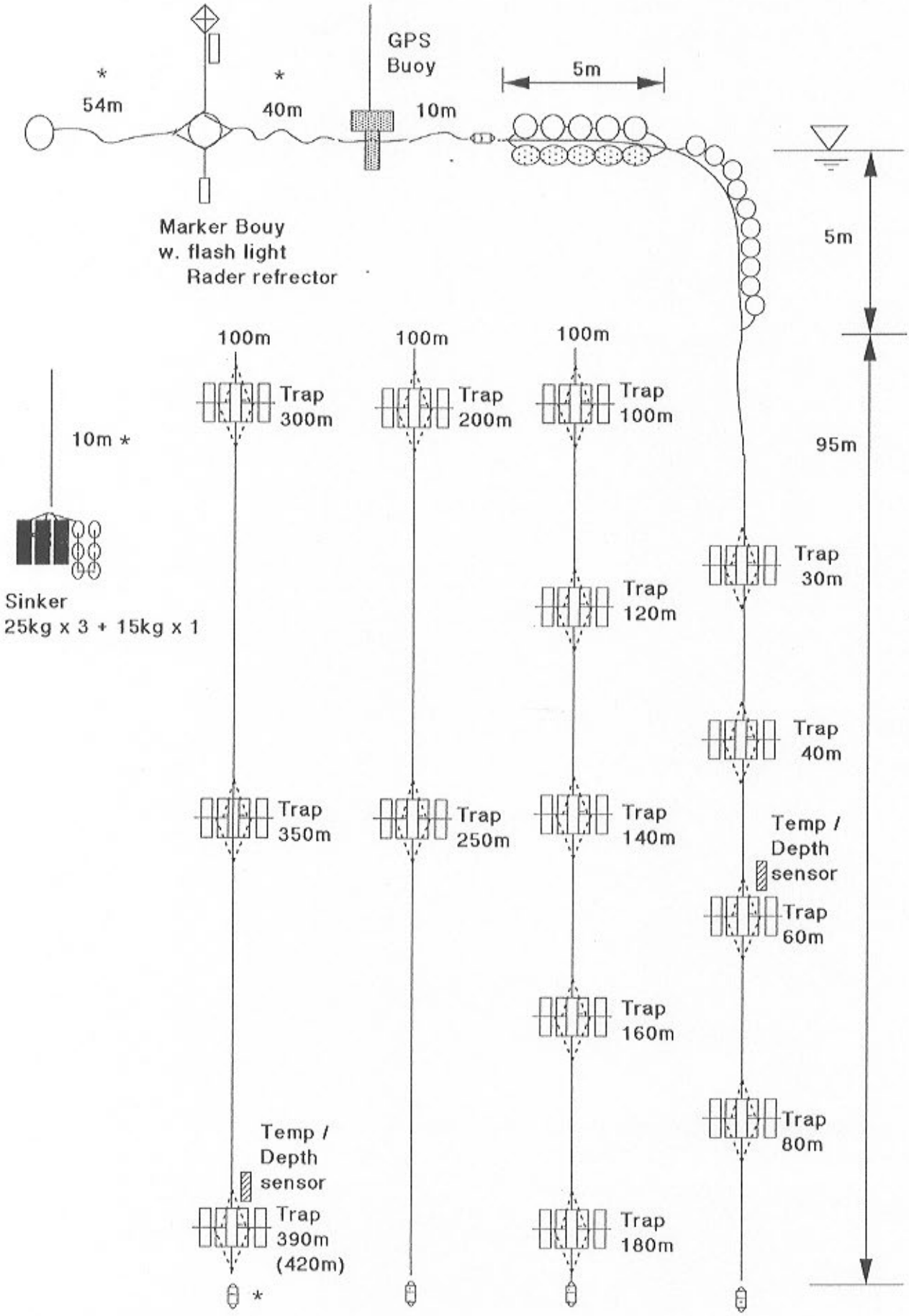


Fig. 3.12.1 Drifting sediment trap mooring system by JAMSTEC

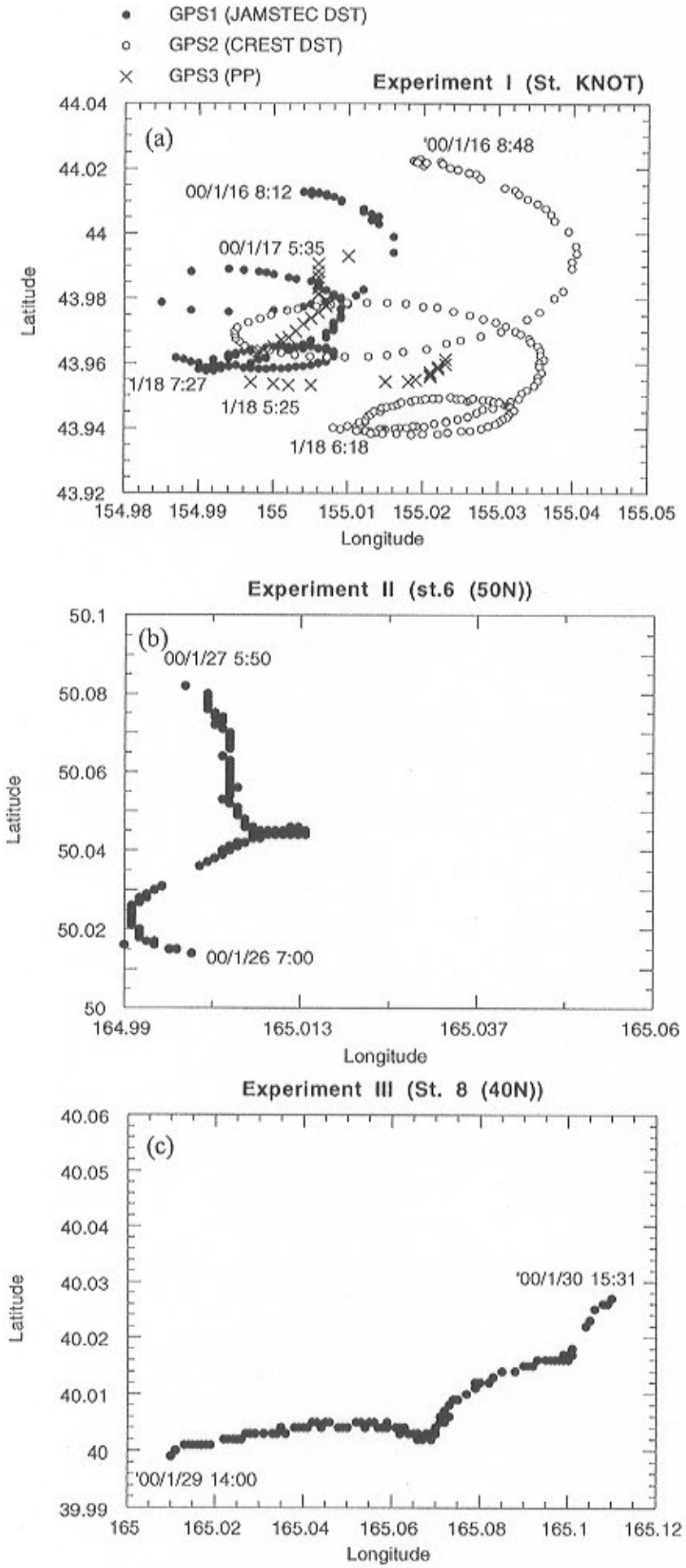


Fig. 3.12.2 Track of drifting sediment trap during respective experiments

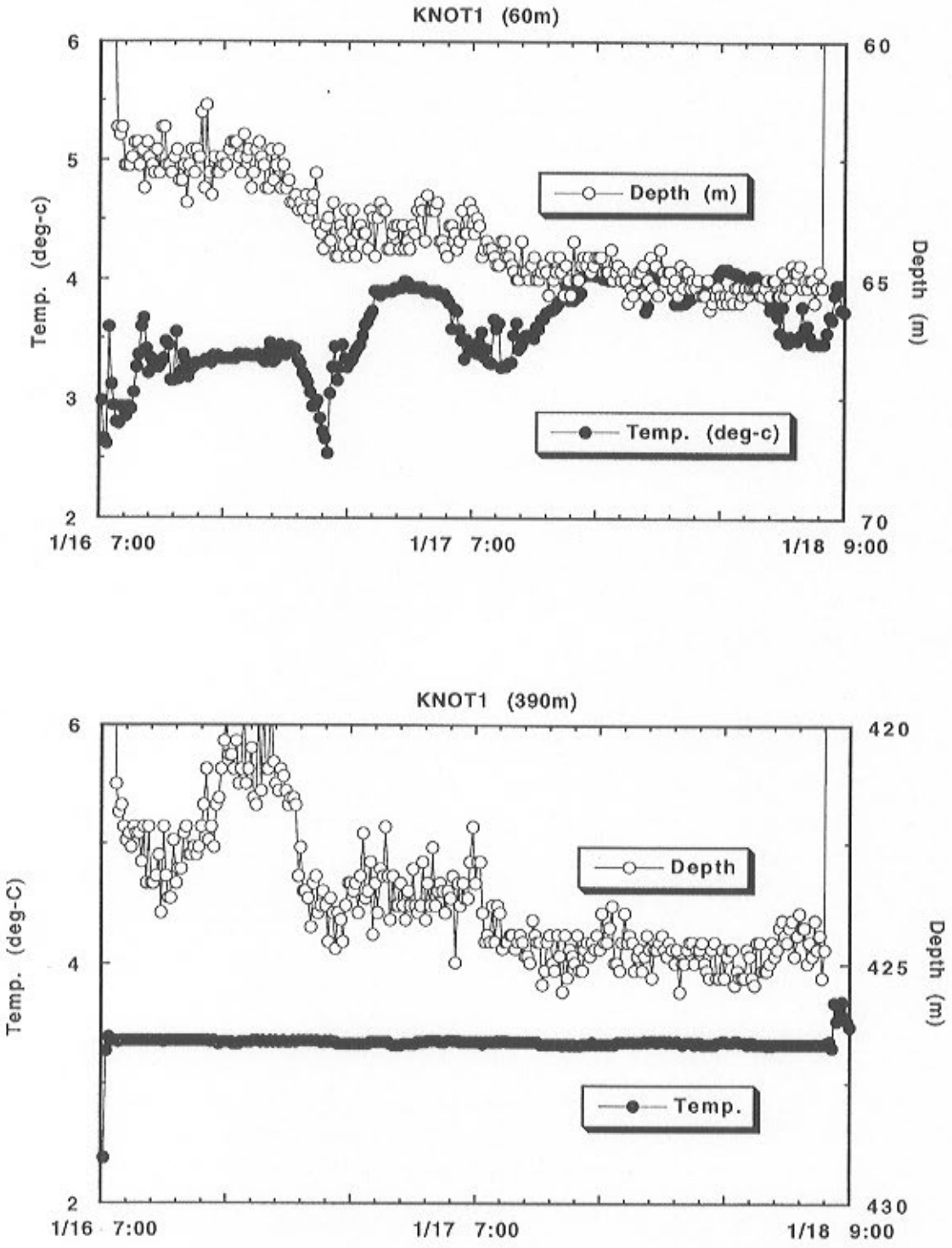


Fig. 3.12.3 (a) Variability in water depth and temperature during experiment (I) at stn. KNOT1

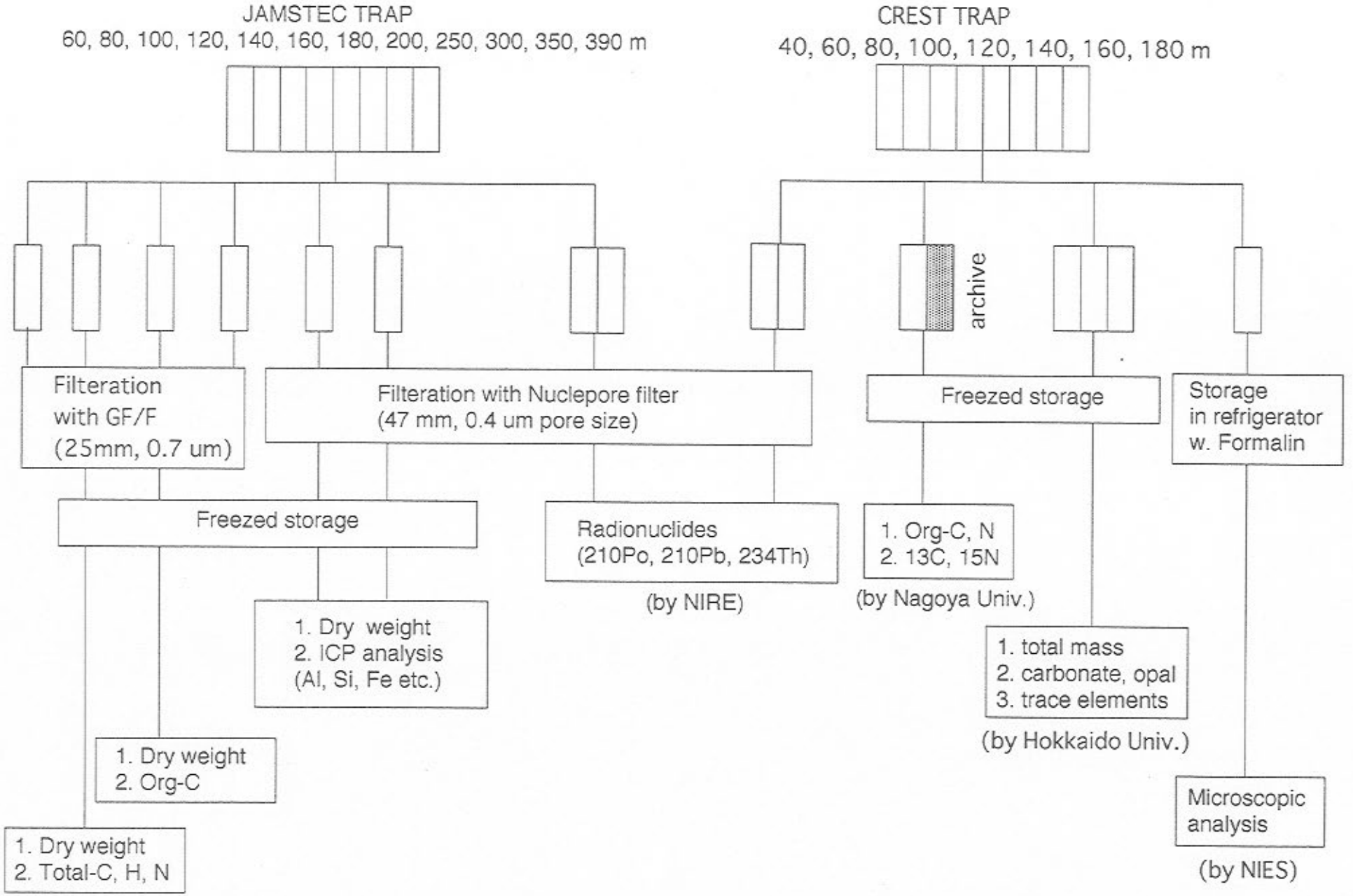


Fig. 3.12.4 (a) Sample treatment and distribution for experiment I at st. KNOT

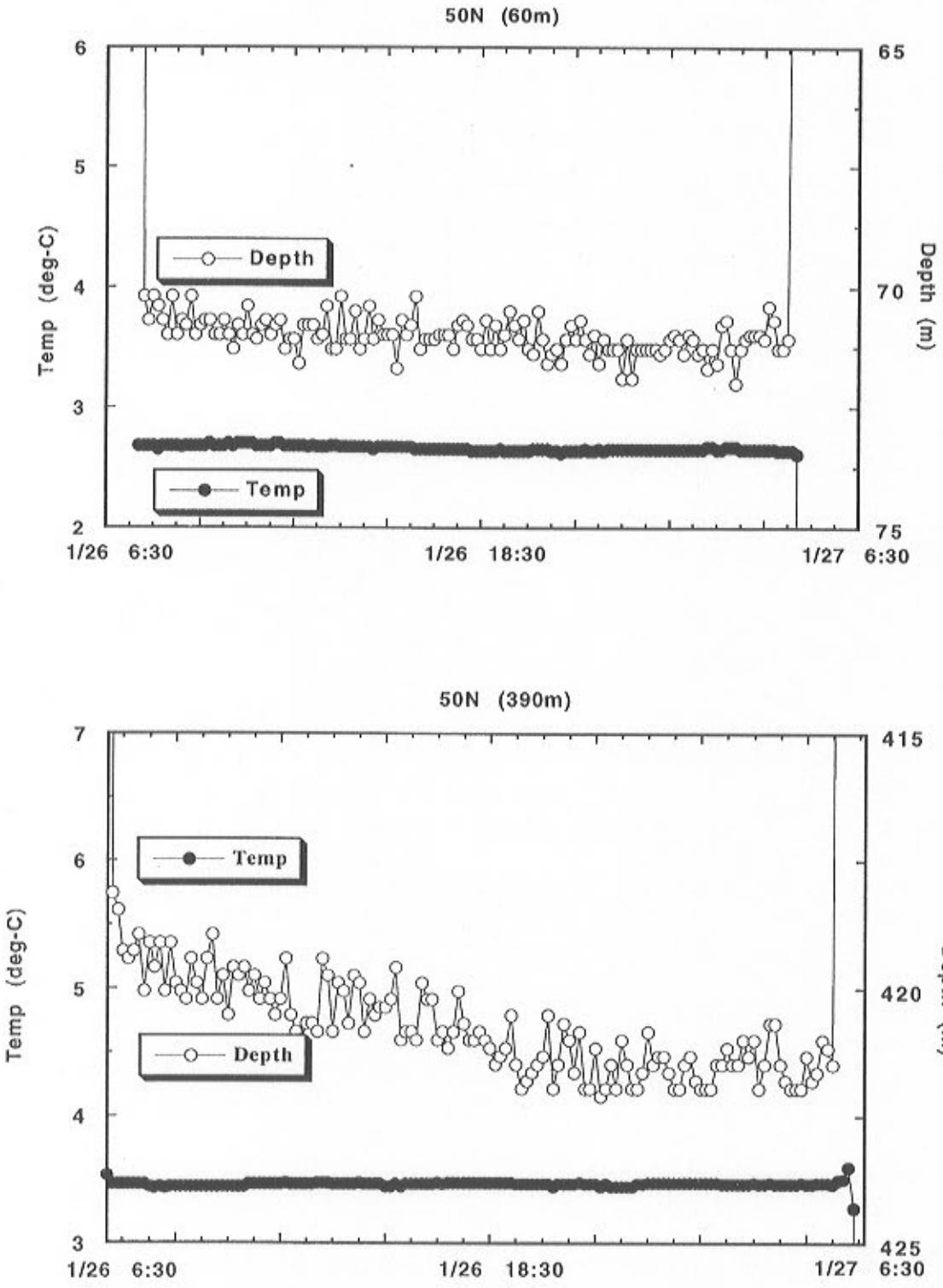


Fig. 3.12.3 (b) Variability in water depth and temperature during experiment (II) at stn. 50N

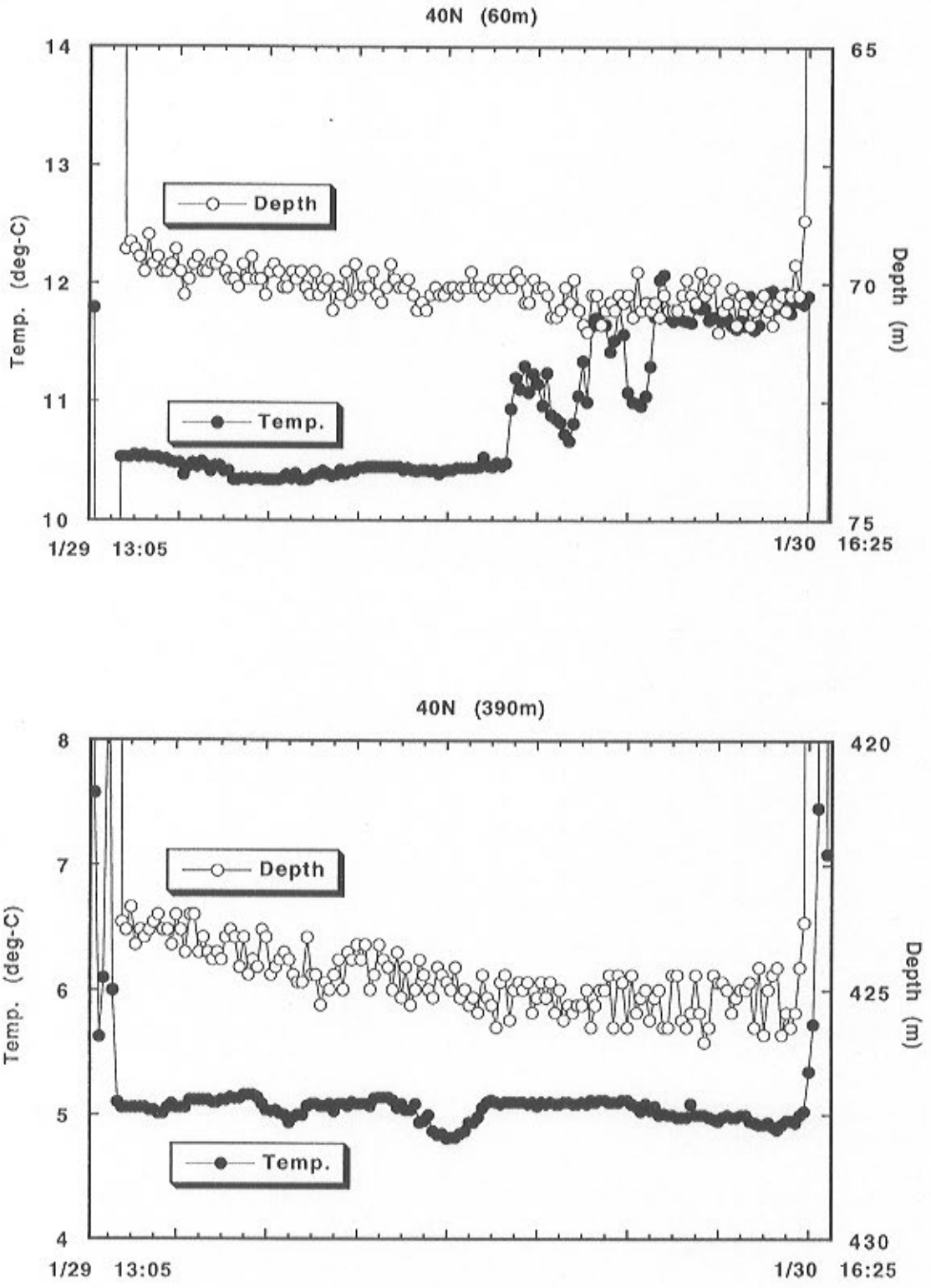


Fig. 3.12.3 (c) Variability in water depth and temperature during experiment (III) at stn.40N

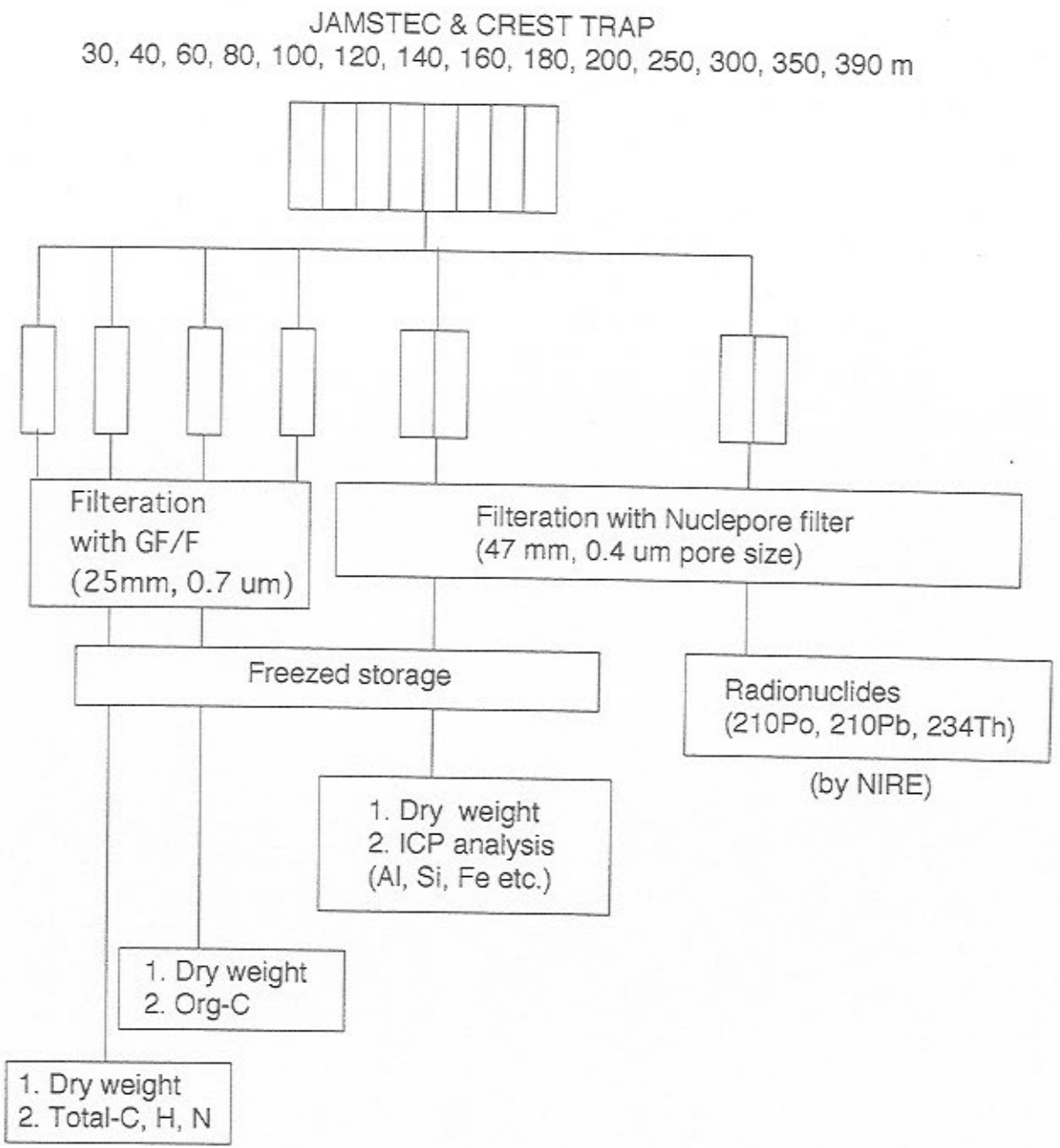


Fig. 3.12.4 (a) Sample treatment and distribution for experiment II at st.50N and III at st. 40N

3.13 Time-series sediment trap experiment

Makio Honda
(Japan Marine Science and Technology center)
Hiroaki Muraki
(Marine Works Japan Ltd.)

(1) Introduction

One of characteristics in the northwestern North Pacific is strong seasonal variability in the biological activity and its related marine chemistry. In order to study seasonal variability in biological pump and its role in materials cycle with the emphasis on the carbon cycle, time-series sediment trap experiment has been conducted since December, 1997 at three stations (St. KNOT : Japanese biogeochemical time-series station, St. 50N: western subarctic gyre, and St. 40N: subarctic front). During MR00-K01 cruise, the sediment trap mooring systems at St. 40N was recovered and re-deployed.

(2) Methods

1) Mooring system

The mooring system at 40N consists of three sediment traps with 21 collecting cups (McLane mark 7G-21 or Mark 78-21), glass floatation, wire / nylon ropes, and acoustic release (Benthos 865A). Sediment traps were deployed at approximately 1000 m, 3000 m, and 5000 m depths. Before deployment, collecting cups were filled with sea water based 5 % buffered formalin to preserve collected settling particles. Each cup was scheduled to rotate every 17.375 days and started in May, 1999.

2) Recovery

Thanks to the enthusiastic assistance by captain Hashimoto, chief officer Kurihara and crew members, the sediment trap mooring systems was recovered successfully during this cruise. All collecting cups (approximately 45) rotated on schedule and valuable samples were collected.

(3) Preliminary results

1) Seasonality in fluxes

On board, heights of total mass flux in collecting cups were measured as the first observation (Table 3.13.1, Fig. 3.13.1).

In May and June, during when total mass flux was expected to be high because of

spring bloom, total mass flux did not increase. Total mass flux at 1000 m water depth increased from the middle of July to September (relatively high flux observed in the last interval should be artifact judging from low fluxes observed during other two intervals in winter). Total mass flux at 3000 m and at 5000 m also increased from July to September. The highest total mass flux was observed during September, which did not appear at 1000 m. In general, seasonal variability in total mass flux synchronized each other.

2) Future plan

These samples will be transported to laboratory being kept in refrigerator. At laboratory, chemical components such as carbon, nitrogen, carbonate, opal and trace elements will be measured. These analysis will reveal property of biological pump in the northwestern North Pacific.

3) Redeployment

The above mooring systems were re-deployed at same positions after sample collection, data acquisition, and exchange of battery and preservative. Each cup was scheduled to rotate every 23.142 days, start on the 1st Feb. 2000. Specification of above sediment trap mooring system are shown in Table 3.13.2. Outlines of mooring systems are shown in Table 3.13.3 and Fig. 3.13.2. The mooring system is planned to be recovered in July, 2001 by R/V MIRAI.

Table 3.13.1 Sediment trap sample record

stn.	40N	(40-00.0941N)		40N			40N		
depth(m)	932	(165-00.3559E)		2965			4996		
S/N	open day	sample hights (mm)	Note	open day	sample hights (mm)	Note	open day	sample hights (mm)	Note
1	1999/5/22	10		1999/5/22	7		1999/5/22	8	
2	1999/6/8	15	shrimp	1999/6/8	9		1999/6/8	10	
3	1999/6/25	8		1999/6/25	8		1999/6/25	7	
4	1999/7/13	60	jelly fish	1999/7/13	45		1999/7/13	23	
5	1999/7/30	19		1999/7/30	41		1999/7/30	47	
6	1999/8/16	35		1999/8/16	24		1999/8/16	17	
7	1999/9/3	20	small shrimp	1999/9/3	55		1999/9/3	67	
8	1999/9/20	8		1999/9/20	20		1999/9/20	34	
9	1999/10/8	5		1999/10/8	14		1999/10/8	27	
10	1999/10/25	18	jelly fish	1999/10/25	9		1999/10/25	12	
11	1999/11/11	13		1999/11/11	15	jelly fish	1999/11/11	23	
12	1999/11/29	14	small shrimp	1999/11/29	21		1999/11/29	12	
13	1999/12/16	3	small shrimp	1999/12/16	14		1999/12/16	15	
14	2000/1/2	3	jelly fish	2000/1/2	13	shrimp	2000/1/2	18	
15	2000/1/20	28	1/30 recovery/jelly fish	2000/1/20	8	1/30 recovery	2000/1/20	-	1/30 recovery
16									
17									
18									
19									
20									
21									

Table 3.13.2 Specification of Sediment Trap Mooring system at 40N

Stn.		**40N**
Date of deploy		2000/01/31
Position	sinker drop	40-00.24N 165-00.73E 5476m
	estimated** (10% of mooring length toward top buoy deployme from sinker drop position)	40-00.28N 165-01.05E 5476m
Sediment trap (McLane Mark7G-21 * Mark78-21) w.depth/tilt sensor	depth and S/N shallow intermediate deep	 934m (S/N: 6854)* 2965m (S/N: 1386) 4996m (S/N: 1388)
	start interval end	2000/02/01 00:00:00 23.142 day 2001/05/31 00:00:00
	preservative	5% buffered formalin (sea water base)
Acoustic Releas (Benthos 865A) NOTE: Re/Tr reverse for Deck Unit	S/N Receive Trans ENABLE RELEASE	624 11.5 kHz 12.0 kHz 4A 4B

Note
* No positioning because of bad weather
** Positions are on the scale of WGS-84.

Table 3.13.3 Sediment trap mooring system at st.40N

Mooring ID	NEW	JAST03HL (40,165)		Water Depth		5476m		2000 Jan.	
Description		Weight (lb/ea)	Item Quantity (#)	Item Length (m)	Item Weight (lbs)	Mooring Length (m)	Mooring Weight (lbs)	Above Bottom (m)	Below Surface (m)
Start of Mooring		0	0	0	0	0	0	4593.1	882.94
Beacon Float		-64	1	0.3	-64	0.3	-64	4593.1	882.94
Nylon rope 3/4"		1	1	20	1	20.3	-63	4592.8	883.24
FLOTATION MODULE		-64	6	1.8	-384	22.1	-447	4572.8	903.24
Chain 3/8"		4.49	1	1	4.49	23.1	-442.51	4571	905.04
FLOTATION MODULE		-64	6	1.8	-384	24.9	-826.51	4570	906.04
Chain 3/8"		4.49	1	1	4.49	25.9	-822.02	4568.2	907.84
FLOTATION MODULE		-64	6	1.8	-384	27.7	-1206	4567.2	908.84
Nylon rope 3/4"		1	1	20	1	47.7	-1205	4565.4	910.64
Chain 3/8"		8.98	1	2	8.98	49.7	-1196	4545.4	930.64
Bridle (1m x 3 wire rope)		9.06	1	1	9.06	50.7	-1187	4543.4	932.64
SEDIMENT TRAP MK7-21	S/N 6854	121	1	1.52	121	52.22	-1066	4542.4	933.64
Bridle (1m x 3 wire rope)		9.06	1	1	9.06	53.22	-1056.9	4540.8	935.16
Chain 3/8"		8.98	1	2	8.98	55.22	-1047.9	4539.8	936.16
Sievel		10	1	0.3	10	55.52	-1037.9	4537.8	938.16
Chain 3/8"		4.49	1	1	4.49	56.52	-1033.5	4537.5	938.46
wire rope 3/16"		75	1	500	75	556.52	-958.45	4536.5	939.46
wire rope 3/16"		75	1	500	75	1056.5	-883.45	4036.5	1439.5
wire rope 3/16"		75	1	500	75	1556.5	-808.45	3536.5	1939.5
wire rope 3/16"		75	1	500	75	2056.5	-733.45	3036.5	2439.5
FLOTATION MODULE		-64	9	2.7	-576	2059.2	-1309.5	2536.5	2939.5
Nylon rope 3/4"		1	1	20	1	2079.2	-1308.5	2533.8	2942.2
Chain 3/8"		8.98	1	2	8.98	2081.2	-1299.5	2513.8	2962.2
Bridle (1m x 3 wire rope)		9.06	1	1	9.06	2082.2	-1290.4	2511.8	2964.2
SEDIMENT TRAP MK7-21	S/N 1386	121	1	1.52	121	2083.7	-1169.4	2510.8	2965.2
Bridle (1m x 3 wire rope)		9.06	1	1	9.06	2084.7	-1160.4	2509.3	2966.7
Chain 3/8"		8.98	1	2	8.98	2086.7	-1151.4	2508.3	2967.7
Sievel		10	1	0.3	10	2087	-1141.4	2506.3	2969.7
wire rope 3/16"		75	1	500	75	2587	-1066.4	2506	2970
wire rope 3/16"		75	1	500	75	3087	-991.37	2006	3470
wire rope 3/16"		75	1	500	75	3587	-916.37	1506	3970
wire rope 3/16"		75	1	500	75	4087	-841.37	1006	4470
FLOTATION MODULE		-64	9	2.7	-576	4089.7	-1417.4	506.02	4970
Nylon rope 3/4"		1	1	20	1	4109.7	-1416.4	503.32	4972.7
Chain 3/8"		8.98	1	2	8.98	4111.7	-1407.4	483.32	4992.7
Bridle (1m x 3 wire rope)		9.06	1	1	9.06	4112.7	-1398.3	481.32	4994.7
SEDIMENT TRAP MK7-21	S/N 1388	121	1	1.52	121	4114.3	-1277.3	480.32	4995.7
Bridle (1m x 3 wire rope)		9.06	1	1	9.06	4115.3	-1268.3	478.8	4997.2
Chain 3/8"		8.98	1	2	8.98	4117.3	-1259.3	477.8	4998.2
Sievel		10	1	0.3	10	4117.6	-1249.3	475.8	5000.2
wire rope 3/16"		45	1	300	45	4417.6	-1204.3	475.5	5000.5
wire rope 3/16"		15	1	100	15	4517.6	-1189.3	175.5	5300.5
Chain 3/8"		4.49	1	1	4.49	4518.6	-1184.8	75.5	5400.5
ACOUSTIC RELEASE		55	1	1	55	4519.6	-1129.8	74.5	5401.5
Chain 3/8"		4.49	1	1	4.49	4520.6	-1125.3	73.5	5402.5
wire rope 3/16"		4.5	1	50	4.5	4570.6	-1120.8	72.5	5403.5
Nylon rope 3/4"		1	1	20	1	4590.6	-1119.8	22.5	5453.5
Chain 3/8"		8.98	1	2	8.98	4592.6	-1110.8	2.5	5473.5
ANCHOR		2800	1	0.5	2800	4593.1	1689.2	0.5	5475.5

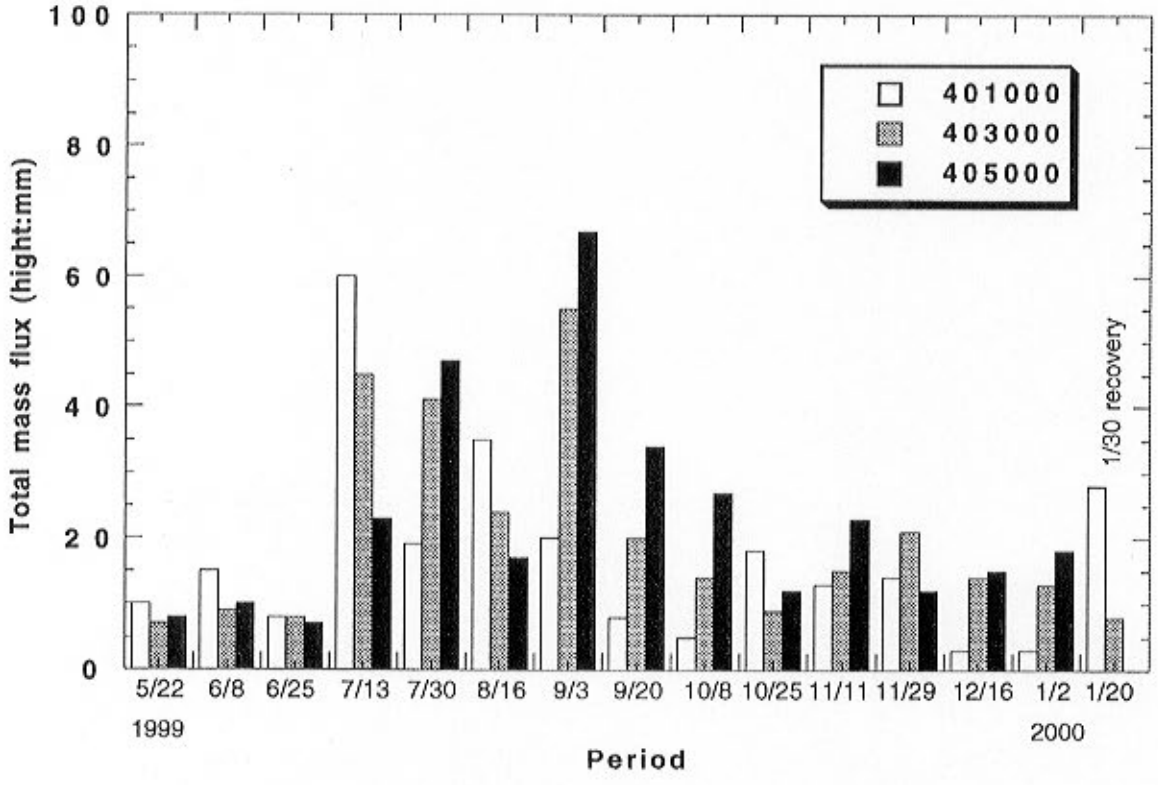


Fig. 3.12.1 Seasonal variability in total mass flux at 40N

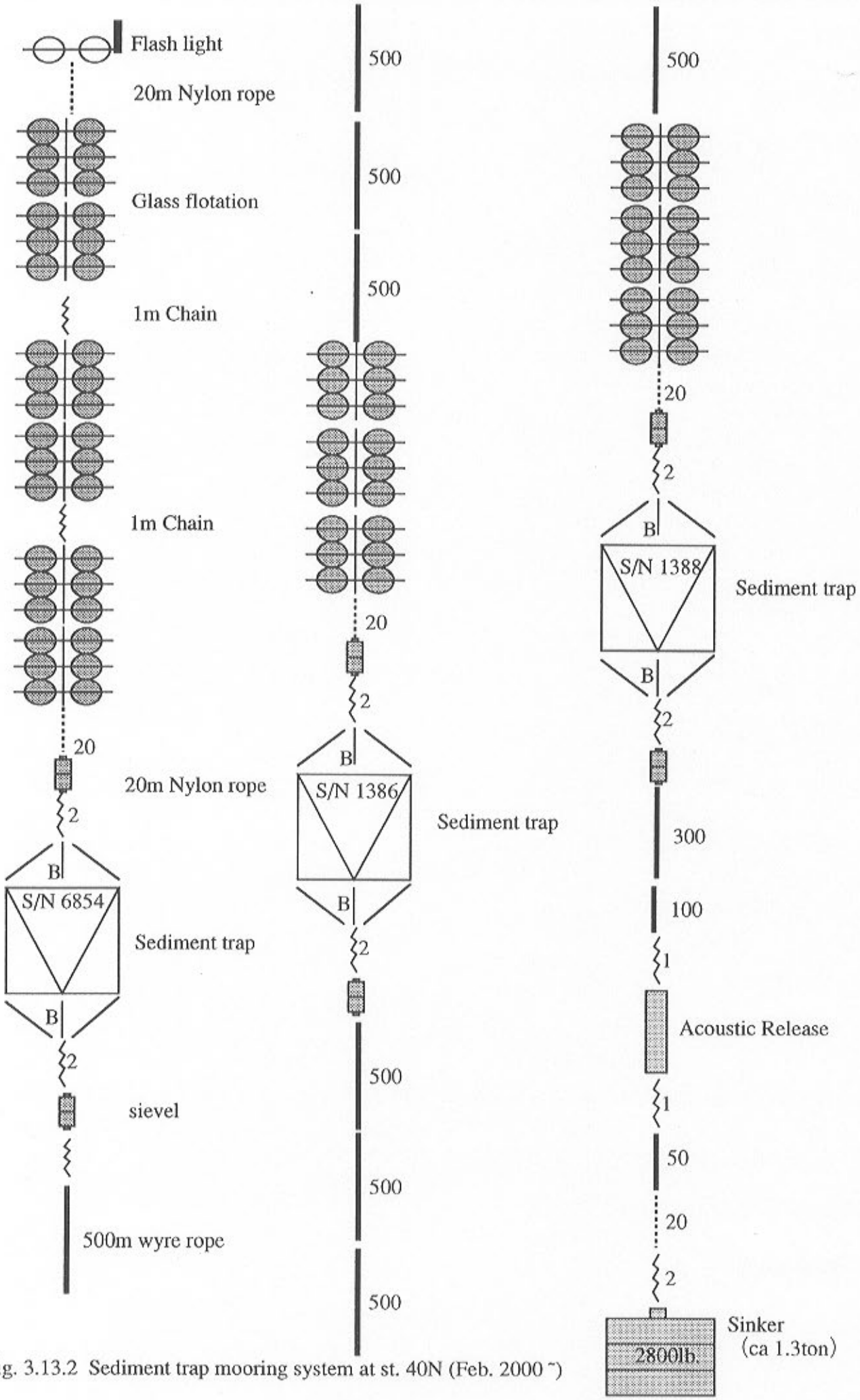


Fig. 3.13.2 Sediment trap mooring system at st. 40N (Feb. 2000 ~)

3.14 Bio-optical measurements: MER (Multi-wavelength Environmental Radiometers)

Kousei Sasaoka
Faculty of Fisheries, Hokkaido University

(1) Introduction

Subarctic North Pacific Ocean is one of the highest biological productivity regions in the world. The quantitative assessment of phytoplankton production in this region is very important to estimate global primary production. Ocean color remote sensing is very useful as a new tool for monitoring temporal and spatial variability of chlorophyll concentration continuously. SeaWiFS on orbview2 launched successfully on Aug., 1997 and operation is very so far stable. We can receive the SeaWiFS data on board. However, there are some problems of in-water algorithms for ocean color remote sensing in the subarctic North Pacific. The solar incoming radiation in the subarctic North Pacific shows large seasonal variability by sky conditions. These radiant environments could effect the photosynthetic characteristics of phytoplankton in the waters. The bio-optical algorithms in the high latitude regions were different from the general algorithms (Mitchell, 1992). Then, the new bio-optical algorithms for the high latitude regions need to be developed as soon as possible. Especially in the winter season, there is a few bio-optical data sets in this region.

The objective of this study is to validate and to develop bio-optical algorithm for new series ocean color sensors, such as Sea-viewing Wide Field-of-view Sensor(SeaWiFS) and Global Imager(GLI) in the subarctic North Pacific Ocean. Therefore, we measured in situ bio-optical parameters, including upwelled spectral radiance and downwelled spectral irradiance using MER2040/2041.

(2) Methods

The underwater spectral downward irradiance and upward radiance were measured using the underwater unit, MER-2040 (Biospherical Instrument Inc.). The measurements were carried out from the sea surface down to depth 100m depending on the water turbidity. The incident solar spectral irradiance was measured using the deck unit, MER-2041 (Biospherical Instrument Inc.). The measurements were carried out near the satellite overpassing time (about 9:00 A.M. to 13:00 P.M.). Fig.1 shows the map of MER-2040/2041 measurement stations in this cruise. The spectral channels of MER-2040/2041 covered the wavelength of 412, 443, 465, 490, 510, 520, 555, 565, 625, 665,

670, 683 nm and PAR (710nm for upward radiance). These channels were selected for compatible satellite ocean color sensor, Sea-viewing Wide Field-of-view Sensor (SeaWiFS) and Global Imager (GLI). Upward and downward PAR (Photosynthetically available radiation) was determined optical depth for the in-situ and in-vitro primary productivity measurement (CREST and Nagoya univ. group).

In future study, we will calculate normalized water leaving radiance (Lwn) and remote sensing reflectance (Rrs) using these bio-optical parameters and examine the relationship between in situ measured chl-a values and estimated chl-a values using the several bio-optical algorithm developed by NASA, NASDA and other researchers. We are going to develop the new bio-optical algorithms for the high latitude regions and make high accuracy chl-a image in this region.

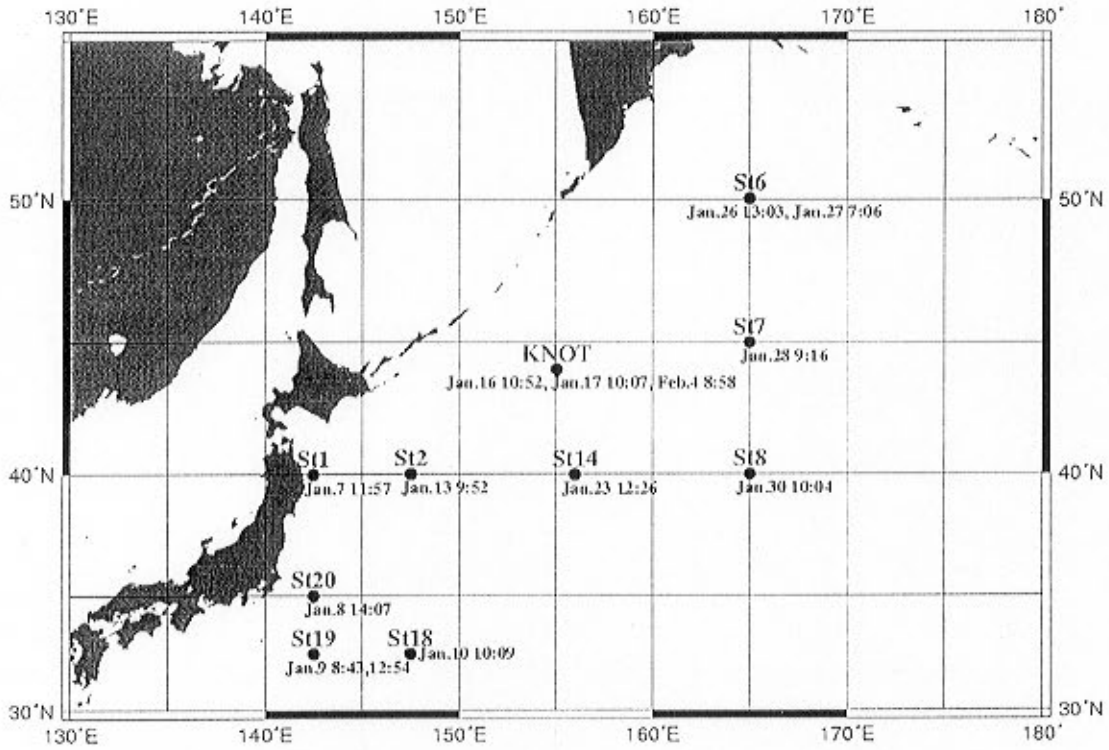


Fig.1 Map of MER observation stations in this cruise

3.15 Plankton net

Takeshi Egashira and Nojiri Yukihiro
(Japan Science and Technology Corporation)

This samplings aims to reveal the biomass, horizontal and vertical distribution, and species composition of net zooplankton in northwestern subarctic Pacific. Net zooplankton were collected using three type nets. Palumbo-Chun-Petersen (POP) type closing net (45cm mouth diameter, 0.06mm mesh) were made at stn. KNOT1. Sampling depth strata were 0-80, 80-250, 250-500, 500-1000 and 1000-1500m. twin-type or single type NORPAC nets were towed vertically. Volumes of water filtered through the net were estimated from readings of a Rigosha flowmeter mounted in the mouth of each net. All net samples were immediately preserved in 5% buffered formalin-seawater solution. Field sampling data for net zooplankton are as follows.

Table 3. 15 Summary of field sampling data for net zooplankton (PCP: Palumbo-Chun-Petersen type closing net, TN: twin-type NORPAC net, SN: single-type NORPAC net)

Date	Station	net	depth(m)
17-Jan	KNOT1 (St.4)	PCP	0-80
			80-250
			250-500
			500-1000
			1000-1500
		TN	0-150
			0-500
		SN	0-200
26-Jan	St.6	TN	0-150
			0-500
		SN	0-200
30-Jan	St.8	TN	0-150
			0-500
		SN	0-200
4-Feb	KNOT2 (St.15)	TN	0-150
			0-500
		SN	0-200

3.16 NMHC and CO

- Air sampling for measuring stable carbon isotopic composition of non-methane hydrocarbons (NMHC) and carbon monoxide (CO) in Pacific atmosphere -

Yousuke Hachisu and Urumu Tsunogai
Department of Environmental Science and Technology
Tokyo Institute of Technology

Purpose

Light molecular weight non-methane hydrocarbons (NMHC) (C2-C5) and carbon monoxide (CO) are commonly present in the lower regions of the atmosphere in concentrations ranging from a few parts per billion by volume (ppbv) to a few parts per trillion (pptv). Many past investigations on the distributions of these compounds have revealed that they play an important role in the chemistry of atmosphere. However, many uncertainties still remain about nature, the strength, and the distribution of their sources and removal processes. Studies on the stable isotopic composition of atmospheric species with more than about ppmv mixing ratio, such as CO_2 and CH_4, have provided valuable information for understanding the distributions of production and removal processes involved in atmospheric cycling. In the case of trace components such as NMHC and CO, however, few data are available for their isotopic composition, because it is difficult to collect sufficient quantity of samples for traditional $\delta^{13}C$ determination.

Analysis

New isotope-ratio-monitoring gas chromatography / mass spectrometry (irm-GC/MS) systems require much smaller samples for isotopic analyses. We have developed an analytical system, which is capable of on-line simultaneous analyses of concentration and $\delta^{13}C$ of low level NMHC and CO in atmosphere using irm-GC/MS. In this study, we will determine distributions of both mixing ratios and stable carbon isotopic compositions of NMHC and CO in Pacific atmosphere, by using irm-GC/MS. The air mass composition reflects land sources followed by

transport over the ocean, during which additional marine contribution and photochemical removal process occur. By using isotopic signatures, we will discuss the sources and removal processes of NMHC and CO in Pacific.

Sampling

All the air samples are collected in 0.2-L pre-evacuated glass canisters and 6.0-L pre-evacuated stainless steel canisters (fused-silica coated) equipped with a diaphragm valve (fused-silica coated). All the samples will be analyzed within a few weeks after sampling, by using sequential determination of $\tilde{}\ ^{13}C$ and $\tilde{}\ ^{18}O$ by Finnigan MAT 252 mass spectrometer.

3.17.1 Partial pressure of CO_2 (pCO_2) in the atmosphere and sea surface

Akihiko Murata (JAMSTEC)
Mikio Kitada (MWJ)

Concentrations of CO_2 in the atmosphere and the sea surface were measured continuously during the entire cruise by the automated system with a non-dispersive infrared (IR) analyzer (BINOSTM). It runs on half hour or two hours cycle during which four standards, an ambient air sample, and a head space sample from the equilibrator were analyzed.

The ambient air sample taken from the bow is introduced into the IR through a mass flow controller which controls the air flow rate at about 0.5L/min, a cooling unit, a perma pure dryer, and a desiccant holder ($Mg(ClO_4)_2$).

The equilibrator has shower head space in the top through which surface water is forced at a rate of 5-8L/min. Air in the head space is circulated with an air pump at 0.5-0.8L/min in a closed loop through two cooling units, a perma pure dryer, and the desiccant holder.

For calibration, compressed gas standards with nominal mixing ratios of 240, 300, 330, 380, ppmv (parts per million by volume) were used.

3.17.2 Continuous pCO_2 measurement

Yukihiro Nojiri (CREST/NIES)

The surface seawater pCO_2 is controlled by the percentage of gaseous carbon dioxide concentration to its solubility in seawater. The four major controlling mechanisms of oceanic pCO_2 are SST (surface seawater temperature), biological activities (photosynthesis and decomposition of organic matter), vertical mixing and gas exchange. The MR00-K01 cruise included the subarctic north Pacific with intensive cooling and vertical mixing of surface seawater.

Because the oceanic pCO_2 varies with time and space, the response time of the underway measurement on board a ship should be as short as possible. The popular types of pCO_2 systems are using showerhead type equilibrator. Because it usually has large ratio of air to water in the equilibrator, the system needs circulating pass to achieve the gas-water equilibrium to have enough contact with gas and seawater. This usually makes the response time of the pCO_2 measurement in the order of hour. The oceanic pCO_2 sometimes changes very sharply with the rapid change of SST at frontal regions. Sharp spatial change is also observed in the spring bloom season, when the patch of highest productivity is commonly observed in the subarctic and coastal regions.

In this cruise, we used the newly developed continuous flow type of equilibrator, which facilitate the rapid response measurement of pCO_2.

Method

The surface seawater taken from the sea chest of R/V Mirai was supplied to an air-liquid equilibrator having Tandem design (Figure 1), which is a combination of bubbling and mixer equilibrators. Seawater is supplied from the inlet locating the top of the equilibrator and run down. As the inlet diameter is 20 mm, it is never clogged by plankton and nekton. Cylinder air having natural CO_2 concentration is supplied from the bottom of the bubbling equilibrator at 350 ml/min flow rate and ascends in the cylindrical tube. The air is equilibrated to the CO_2 concentration in seawater at the overflow surface of the cylindrical tube. Because of the surface tension in the bubbling air makes the inside pressure of air bubble increase, the resulted pCO_2 of the bubble has slightly lower pCO_2 than the true seawater pCO_2, which is estimated about 0.8 % of the total pCO_2 in seawater. The supplied air then pass through the mixer equilibrator with a splasher inside. The air is accurately equilibrated by the second equilibrator and then flow out from the equilibrator. 200 ml/min of the air overflows at a separator, and 150 ml/min of the air is aspirated to a CO_2

measurement system with NDIR.

The NDIR is calibrated with 4 working standard gases having 270, 320, 390, and 450 ppm of CO_2 in air. The working standard gases have already been critically calibrated against NIES-95 standard gas scale. The calibration was done at 0 and 12 of GMT. The calibration takes 40 minutes and atmospheric CO_2 was measured after each calibration for 10 minutes. The NDIR output signal was logged with 10 seconds interval for standard gases and with 1 minute interval for atmosphere and seawater measurement. Then, we had 2 series of 670 minutes (11 hour and 10 minutes) of continuous pCO_2 measurement of 1 minutes data logging in a day.

The NDIR mV output are corrected with pressure effect with pressure gage at the outlet of NDIR cell and then calibrated by the standard gas readings.

Result

We met only one day of problem for operating the pCO_2 system during the 31 days of the cruise. On January 19th, a gas valve problem caused one hour of data lack. At the same day, high amount of zooplankton in seawater caused foaming inside the cylindrical equilibrator. The foam was detected by water level sensor inside the equilibrator and measurement was stopped. Both troubles were detected from the data chart monitoring in my cabin and buoy maintenance laboratory using Mirai computer network system. This network monitor facilitated the early detection of the problem.
Totally the data loss period was approximately 2 hours in the cruise.

Figure 2a-c are the plot of pCO_2 and SST for selected periods of the cruise. MR00-K01 cruise covered subtropical, frontal and subarctic region in the western north Pacific. The pCO_2 in the frontal region was generally explained as a temperature function. When temperature increases, pCO_2 decreased with a slope of 6 ˜atm/degree. The thermodynamic pCO_2 change with temperature is 0.042%/degree increasing with temperature increase. The pCO_2 change observed is not by thermodynamic change but the mixing of surface mixed layer with sub surface water, having higher pCO_2 and usually having high concentration of inorganic carbon.

When we visited station 6, the surface mixing reached to the upper halocline. The pCO_2-SST relationship showed larger slope than the frontal zone (Figure 2b). It was also observed at the second KNOT survey, where KNOT-N (station 5) showed fairly higher pCO_2 than the KNOT (station 15). The mixing of waters of mixed layer and upper halocline causes the intense increase of DIC but small change of temperature.

The spatial change of pCO_2 was not so evident compared with the spring season survey like previous May, however, the true continuous measurement of pCO_2 with high time

resolution was useful for the accurate description of the distribution. Especially at the front of subtropical and subarctic waters, temperature jumped and simultaneous jump of pCO_2 was observed.

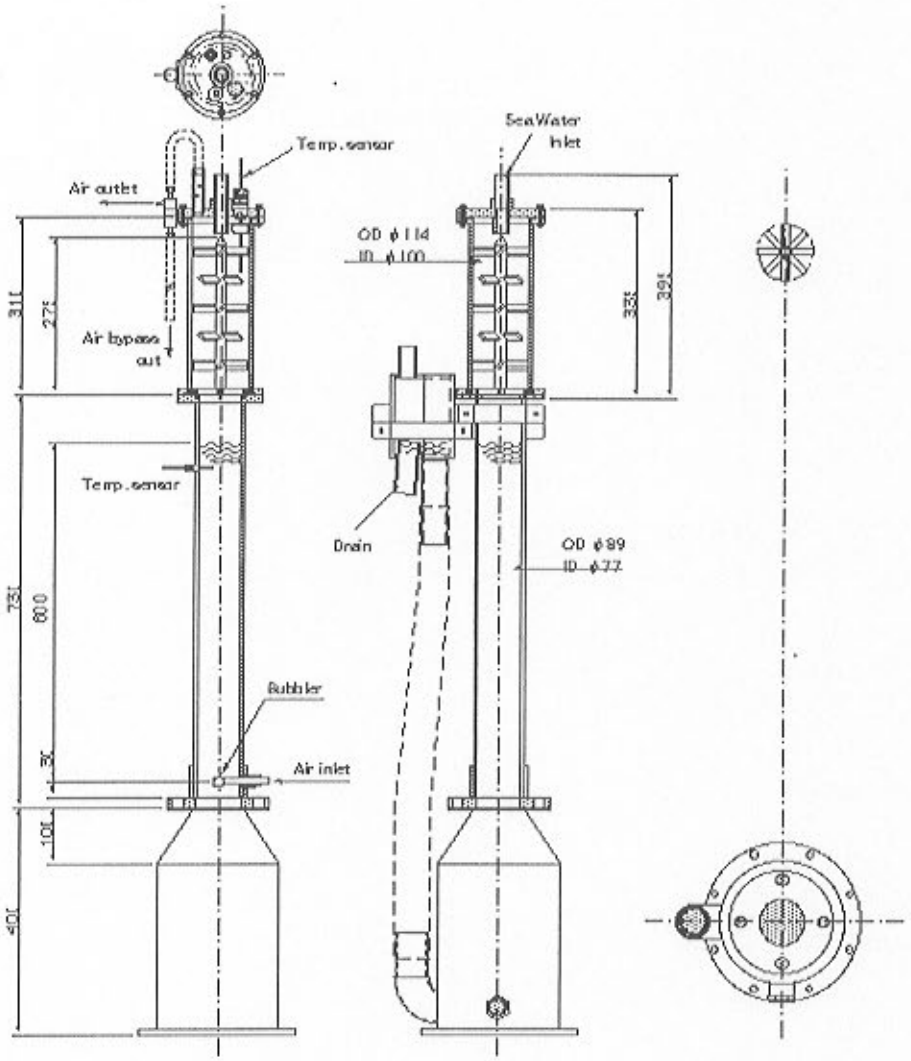


Fig. 1 Schematic of Tandem equilibrator

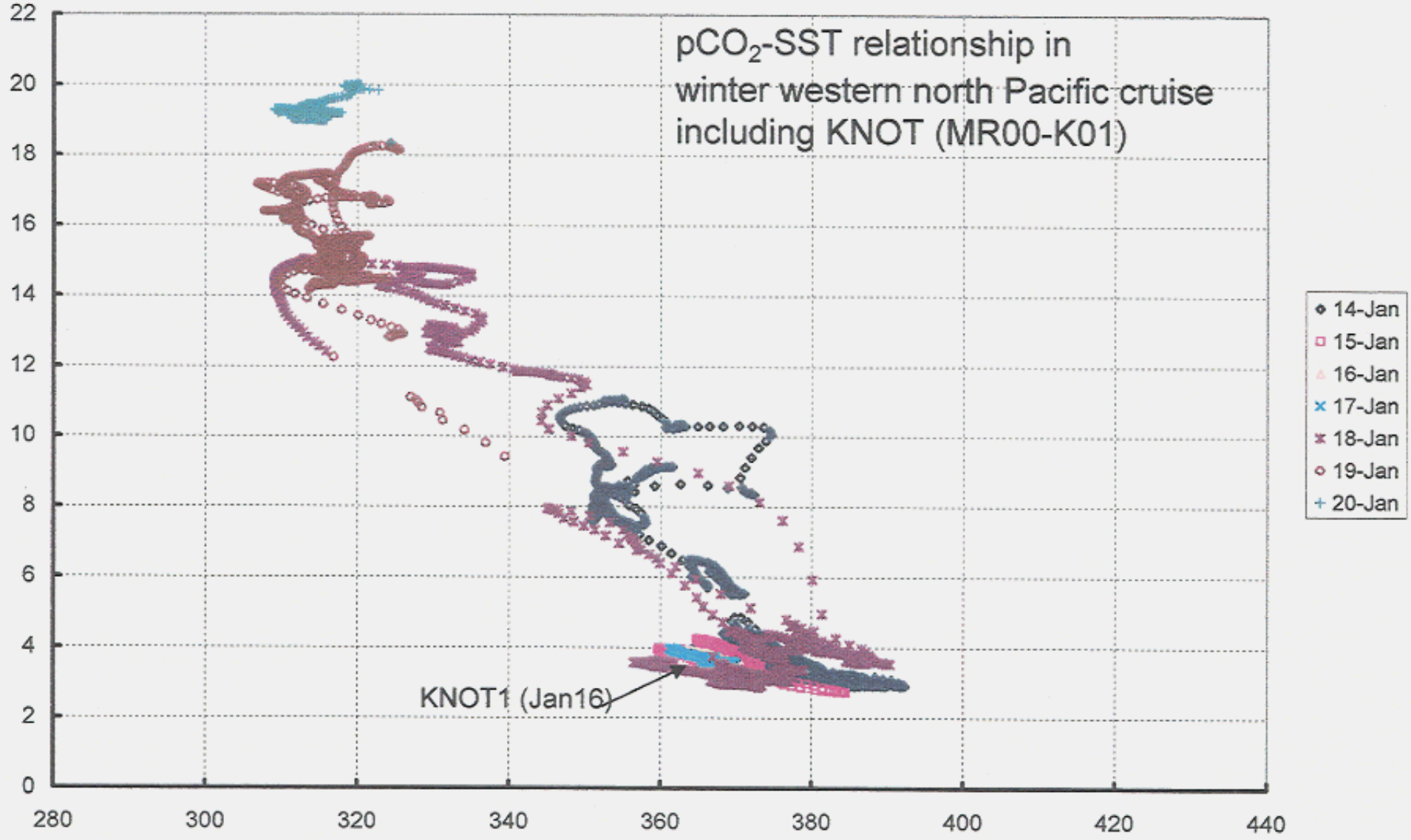


Fig. 2 (a) SST-pCO_2 relationship in MR00-K01 cruise: January 14 - 20

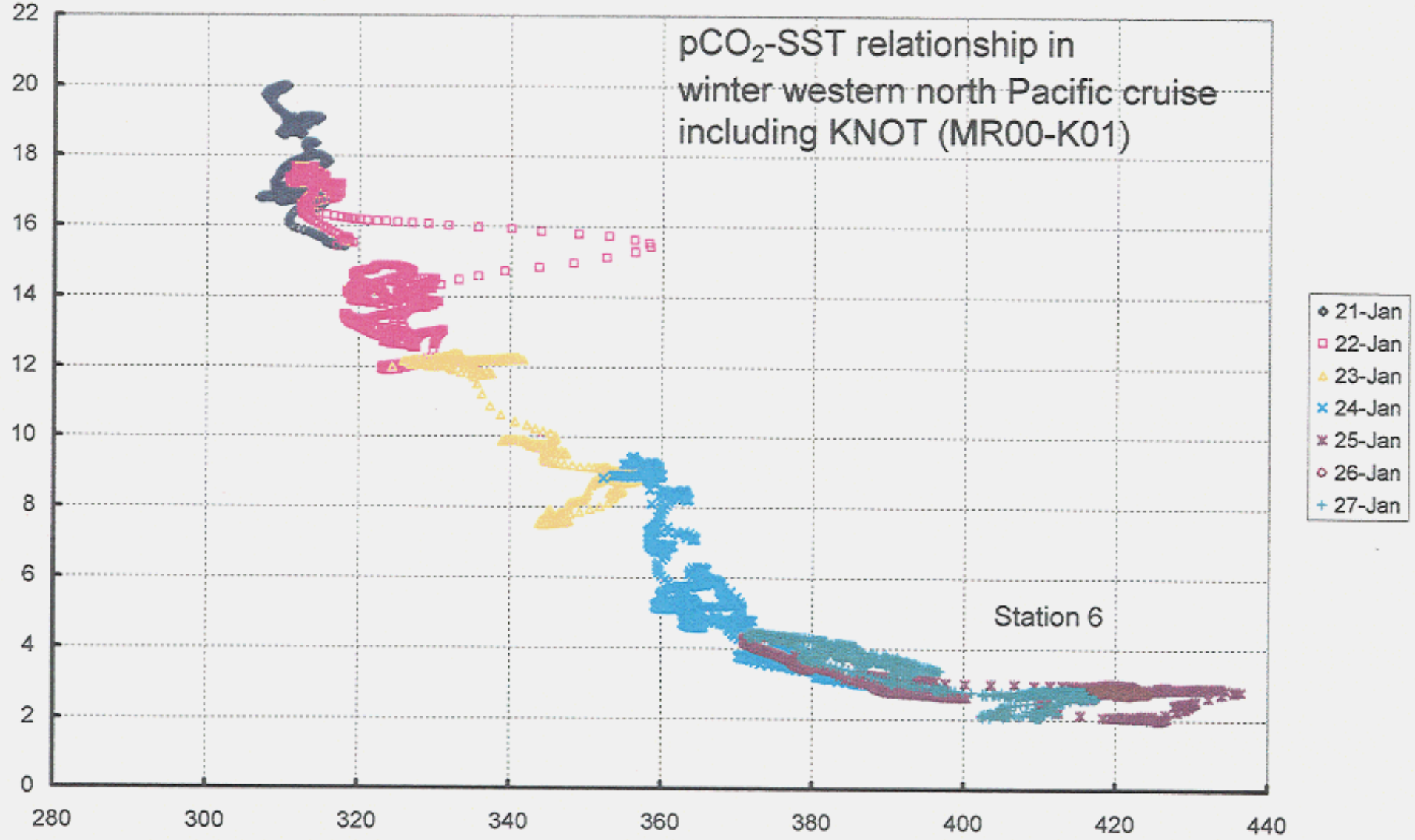


Fig. 2 (b) SST-pCO_2 relationship in MR00-K01 cruise: January 21 - 27

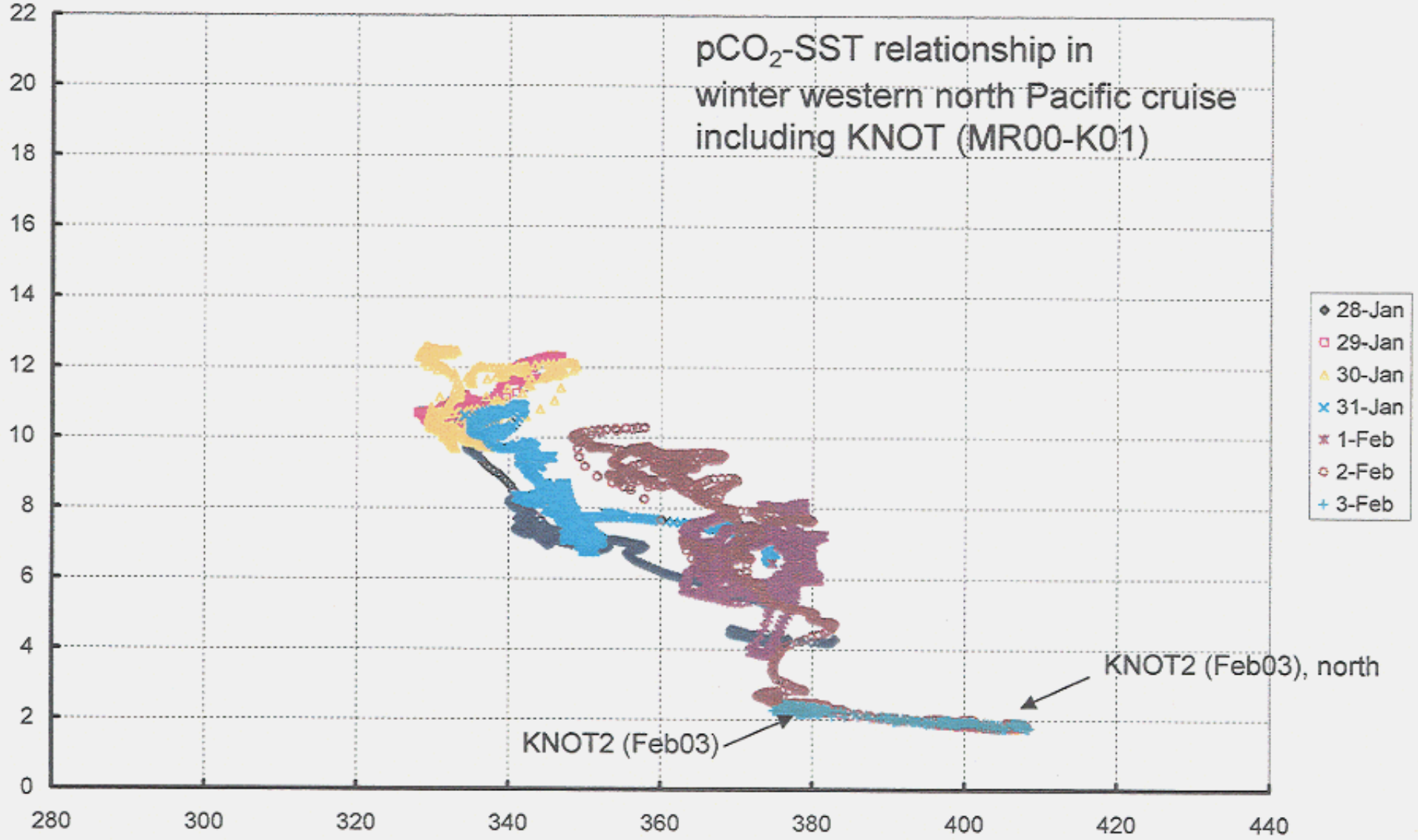


Fig. 2 (c) SST-pCO_2 relationship in MR00-K01 cruise: January 28 - February 3

3.17.3 Salinity, Temperature, D.O., and Fluorescence

Katsunori Sagishima (MWJ)

(1) Objectives

To monitor continuously the physical, chemical and biological characteristics of near-sea surface water.

(2) Parameters

Temperature, salinity, dissolved oxygen, fluorescence, particle size of plankton in the near-surface water.

(3) Methods

The *Continuous Sea Surface Water Monitoring System* (Nippon Kaiyo co., Ltd.) is located in the "*sea surface monitoring laboratory*" on R/V Mirai. It can automatically measure temperature, salinity, dissolved oxygen, fluorescence and particle size of plankton in the near-surface water every 1-minute. Measured data are saved every one-minute together with time and the position of ship, and displayed in the data management PC machine. This system is connected to shipboard LAN-system and provides the acquired data for p-CO_2 measurement system, etc.

The uncontaminated seawater intake is 4.5m below the sea surface. Near-surface water was continuously pumped up about 200L/min from the intake to the laboratory and then flowed into *the Continuous Sea Surface Water Monitoring System* and p-CO_2 measurement system etc. through a steel pipe. The flow rate of surface water for this system was 12L/min, which controlled by some valves and passed through some sensors except with fluorometer (about 0.3L/min) through vinyl-chloride pipes.

The Continuous Sea Surface Water Monitoring System has six kinds of sensors, which TSG comprises of two SBE sensor modules. Sea surface temperature is measured by a ship bottom oceanographic thermometer situated on the suction side of the uncontaminated seawater supply in the forward hold. Specification and calibration date of the each sensor in this system of listed below.

a-1) Temperature and salinity sensors

SEACAT THERMOSALINOGRAPH

Model: SBE-21, SEA-BIRD ELECTRONICS, INC.

Serial number: 2113117-2641

Measurement range: Temperature -5 to +35 deg-C, Salinity 0 to 6.5 S/m

Accuracy: Temperature 0.01 deg-C/6month, Salinity 0.001 S/m/month

Resolution: Temperature 0.001 deg-C, Salinity 0.0001 S/m

Calibration date: 08-Sep-99 (mounted on 15-Oct-99 in this system)

a-2) Ship bottom oceanographic thermometer (mounted at the back of the pump for surface water)

Model: SBE 3S, SEA-BIRD ELECTRONICS, INC.

Serial number: 032607

Measurement range: -5 to +35 deg-C

Initial Accuracy: 0.001 deg-C per year typical

Stability: 0.002 deg-C per year typical

Calibration date: 29-Apr-99 (mounted on 24-Aug-99 in this system)

b) Dissolved oxygen sensor

Model: 2127, Oubisufair Laboratories Japan INC.

Serial number: 31757

Measurement range: 0 to 14 ppm

Accuracy: ±1% at 5 deg-C of correction range

Stability: 1% per month

Calibration date: 15-Oct-99

c) Fluorometer

Model:	10-AU-005, TURNER DESIGNS
Serial number:	5562 FRXX
Detection limit:	5 ppt or less for chlorophyll a
Stability:	0.5% per month of full scale

d) Particle size sensor

Model:	P-05, Nippon Kaiyo LTD.
Serial number:	P5024
Accuracy:	±10% of range
Measurement range:	0.02681mm to 6.666mm
Reproducibility:	±5%
Stability:	5% per week

e) Flowmeter

Model:	EMARG2W, Aichi Watch Electronics LTD.
Serial number:	8672
Measurement range:	0 to 30 L/min
Accuracy:	±1%
Stability:	±1% per day

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

06-Jan.-‘00 03:08 to 06-Feb.-‘00 08:52 (UTC)

(4) Preliminary Result

4-1 Calibration

Temperature and salinity sense

We compared salinity values of the water samples and those from SBE21 sensor of the system (Fig 3.17.3-1).

Almost salinity values of the sensor were lower than those of water samples. This trend is as well as during the former cruise. We calculated the Root Mean Squares (R.M.S.) of differences of values was 0.0074 (one sigma).

Dissolved Oxygen (D.O.) sensor

To estimate of accuracy of the sensor, we collected the 11 samples from the course of the system and analyzed by Winkler method. The samples for the titration method were analyzed by Metrohm piston burette of 10ml with Pt Electrode using Whole bottle titration. The standardization and pure water blank determination have been performed before the sample titration. Concentration of D.O. was calculated by equation (8) of WHP Operations and Methods (Culberson, 1991). The amount of D.O. in the reagents was used the value (=0.0027 ml at 21 deg-C) measured at 1995 WOCE cruise.

The results were shown in table 3.17.3-1 and Figure 3.17.3-2. D.O. value of the sensor was always higher than the values analyzed by the Winkler method. The values of D.O. sensor were always higher than the values analyzed by the Winkler method. Calculated R.M.S was 0.284 ml/l (one sigma). These trend and value was similar to those at MR99-K02.

4-2 result

Preliminary data every 10 minutes from 06-Jan.-‘00 03:08 to 06-Feb.-‘00 08:52 (UTC), were shown in Figure 3.17.3-3, respectively on this cruise periods. They showed the respective trend of temperature, salinity, D.O. and fluorescence distributions.

(5) Other remarks

References:

Culberson, C. H. (1991) Dissolved Oxygen, in WHP Operations Methods, Woods Hole, pp.1-15.

Porra R. J., W. A. Thompson and P. E. Kriedemann (1989) Biochem. Biophys. Acta, 975, 384 – 394.

(6) Data archive

All the files of raw data, Microsoft excel files of raw data, excel files divided into each 10minutes data were stored on a magnetic optical disk. All the data will be submitted to the DMO at JAMSTEC.

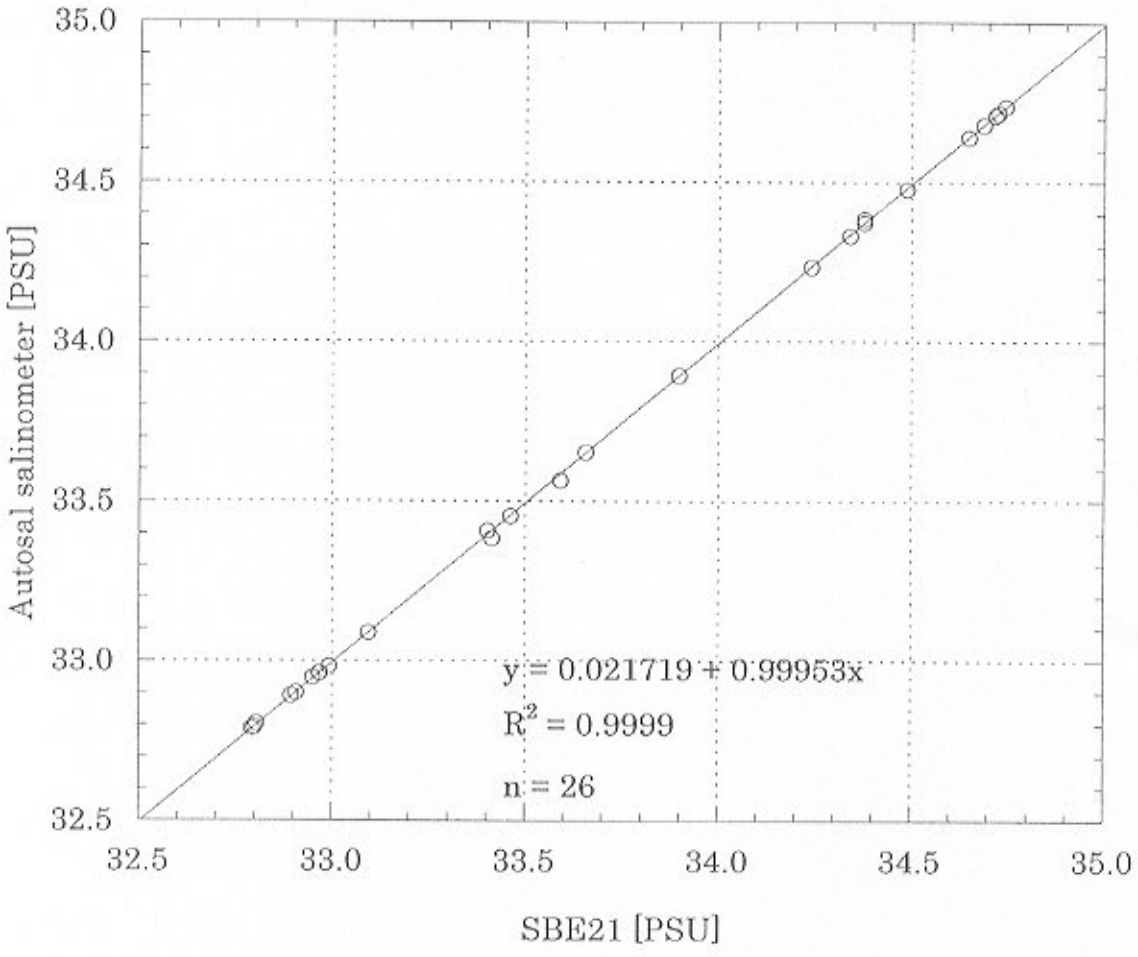


Fig. 3.17.3-1 Comparison between the salinity values measured by SBE21 of the Sea Surface Monitoring System and Autosal salinometer for 26 samples. Note: Salinity in this figure is not corrected.

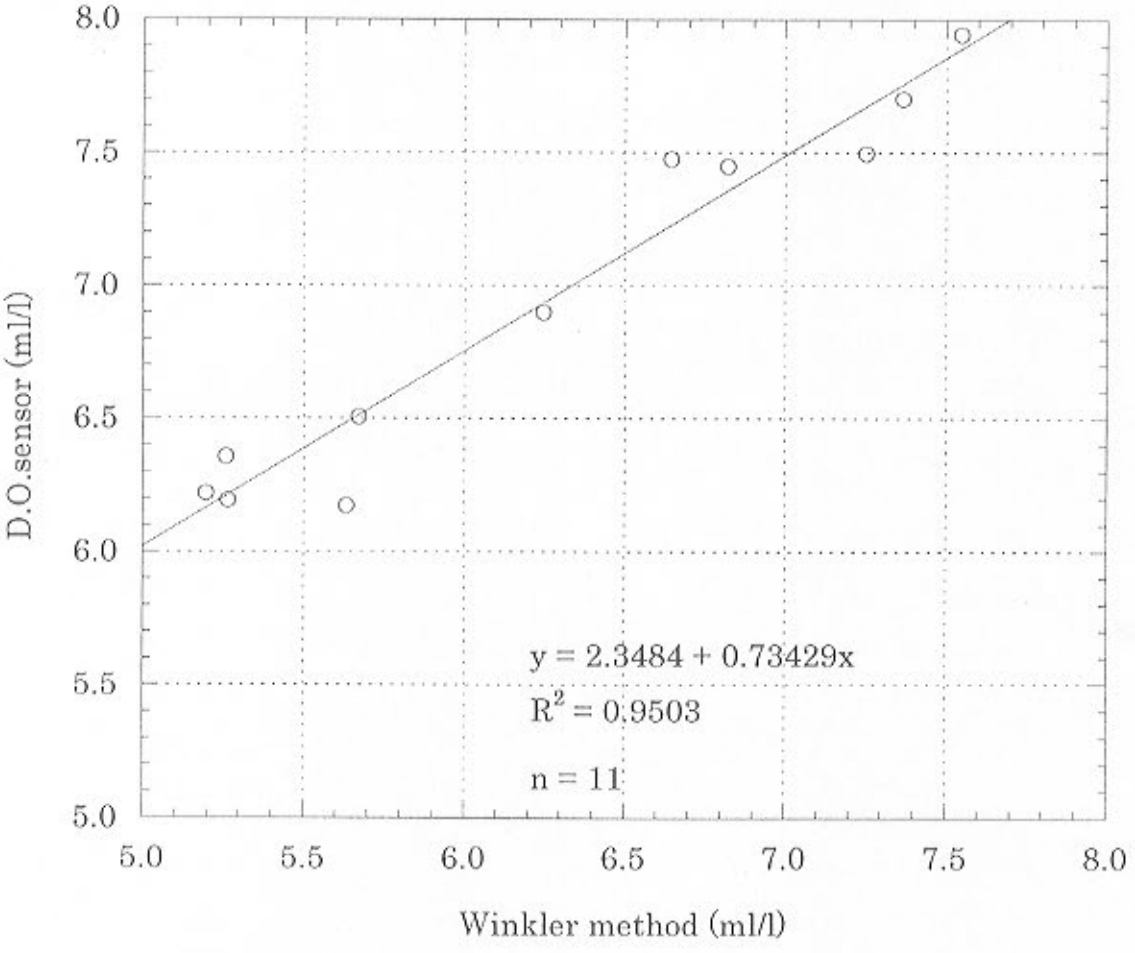


Fig.3.17.3-2 Comarison between the D.O. value measured by D.O. senser of the Sea Surface Monitoring System and by Winkler method for 11 samples obtained during MR00-K01 cruise.

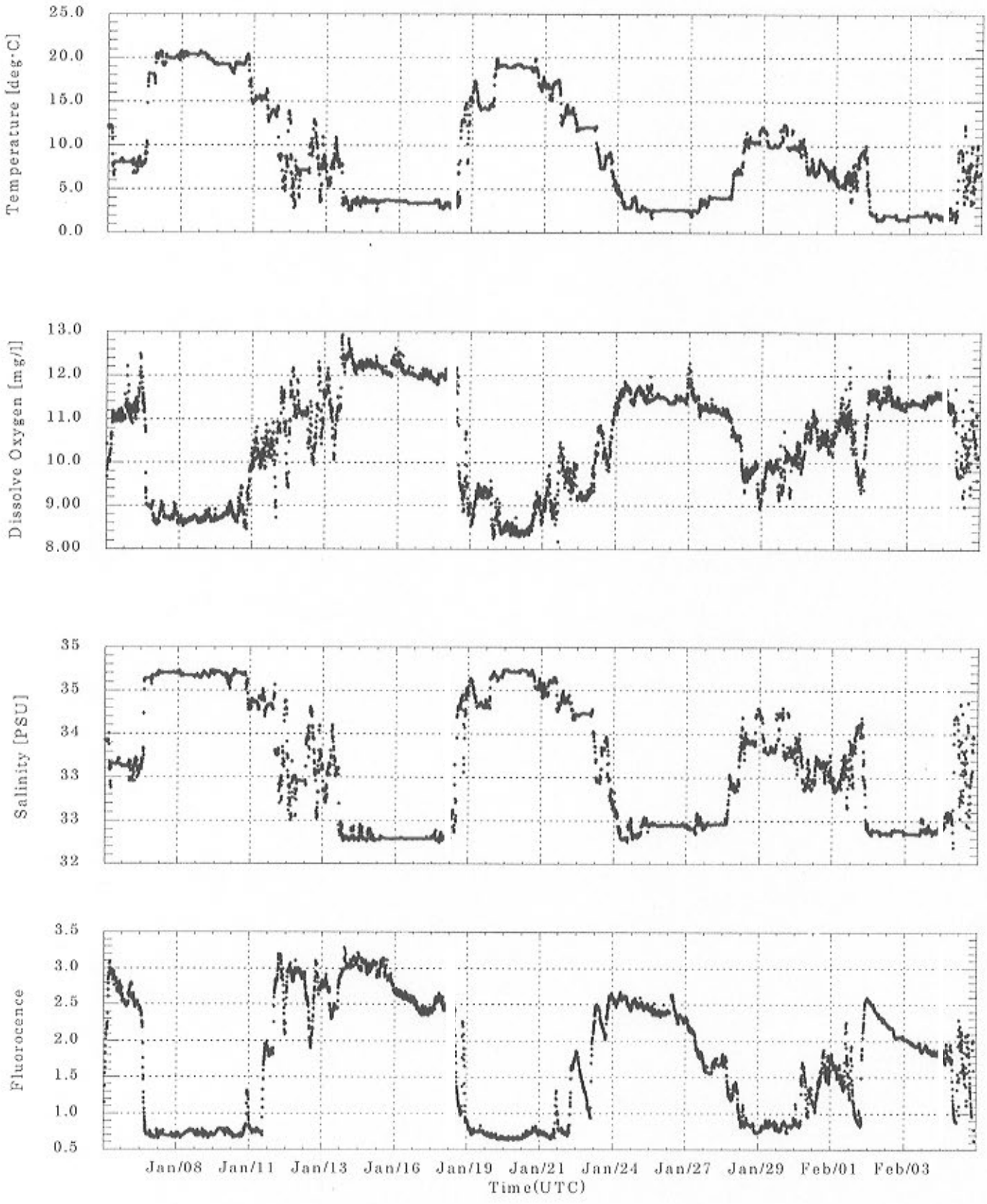


Fig. 3.17.3-3 Temperature, D.O., salinity and fluorescence of surface water from Jam.-06 to Feb.-06

3.17.4 Nutrients monitoring in sea water

Kenichiro SATO, Ichiro YAMAZAKI (MWJ)
Chizuru SAITO (JAMSTEC)

(1) Sea surface nutrients measurement

The distribution of nutrients of sea surface water is important to investigate the primary production. The nutrients were measured colorimetrically by BRAN + LUEBBE nutrients monitoring system. This system was located in the sea surface water monitoring laboratory on R/V Mirai. Sea surface water pumped up to laboratory and drawn into this monitoring system continuously.

(2) Preliminary results

Sea surface nutrient concentrations dramatically increased from coastal to northern open sea. In this cruise, base line for silicate measurement became unstable, because it might be a contamination of silicate line or so, but other 3 elements (nitrate + nitrite, nitrite and phosphate) were almost coinsident with rutinaly surface nutrient concetrations. We are going to clean this system for the coming cruise.

These data are stored in MO disk in Ocean Research Department in JAMSTEC.

3.18 Sea floor sediment sampling and study on geochemical cycle on sea floor

Koh Harada (National Institute for Resources and Environment)
Yoko Shibamoto (National Institute for Resources and Environment)
Hiroaki Muraki (Marine Works Japan Ltd.)
Kazuhiro Hayashi (Marine Works Japan Ltd.)

Introduction

Water-sediment boundary is a place where biogeochemical processes actively occur. To clarify regeneration process of nutrients, balances of the nutrients at the boundary are investigated by measuring the nutrient concentration in pore water.
Sediment particles near the boundary are well mixed by organisms at sea floor. To clarify the space and seasonal variation of the bioturbation,
shot lived radio-nuclides are also investigated.

Methods and preliminary result

Sediment core sampling were conducted at Stn. KNOT-1 using with a Multiple Corer. The coring logs are shown in Table 1 and 2. Eight non-disturbed cores of which length was about 30 cm were successively collected. Immediately after recovering the corer on the deck, three of the eight cores were sliced in about 3.5 mm thick each for topmost ten sub-samples, about 7 mm thick each for the next ten sub-samples and about 14 mm thick each for other sub-samples down to the bottom. Pore water samples were squeezed by centrifugation at 2^{o}C from sub-samples of the two cores. Concentrations of silicate, phosphate, nitrate and nitrite were determined by an Auto Analyzer. Ratios of alpha and beta activity in the sub-samples after pore water
squeezing were determined on board of the ship. Sub-samples from another core were kept in a freezer and brought to the land laboratory in NIRE. Concentrations of ^{230}Th, ^{210}Pb and ^{210}Po will be determined. For general information of the geochemical properties such as water content, concentration of $CaCO_3$, biogenic silica and sedimentation rate will be also investigated. A X-ray photograph was also taken from one core. Other cores were distributed as follows:

Test of alkalinity determination in pore water: JAMSTEC
Determination of metals by ICP-MS: Hokkaido University

Table.1:MR00-K01 Multiple Core Site Table

Site	Type	Date	Start		Hit the bottom				Leave the bottom	Recovery		Number of sections	Major Lithology
			Time	Depth(m)	Time	Point	Depth(m)	Wire Length(m)		Time	Depth(m)		
St.1	MC-1	1.12.00	18:12	1549	18:53	40-30.0952N 143-00.0428E	1548	1546	18:54	19:35	1548		
St.KNOT	MC-2	1.17.00	11:05	5334	12:54	44-00.5900N 154-57.0900E	5333	5351	12:58	14:30	5333		

Table.2:MR00-K01 Multiple Core Operation Log

CRUISE & LEG NO.		STATION NO.		DAY	MONTH	YEAR	NO.
MR00-K01		St.1(MC-1)		12	1	00	
Hit botom	40-30.0952N	143-00.0428E	Depth(m)	1548			

TIME	TENSION(ton)	WIRE OUT(m)		COMMENTS
18:12	-	0		surface
18:13	0.4	0		wire out speed 0.8m/sec
18:29	0.9	500		wire out speed 1.0m/sec
18:37	1.2	1000		wire out speed 1.0m/sec
18:47	1.7	1500		wire out stop , 3 min wait
18:50	1.8	1500		wire out start again at 0.3m/sec
18:53	1.2	1546		hit bottom , 1 min wait
18:57	1.8	1544		leave bottom
19:53	-	0		surface

Table.2:MR00-K01 Multiple Core Operation Log

CRUISE & LEG NO.	STATION NO.	DAY	MONTH	YEAR	NO.
MR00-K01	St.KNOT(MC-2)	17	1	00	

Hit botom	44-00.5900N	154-57.0900E	Depth(m)	5333	

TIME	TENSION(ton)	WIRE OUT(m)		COMMENTS
11:05	-	0		surface
11:08	0.4	0		wire out speed 1.0m/sec
11:33	1.2	1000		wire out speed 1.0m/sec
11:50	2.1	2000		wire out speed 1.0m/sec
12:07	2.9	3000		wire out speed 1.0m/sec
12:22	3.8	4000		wire out speed 1.0m/sec
12:38	4.6	5000		wire out speed 1.0m/sec
12:45	5.0	5250		wire out stop , 3 min wait
12:48	5	5250		wire out start again at 0.3m/sec
12:54	4.8	5351		hit bottom , 1 min wait
12:58	5.2	5350		leave bottom
14:30	-	0		surface

3.19 XBT and XCTD Observations

NAKANO Toshiya (JMA), FURUTA Toshio (GODI) and OKUMURA Satoshi (GODI)

1. Introduction

We carried out XBT and XCTD observations, to research the structure and variation of sub-surface temperature and current in the subarctic circulation area, and to research the formation, advection and diffusion process of the North Pacific Intermediate Water (NPIW).

2. Equipment and correction

2-1 XBT observation

T.S.K (Tsurumi Seiki) MK-30N converter.

T.S.K (Tsurumi Seiki) T-7 type probe.

Depth calculation formula was as follows ;

Formula : Z=A*T+B*T^2

Where Z (meters) : depth

T (seconds) : elapsed time

A : 6.691

B : -0.00225

2-2 XCTD observation

T.S.K (Tsurumi Seiki) MK-100 converter.

T.S.K (Tsurumi Seiki) XCTD probe.

The coefficients of depth, temperature and conductivity calculation are installed in the probe.

3. Summary

The lists of XBT and XCTD observation stations are shown in Table 1 and Table 2, respectively. Station location chart, vertical profiles for XBT and XCTD at all stations and distributions of temperature and salinity follows. XCTD-33 (46-00N,165-00E) show doubtful salinity values in deep layers.

XBT and XCTD data will be submitted to the DMO (Data Management Office), JAMSTEC.

4. Acknowledgement

We thank Chief operator NAKABAYASHI and Mr. SHISHIDO (GODI) for their cooperation on these observations.

Table 1 XBT observation stations

No.	Date	Time(UTC)	Latitude(N)	Longitude(E)
1	2000/01/07	05:23	39-29.91	142-28.10
2	2000/01/07	07:19	38-59.93	142-28.89
3	2000/01/07	11:16	37-59.94	142-29.87
4	2000/01/07	20:01	36-59.96	142-29.98
5	2000/01/07	22:30	36-29.96	142-30.14
6	2000/01/08	02:53	35-29.89	142-29.97
7	2000/01/08	14:51	34-29.94	142-30.02
8	2000/01/08	16:51	34-00.60	142-30.02
9	2000/01/08	20:50	32-59.94	142-30.00
10	2000/01/09	12:00	32-30.08	143-30.07
11	2000/01/09	15:10	32-29.79	144-30.06
12	2000/01/09	18:29	32-29.79	145-30.10
13	2000/01/09	21:50	32-30.03	146-30.27
14	2000/01/10	12:08	33-00.09	147-29.80
15	2000/01/10	16:22	34-00.04	147-30.10
16	2000/01/10	18:27	34-30.01	147-29.59
17	2000/01/11	00:13	35-30.02	147-30.09
18	2000/01/11	05:04	36-30.56	147-30.66
19	2000/01/11	07:46	37-00.01	147-30.04
20	2000/01/11	11:10	37-29.96	147-10.79
21	2000/01/11	15:22	38-00.00	146-28.93
22	2000/01/11	23:06	39-00.01	145-05.73
23	2000/01/12	06:12	40-00.02	143-41.80
24	2000/01/12	09:12	40-29.94	142-59.94
25	2000/01/12	13:52	40-23.63	144-00.12
26	2000/01/12	16:55	40-16.71	145-00.10
27	2000/01/12	20:00	40-09.90	146-00.10
28	2000/01/12	23:05	40-03.42	147-00.12
29	2000/01/13	11:10	40-28.69	148-30.07
30	2000/01/13	14:53	40-55.76	149-30.09
31	2000/01/13	18:32	41-24.30	150-30.08
32	2000/01/13	22:11	41-52.27	151-30.04
33	2000/01/14	02:12	42-20.20	152-30.08

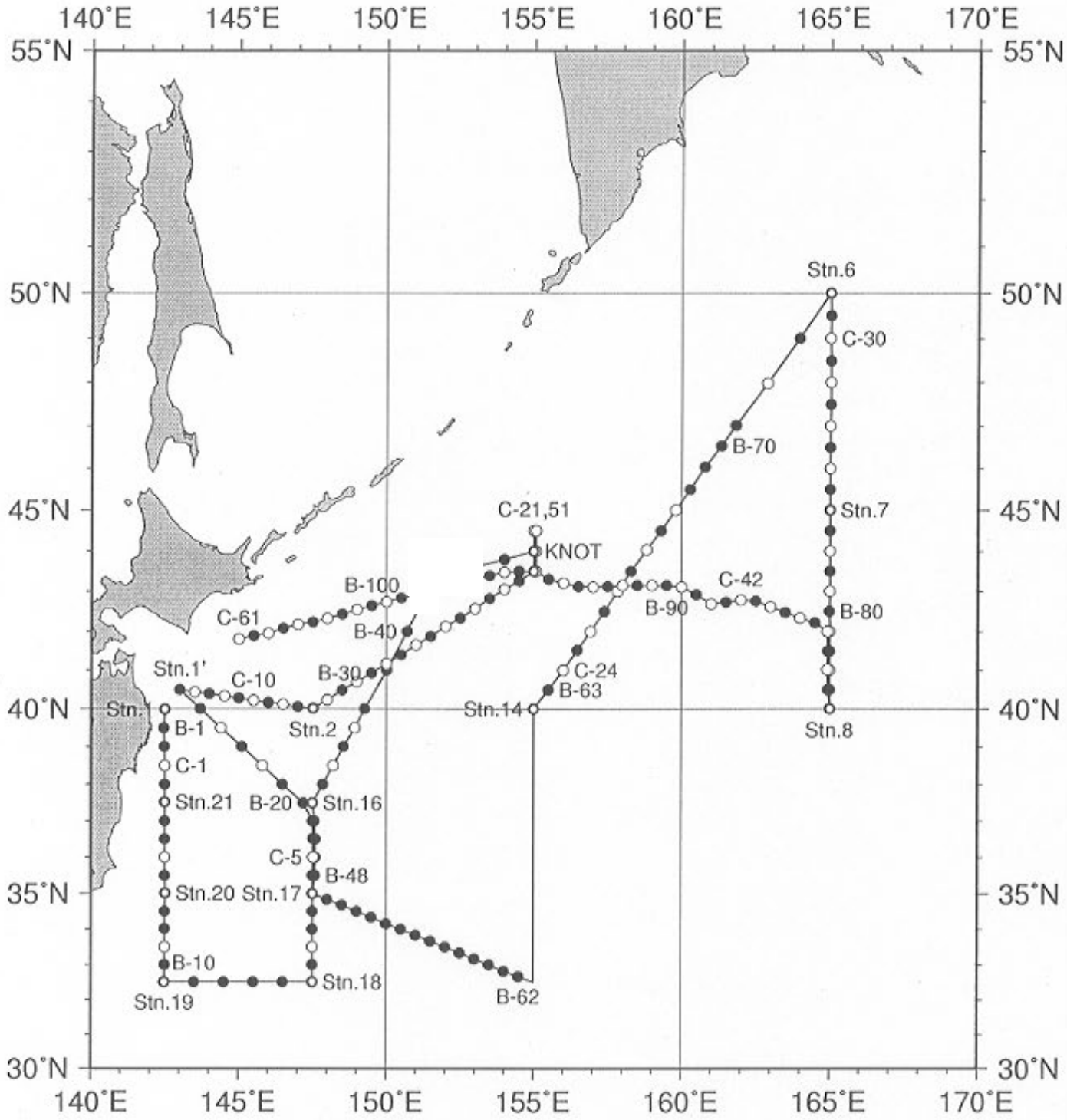
34	2000/01/14	06:26	42-48.86	153-30.04
35	2000/01/14	11:06	43-16.42	154-30.07
36	2000/01/18	02:07	43-48.34	153-59.89
40	2000/01/18	14:38	41-59.80	150-41.61
41	2000/01/18	19:03	41-00.01	150-00.91
42	2000/01/18	23:55	40-00.01	149-16.34
43	2000/01/19	04:45	38-59.99	148-33.28
44	2000/01/19	09:15	37-59.97	147-51.38
45	2000/01/19	20:58	36-59.97	147-29.45
46	2000/01/19	23:07	36-30.08	147-31.14
47	2000/01/20	01:35	36-00.05	147-30.62
48	2000/01/20	04:02	35-30.00	147-29.90
49	2000/01/20	10:25	34-50.52	148-00.05
50	2000/01/20	12:11	34-40.75	148-30.04
51	2000/01/20	14:01	34-29.79	149-00.02
52	2000/01/20	15:46	34-19.63	149-30.02
53	2000/01/20	17:27	34-09.46	150-00.02
54	2000/01/20	19:02	33-59.62	150-30.02
55	2000/01/20	20:31	33-50.29	150-59.99
56	2000/01/20	22:00	33-40.31	151-30.00
57	2000/01/20	23:36	33-29.85	152-00.01
58	2000/01/21	01:14	33-20.03	152-30.06
59	2000/01/21	02:54	33-10.05	152-59.97
60	2000/01/21	04:44	32-59.68	153-30.01
61	2000/01/21	06:37	32-49.19	154-00.02
62	2000/01/21	08:30	32-40.25	154-30.03
63	2000/01/23	15:48	40-30.01	155-30.22
64	2000/01/23	20:44	41-31.16	156-28.43
65	2000/01/24	01:25	42-30.03	157-22.98
66	2000/01/24	06:22	43-30.05	158-17.30
67	2000/01/24	11:23	44-30.23	159-17.82
68	2000/01/24	16:09	45-30.24	160-16.62
69	2000/01/24	18:47	46-01.76	160-47.04

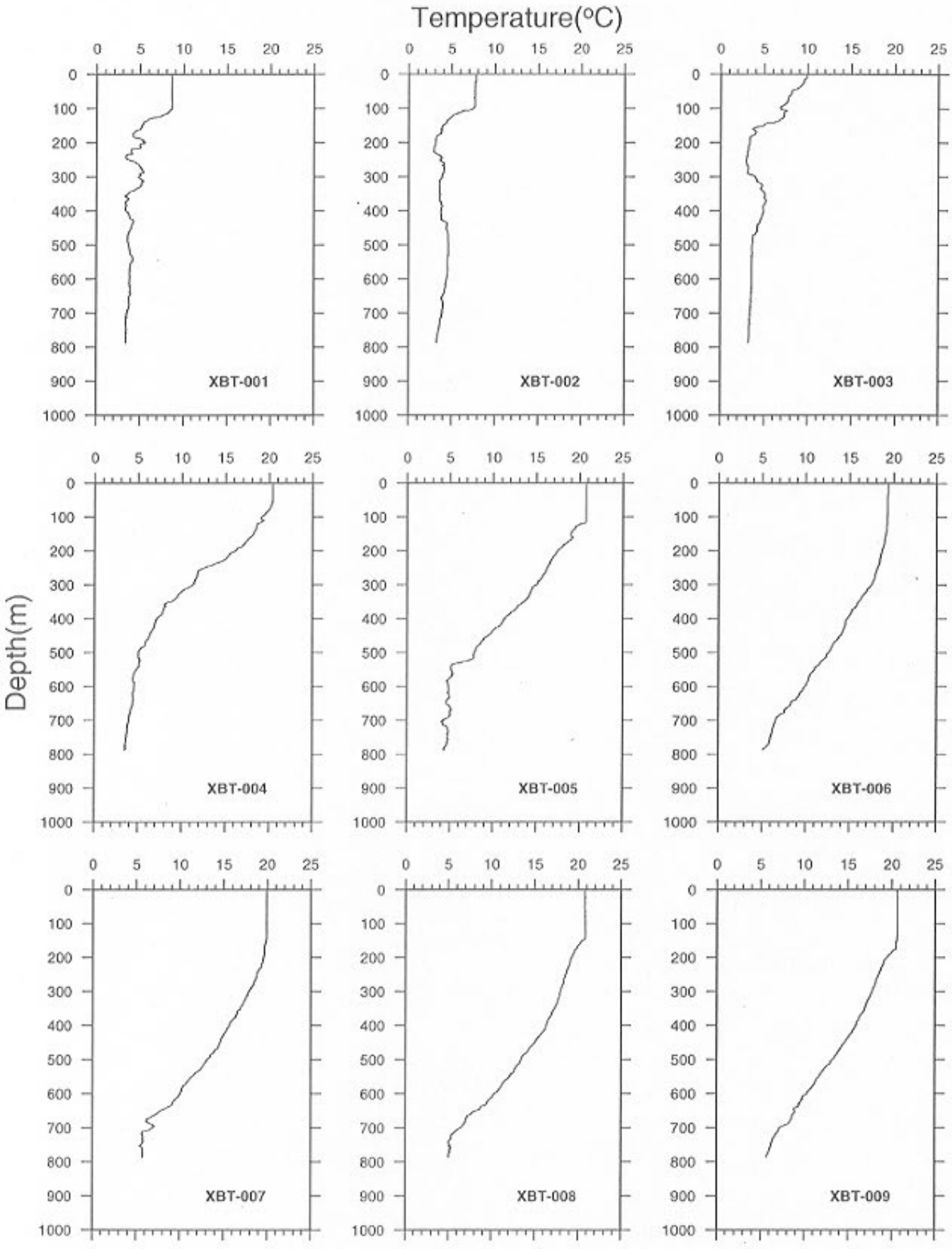
70	2000/01/24	21:21	46-31.82	161-19.63
71	2000/01/24	23:47	47-00.54	161-48.90
72	2000/01/25	11:02	49-00.19	163-58.22
73	2000/01/27	00:39	49-29.97	165-00.60
74	2000/01/27	04:50	48-30.00	165-00.85
75	2000/01/27	09:14	47-29.98	165-00.11
76	2000/01/27	13:42	46-29.98	165-00.35
77	2000/01/27	17:54	45-29.97	165-00.30
78	2000/01/28	11:27	44-29.94	165-00.15
79	2000/01/28	15:17	43-29.98	164-59.94
80	2000/01/28	19:07	42-29.99	164-59.46
81	2000/01/28	22:50	41-30.00	165-00.05
82	2000/01/28	02:46	40-29.98	165-00.07
83	2000/01/31	00:00	40-30.04	164-56.26
84	2000/01/31	03:59	41-30.08	164-55.55
85	2000/01/31	08:51	42-13.34	164-29.93
86	2000/01/31	13:54	42-28.79	163-29.98
87	2000/01/31	19:15	42-45.75	162-30.03
88	2000/02/01	01:02	42-43.59	161-29.99
89	2000/02/01	07:04	42-54.72	160-30.03
90	2000/02/01	12:55	43-08.67	159-29.94
91	2000/02/01	17:39	43-08.94	158-30.03
92	2000/02/01	22:39	43-08.13	157-30.04
93	2000/02/02	03:29	43-08.17	156-30.02
94	2000/02/02	08:48	43-19.04	155-30.02
95	2000/02/04	14:21	43-30.06	154-30.03
96	2000/02/04	17:27	43-23.62	153-30.04
99	2000/02/05	02:56	42-50.06	150-29.93
100	2000/02/05	06:03	42-38.20	149-30.01
101	2000/02/05	09:16	42-25.79	148-29.91
102	2000/02/05	12:26	42-13.89	147-29.74
103	2000/02/05	15:28	42-03.75	146-29.85
104	2000/02/05	18:29	41-53.14	145-29.92

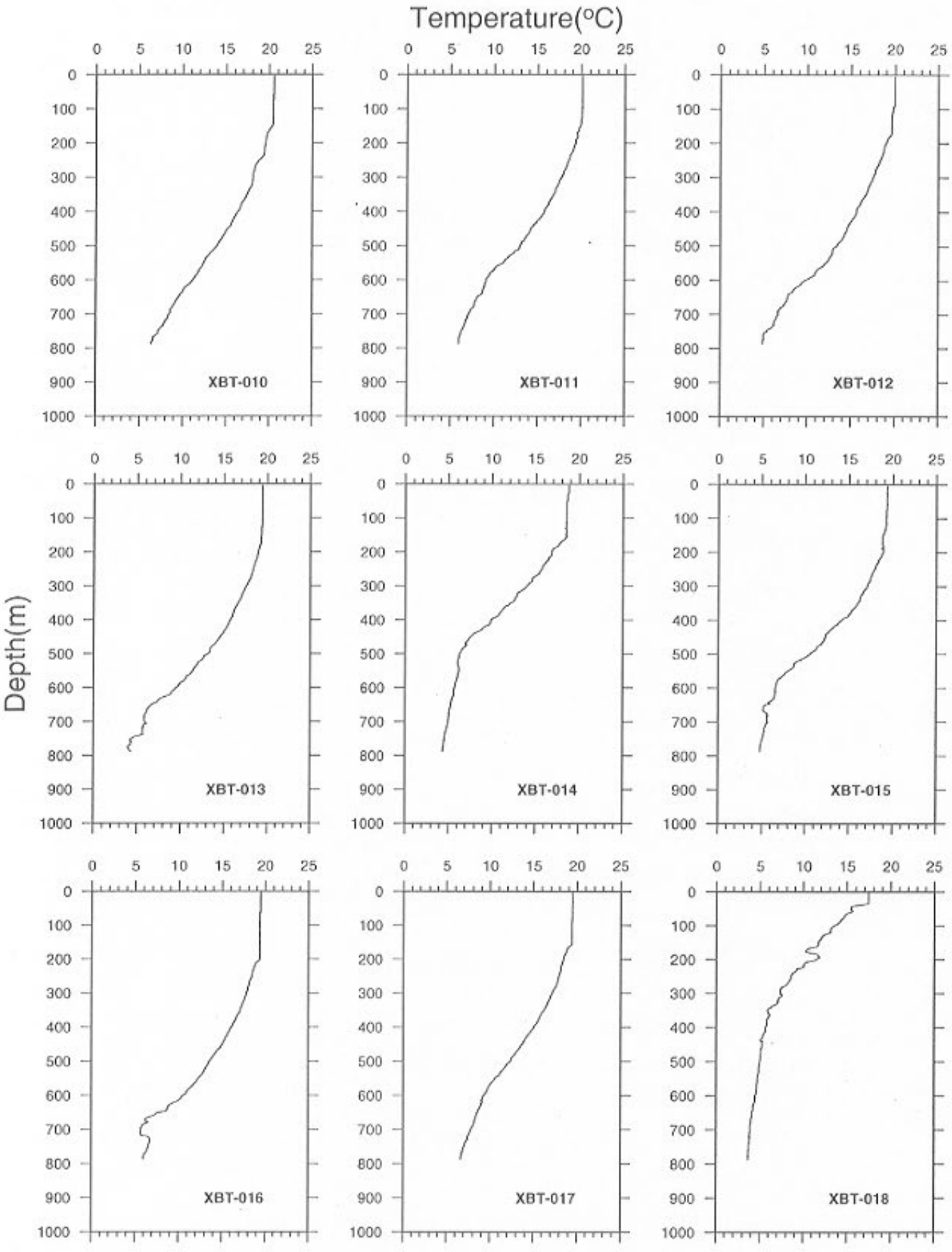
Table 2 XCTD observation stations

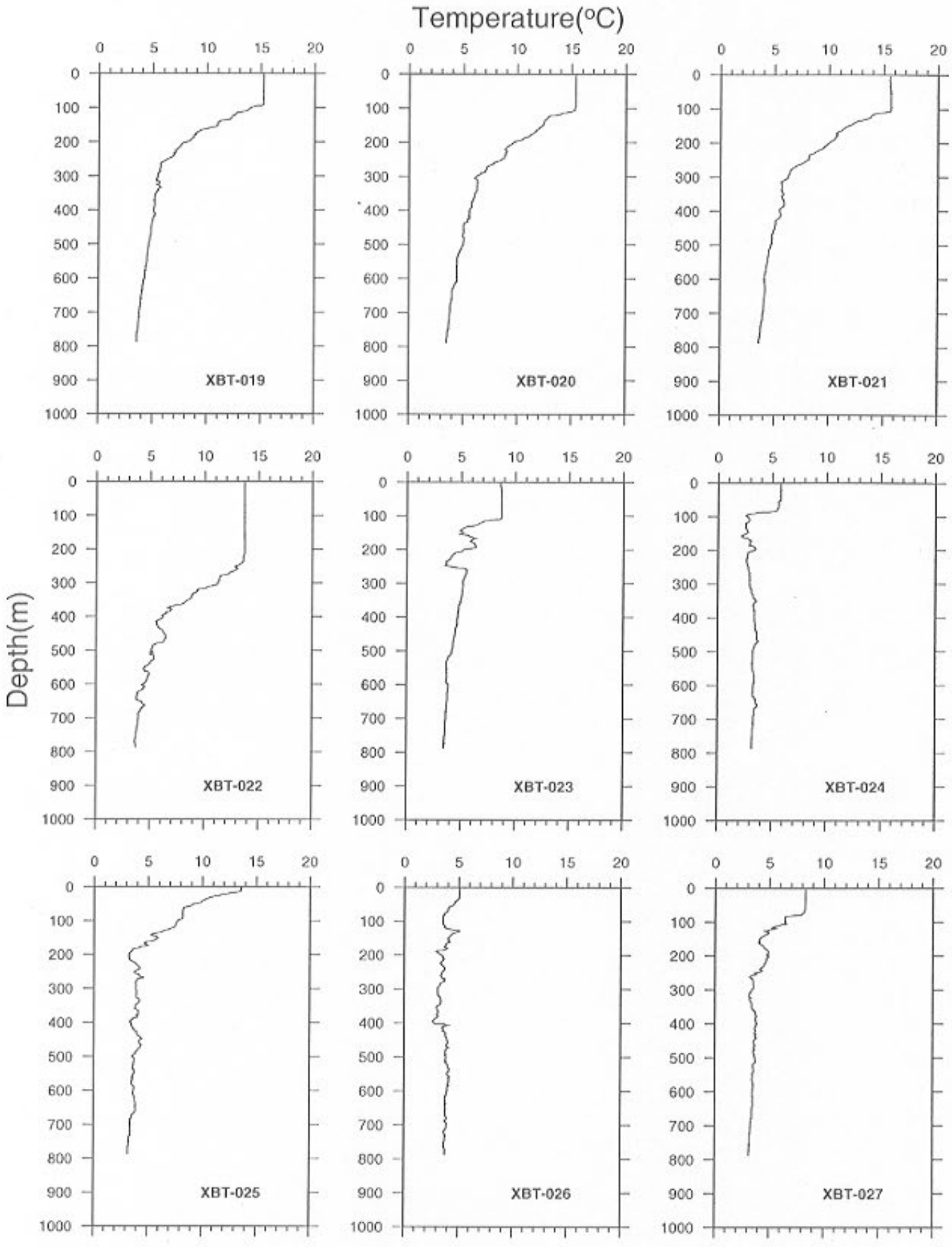
No.	Date	Time(UTC)	Latitude(N)	Longitude(E)
1	2000/01/07	09:21	38-29.88	142-30.05
2	2000/01/08	00:44	36-00.12	142-29.96
3	2000/01/08	18:53	33-29.99	142-29.49
4	2000/01/10	14:13	33-29.97	147-29.71
5	2000/01/11	02:41	36-00.40	147-30.69
6	2000/01/11	19:17	38-29.94	145-47.72
7	2000/01/12	02:44	39-30.21	144-23.81
8	2000/01/12	12:22	40-26.45	143-31.07
9	2000/01/12	15:25	40-19.90	144-30.50
10	2000/01/12	18:28	40-13.11	145-30.21
11	2000/01/12	21:32	40-06.68	146-30.00
12	2000/01/13	09:15	40-14.49	147-59.90
13	2000/01/13	13:02	40-41.81	149-00.16
14	2000/01/13	16:42	41-09.98	150-00.07
15	2000/01/13	20:20	41-38.64	151-00.01
16	2000/01/14	00:09	42-06.70	152-00.15
17	2000/01/14	04:16	42-34.11	152-59.55
18	2000/01/14	08:38	43-02.63	154-00.00
19	2000/01/14	13:21	43-29.73	154-59.84
20	2000/01/14	15:59	43-59.99	155-00.81
21	2000/01/14	18:35	44-30.03	155-00.55
22	2000/01/19	02:22	39-29.64	148-55.94
23	2000/01/19	07:03	38-29.81	148-11.88
24	2000/01/23	18:16	41-00.13	155-59.85
25	2000/01/23	22:58	41-59.84	156-54.87
26	2000/01/24	03:52	42-59.67	157-50.09
27	2000/01/24	09:03	44-01.66	158-48.89
28	2000/01/24	13:47	45-00.47	159-48.32
29	2000/01/25	05:15	47-59.36	162-53.48
30	2000/01/27	02:38	48-59.99	165-00.02
31	2000/01/27	07:00	48-00.00	165-00.71
32	2000/01/27	11:27	47-00.34	165-00.10
33	2000/01/27	15:50	46-00.03	165-00.07

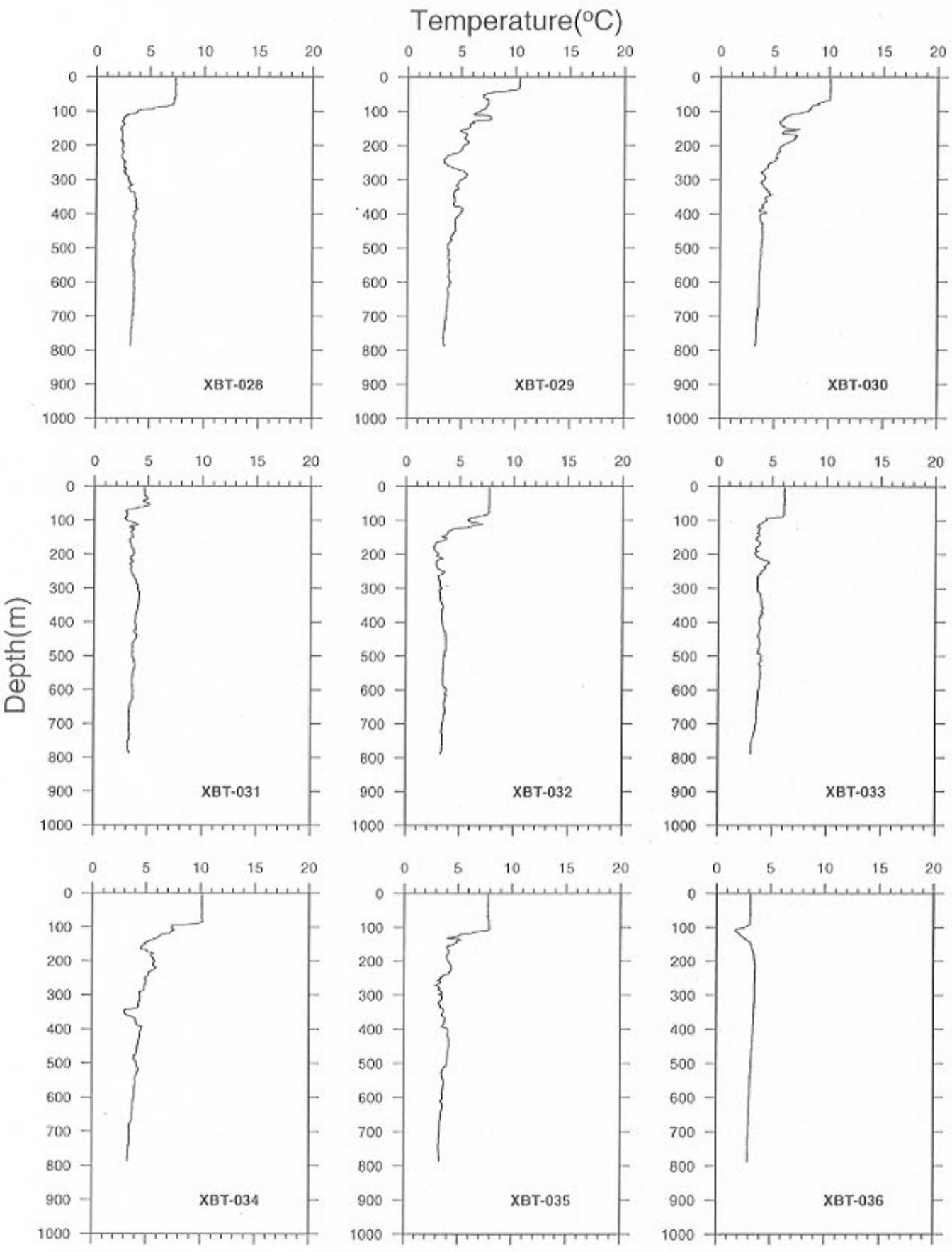
34	2000/01/28	13:22	44-00.02	165-00.18
35	2000/01/28	17:12	43-00.02	165-00.27
36	2000/01/28	20:58	42-00.02	165-00.05
37	2000/01/29	00:43	40-59.97	164-59.96
38	2000/01/31	02:01	41-01.28	164-55.35
39	2000/01/31	06:06	41-59.99	164-54.95
40	2000/01/31	11:16	42-20.19	164-00.02
41	2000/01/31	16:29	42-37.44	163-00.02
42	2000/01/31	22:14	42-46.63	162-00.00
43	2000/02/01	03:34	42-41.33	161-00.00
44	2000/02/01	10:30	43-07.49	160-00.02
45	2000/02/01	15:14	43-08.69	159-00.05
46	2000/02/01	20:03	43-08.78	158-00.04
47	2000/02/02	01:07	43-07.30	156-59.97
48	2000/02/02	06:01	43-13.26	156-00.01
49	2000/02/02	12:11	43-29.96	155-00.28
50	2000/02/02	16:06	43-59.95	154-59.75
51	2000/02/02	20:13	44-29.99	155-00.00
52	2000/02/04	15:54	43-29.91	154-00.03
56	2000/02/05	04:27	42-44.38	150-00.04
57	2000/02/05	07:39	42-31.83	149-00.03
58	2000/02/05	10:49	42-19.25	148-00.01
59	2000/02/05	13:56	42-09.91	146-59.98
60	2000/02/05	16:59	41-57.48	145-59.88
61	2000/02/05	19:56	41-47.58	144-59.99

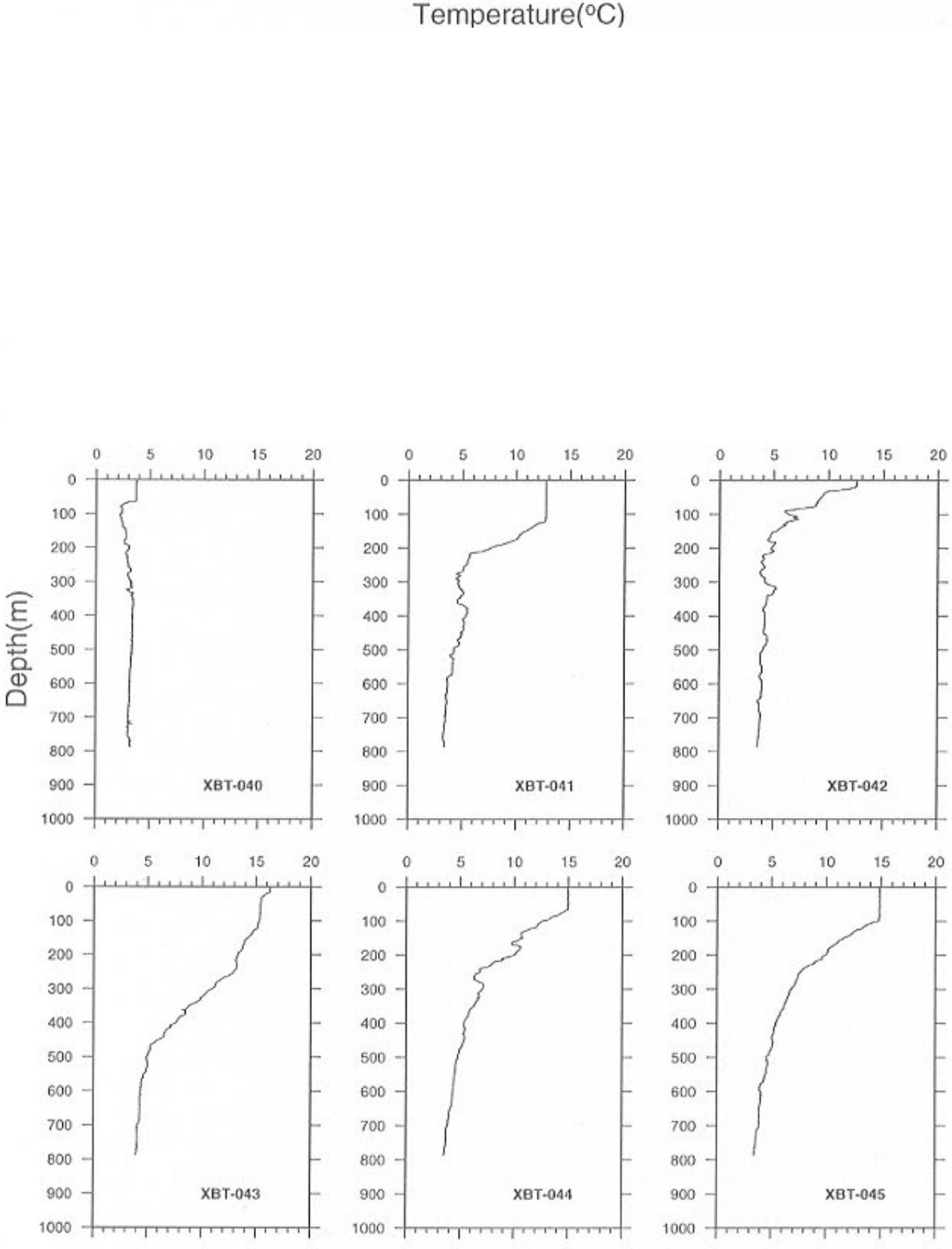

140°E
145°E
150°E
155°E
160°E
165°E
170°E
55°N
50°N
45°N
40°N
35°N
30°N
Stn.6
C-30
B-70
Stn.7
C-21,51
KNOT
B-100
C-61
B-40
C-42
B-90
B-80
Stn.1'
C-10
B-30
C-24
B-63
Stn.1
B-1
Stn.2
Stn.14
Stn.8
C-1
Stn.21
B-20
Stn.16
C-5
B-48
Stn.20
Stn.17
B-10
Stn.18
Stn.19
B-62

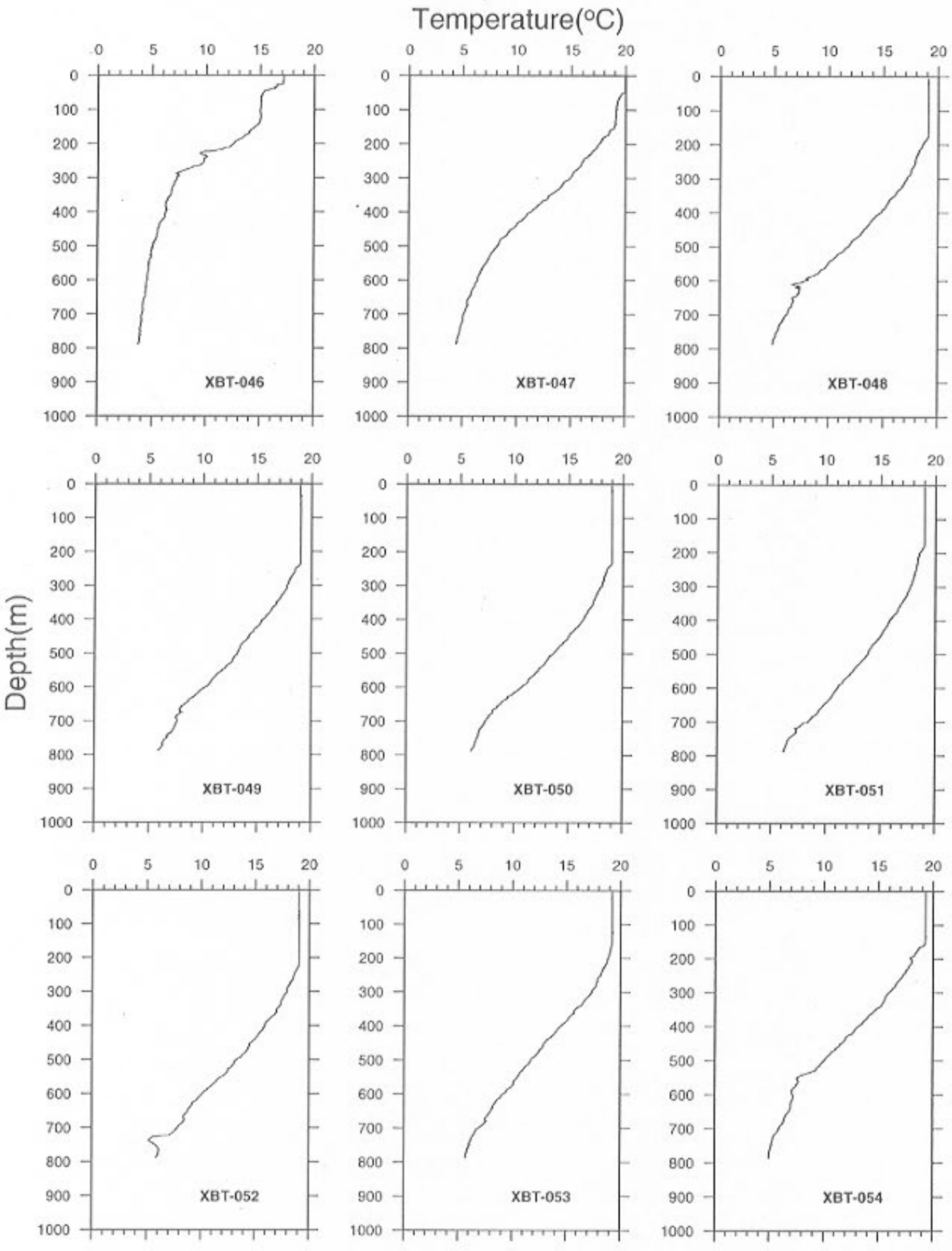

Temperature(°C)
Depth(m)
0 5 10 15 20 25
0 100 200 300 400 500 600 700 800 900 1000
XBT-001
XBT-002
XBT-003
XBT-004
XBT-005
XBT-006
XBT-007
XBT-008
XBT-009

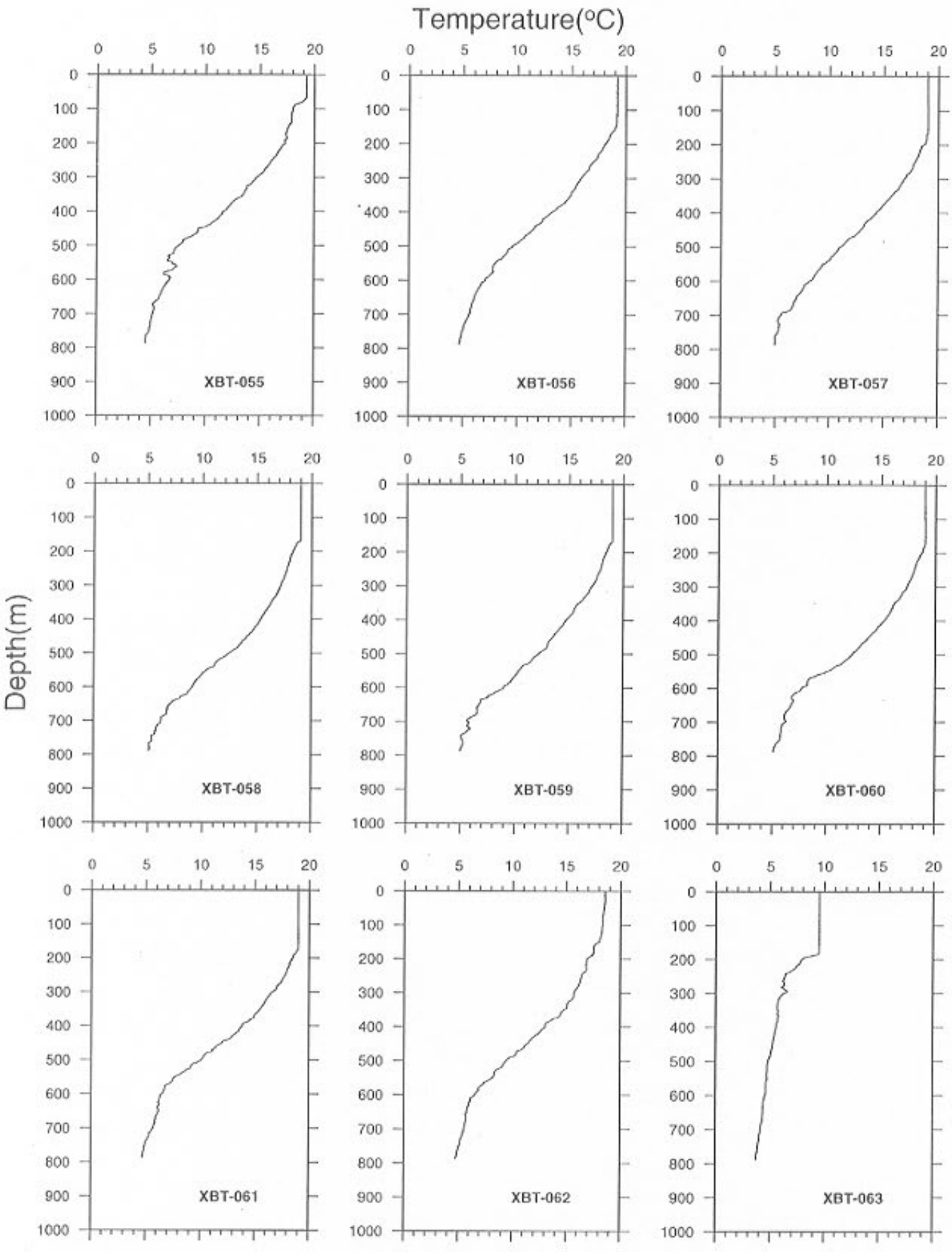

Temperature(°C)
Depth(m)
0 5 10 15 20 25
0 100 200 300 400 500 600 700 800 900 1000
XBT-010
XBT-011
XBT-012
XBT-013
XBT-014
XBT-015
XBT-016
XBT-017
XBT-018

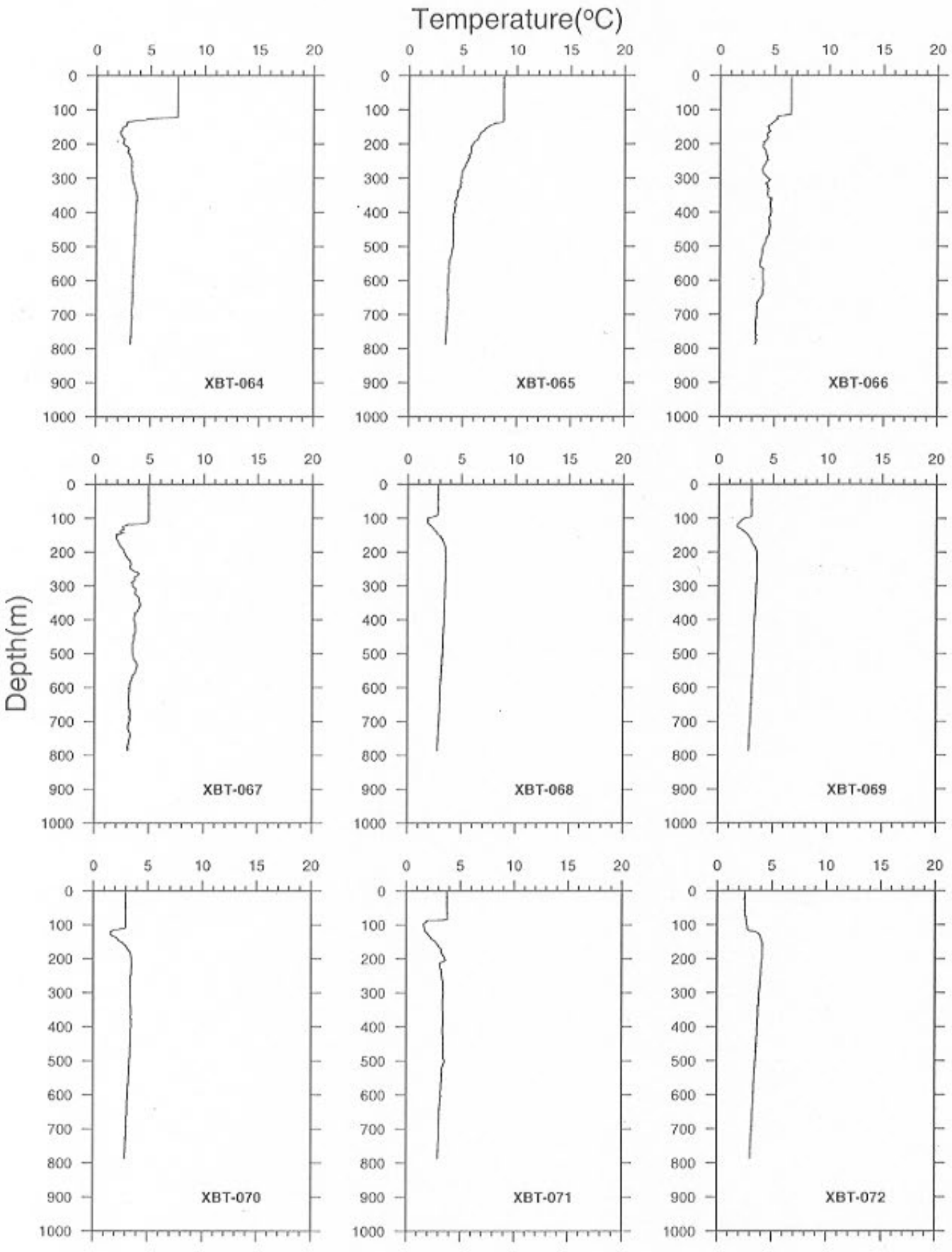

Temperature(°C)
Depth(m)
0 5 10 15 20
0 100 200 300 400 500 600 700 800 900 1000
XBT-019
XBT-020
XBT-021
XBT-022
XBT-023
XBT-024
XBT-025
XBT-026
XBT-027

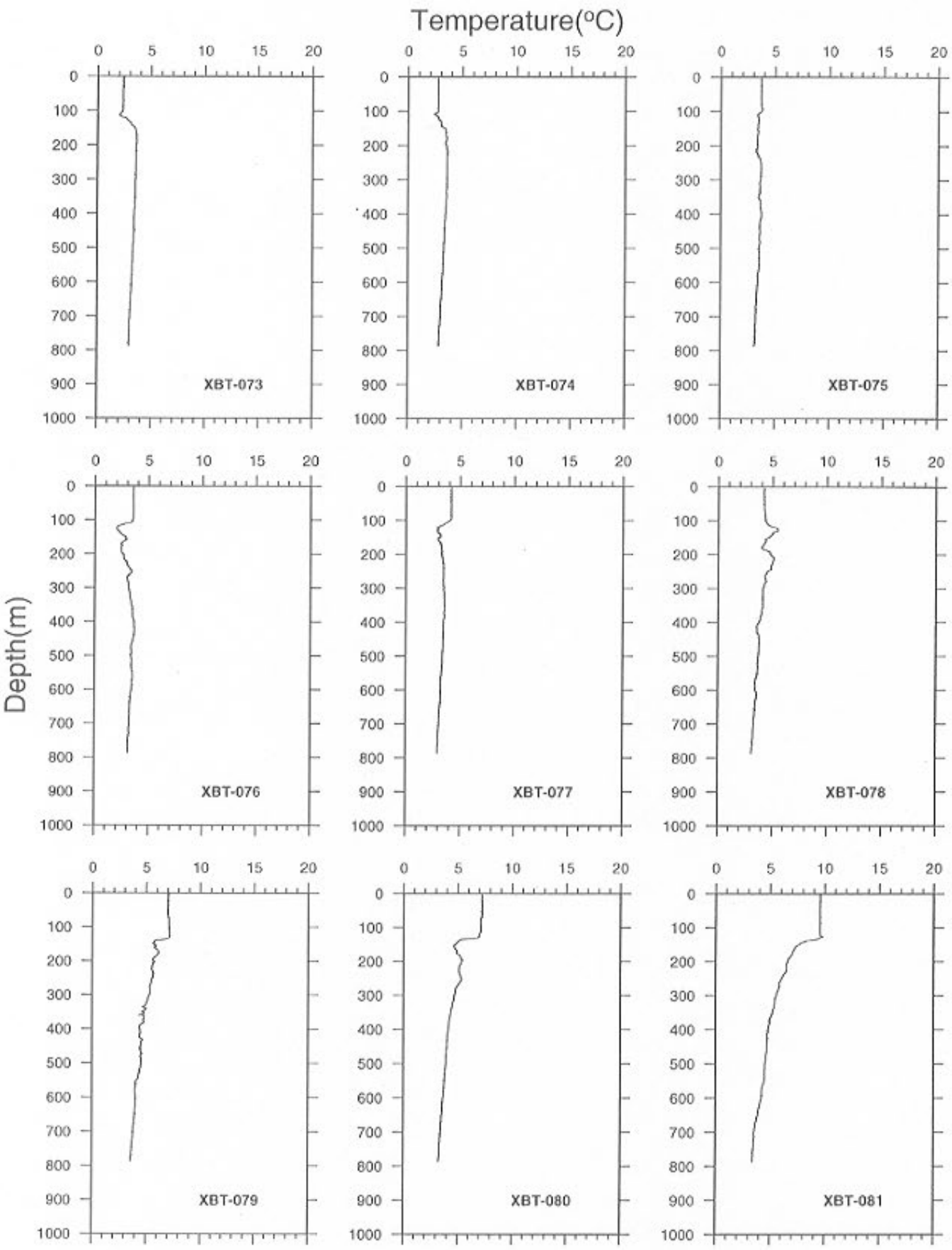

Temperature(°C)
Depth(m)
0 5 10 15 20
0 100 200 300 400 500 600 700 800 900 1000
XBT-028
XBT-029
XBT-030
XBT-031
XBT-032
XBT-033
XBT-034
XBT-035
XBT-036

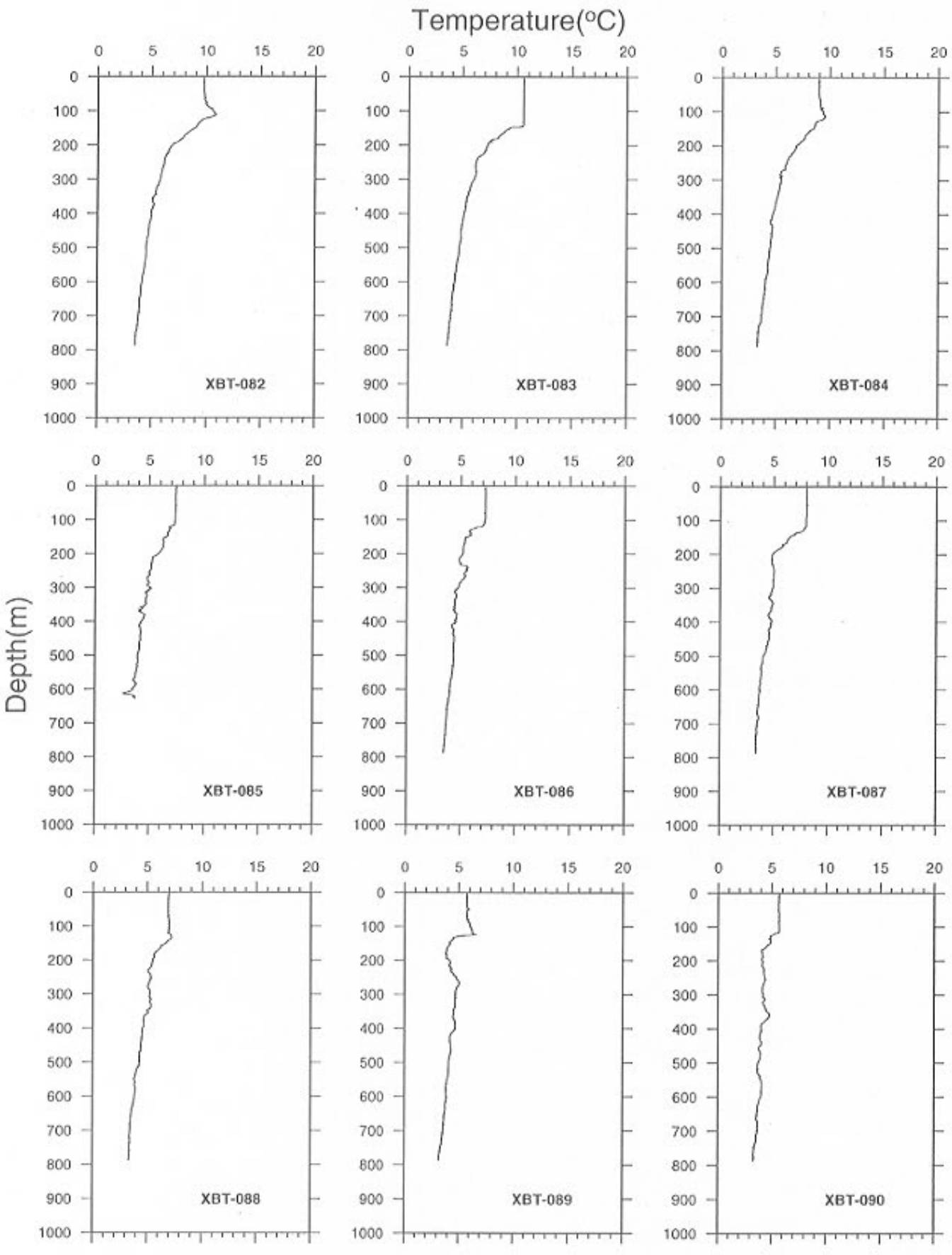

Temperature(°C)
Depth(m)
0
5
10
15
20
0
100
200
300
400
500
600
700
800
900
1000
XBT-040
XBT-041
XBT-042
XBT-043
XBT-044
XBT-045

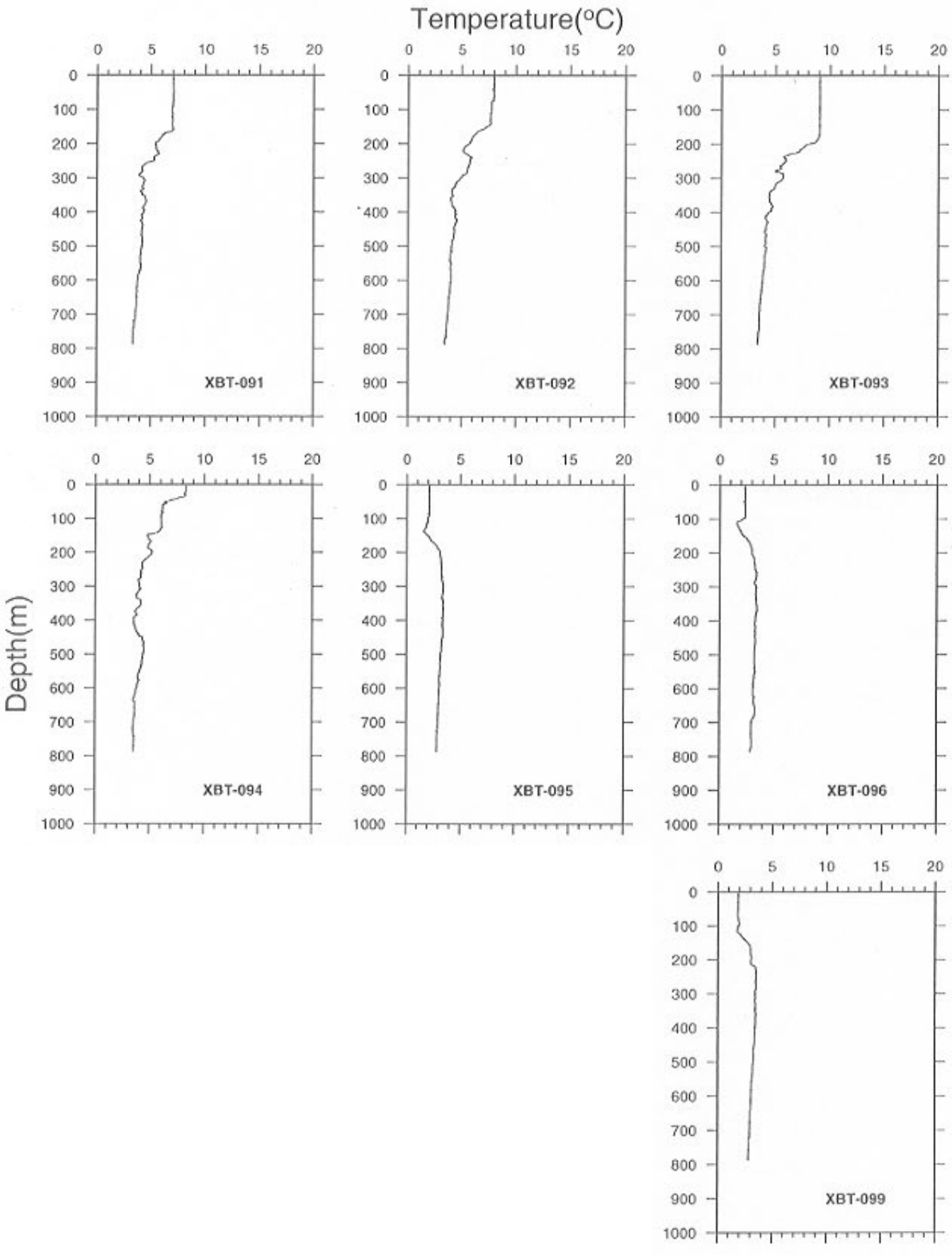

Temperature(°C)
Depth(m)
0 5 10 15 20
0 100 200 300 400 500 600 700 800 900 1000
XBT-046
XBT-047
XBT-048
XBT-049
XBT-050
XBT-051
XBT-052
XBT-053
XBT-054

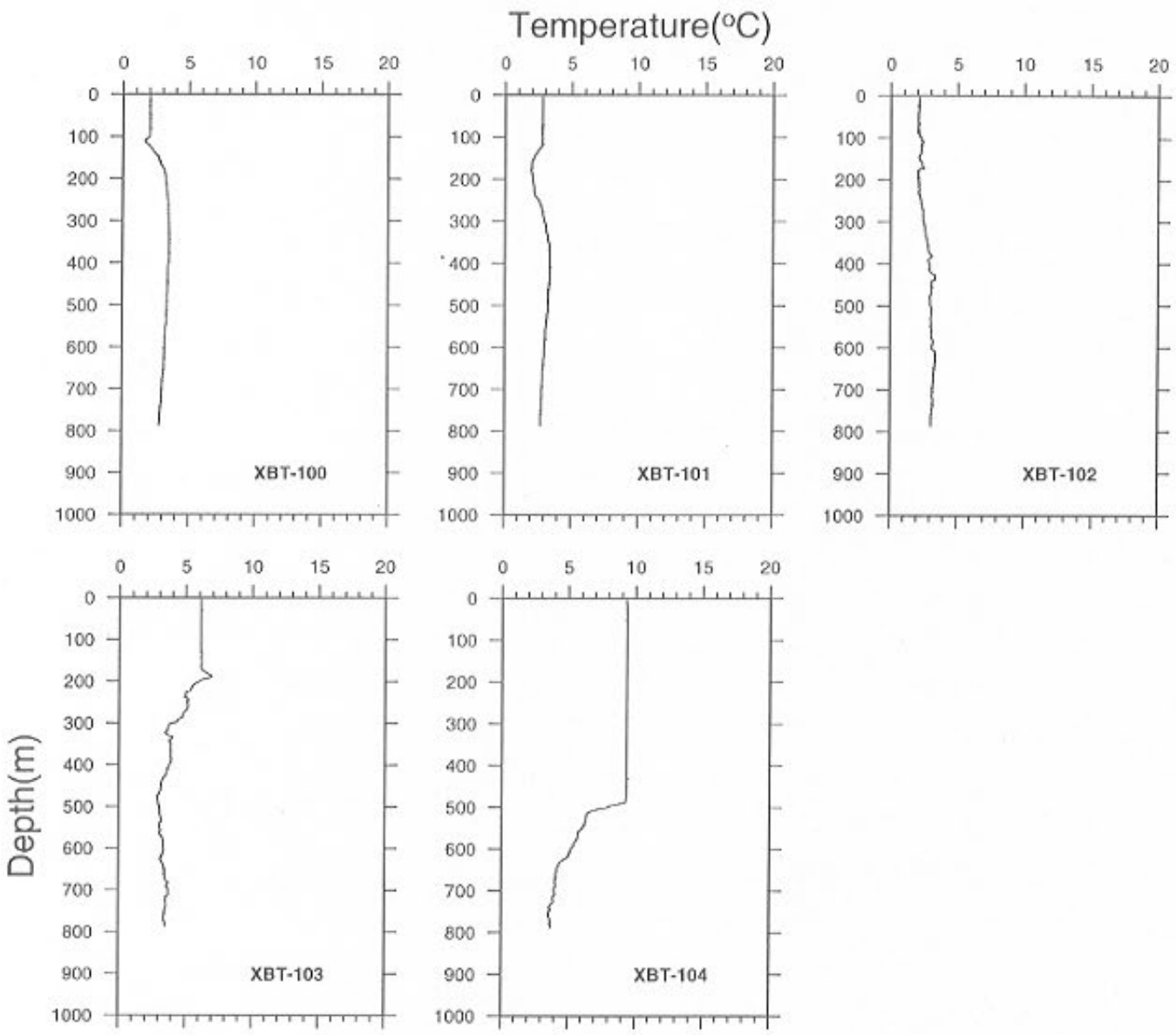

Temperature(°C)
Depth(m)
0 5 10 15 20
0 100 200 300 400 500 600 700 800 900 1000
XBT-055
XBT-056
XBT-057
XBT-058
XBT-059
XBT-060
XBT-061
XBT-062
XBT-063

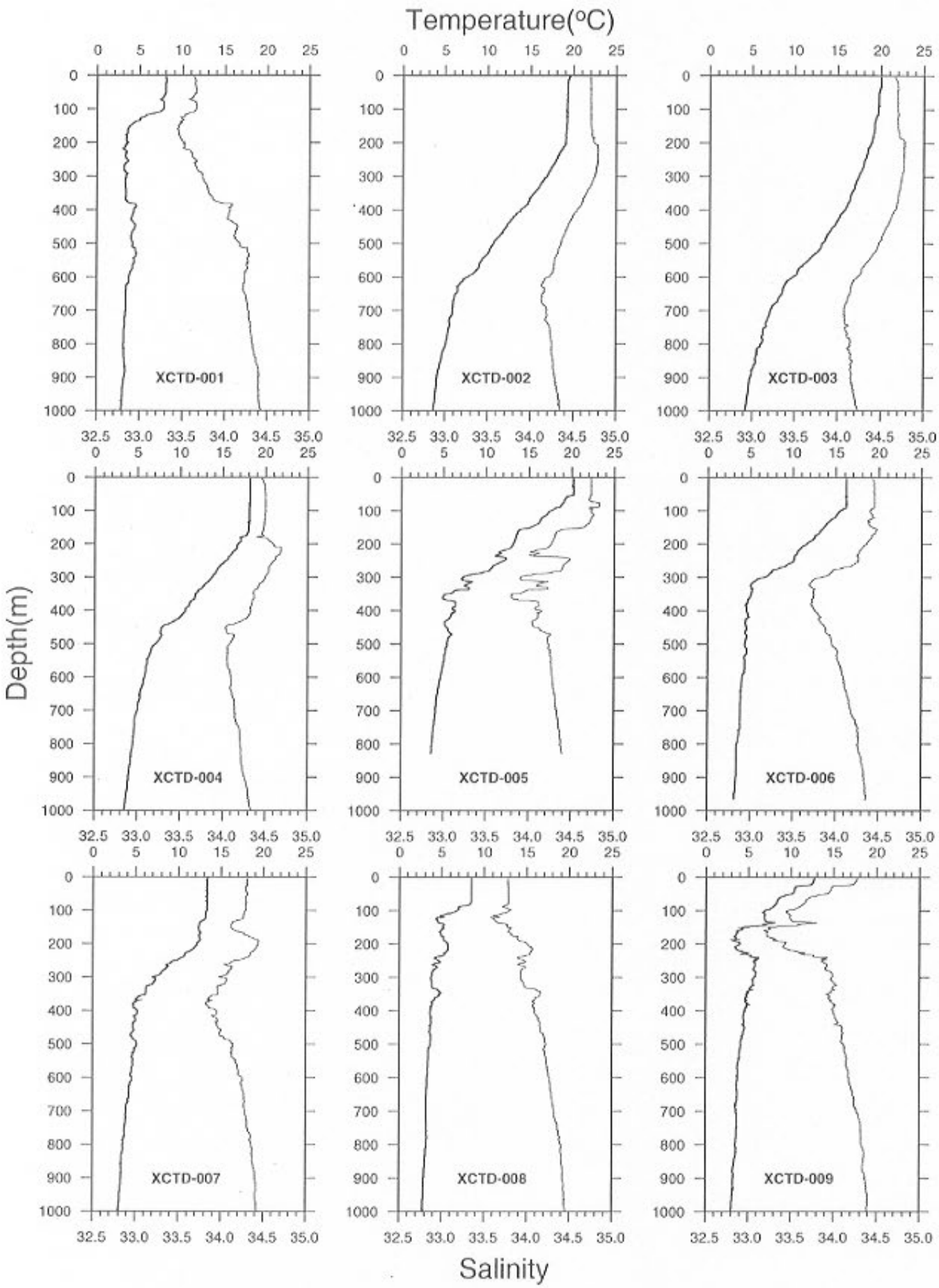

Temperature(°C)
Depth(m)
0 5 10 15 20
0 100 200 300 400 500 600 700 800 900 1000
XBT-064
XBT-065
XBT-066
XBT-067
XBT-068
XBT-069
XBT-070
XBT-071
XBT-072

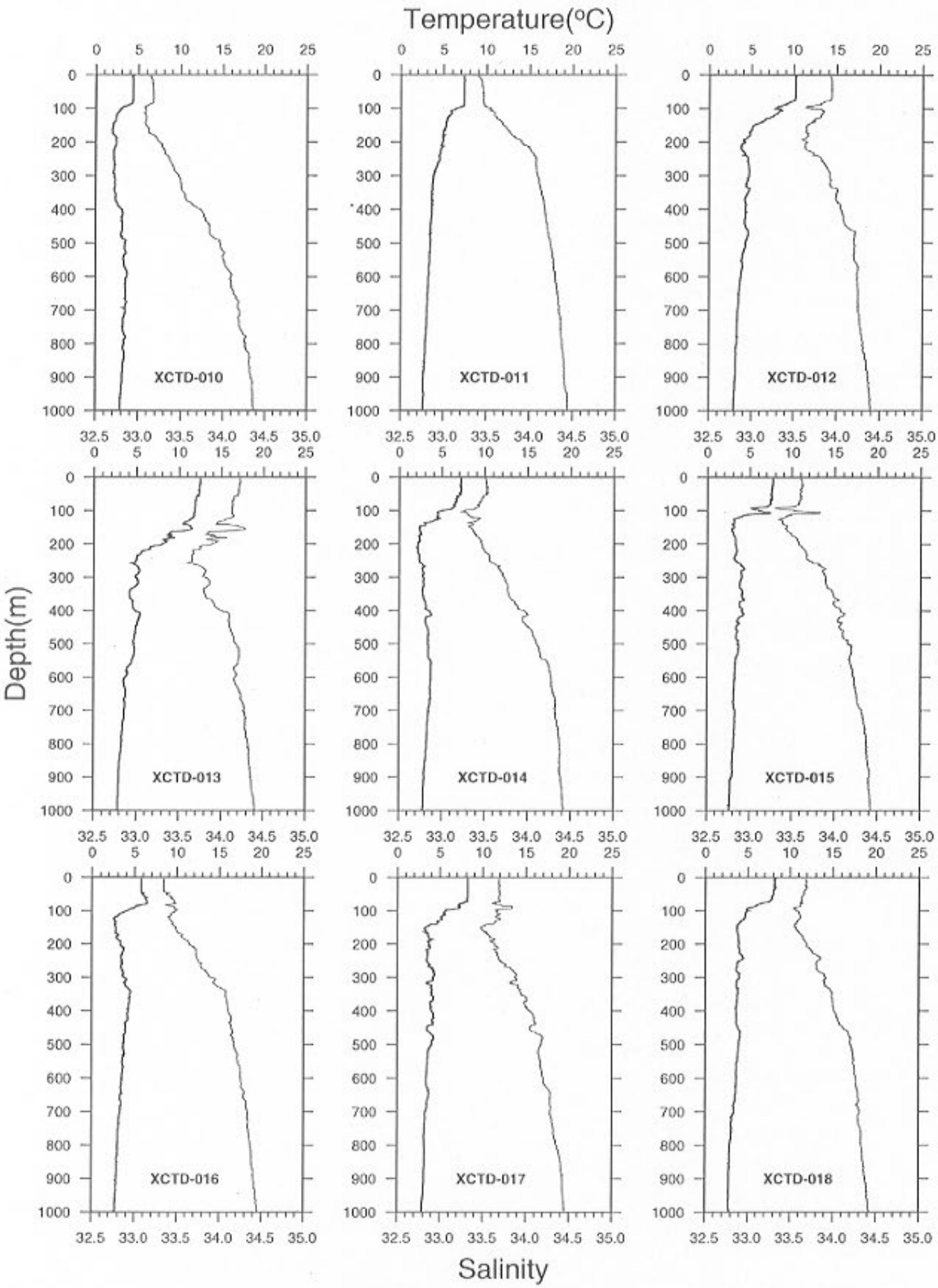

Temperature(°C)
Depth(m)
0 5 10 15 20
0 100 200 300 400 500 600 700 800 900 1000
XBT-073
XBT-074
XBT-075
XBT-076
XBT-077
XBT-078
XBT-079
XBT-080
XBT-081

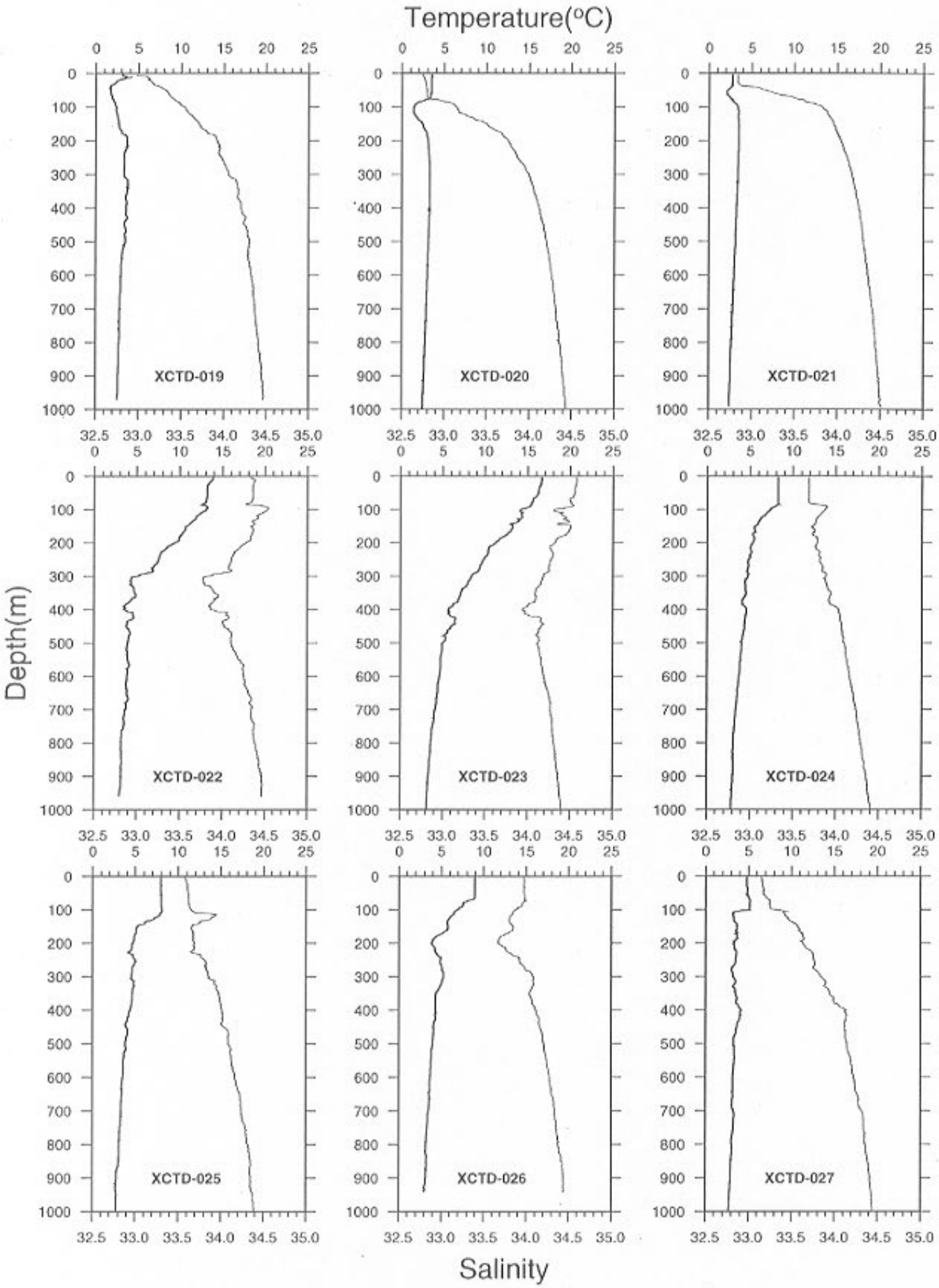

Temperature(°C)
Depth(m)
0 5 10 15 20
0 100 200 300 400 500 600 700 800 900 1000
XBT-082
XBT-083
XBT-084
XBT-085
XBT-086
XBT-087
XBT-088
XBT-089
XBT-090

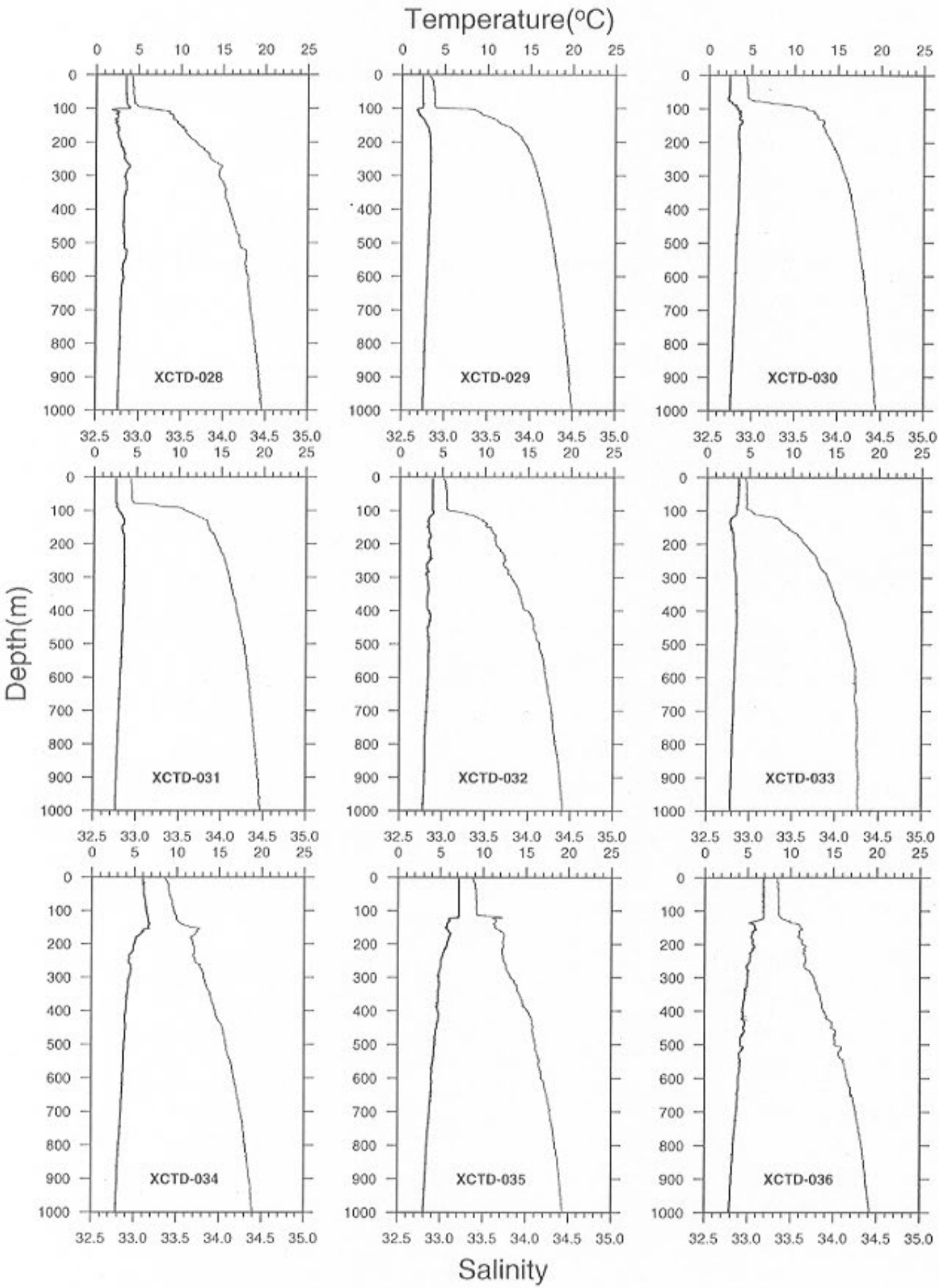

Temperature(°C)
Depth(m)
0 5 10 15 20
0 100 200 300 400 500 600 700 800 900 1000
XBT-091
XBT-092
XBT-093
XBT-094
XBT-095
XBT-096
XBT-099

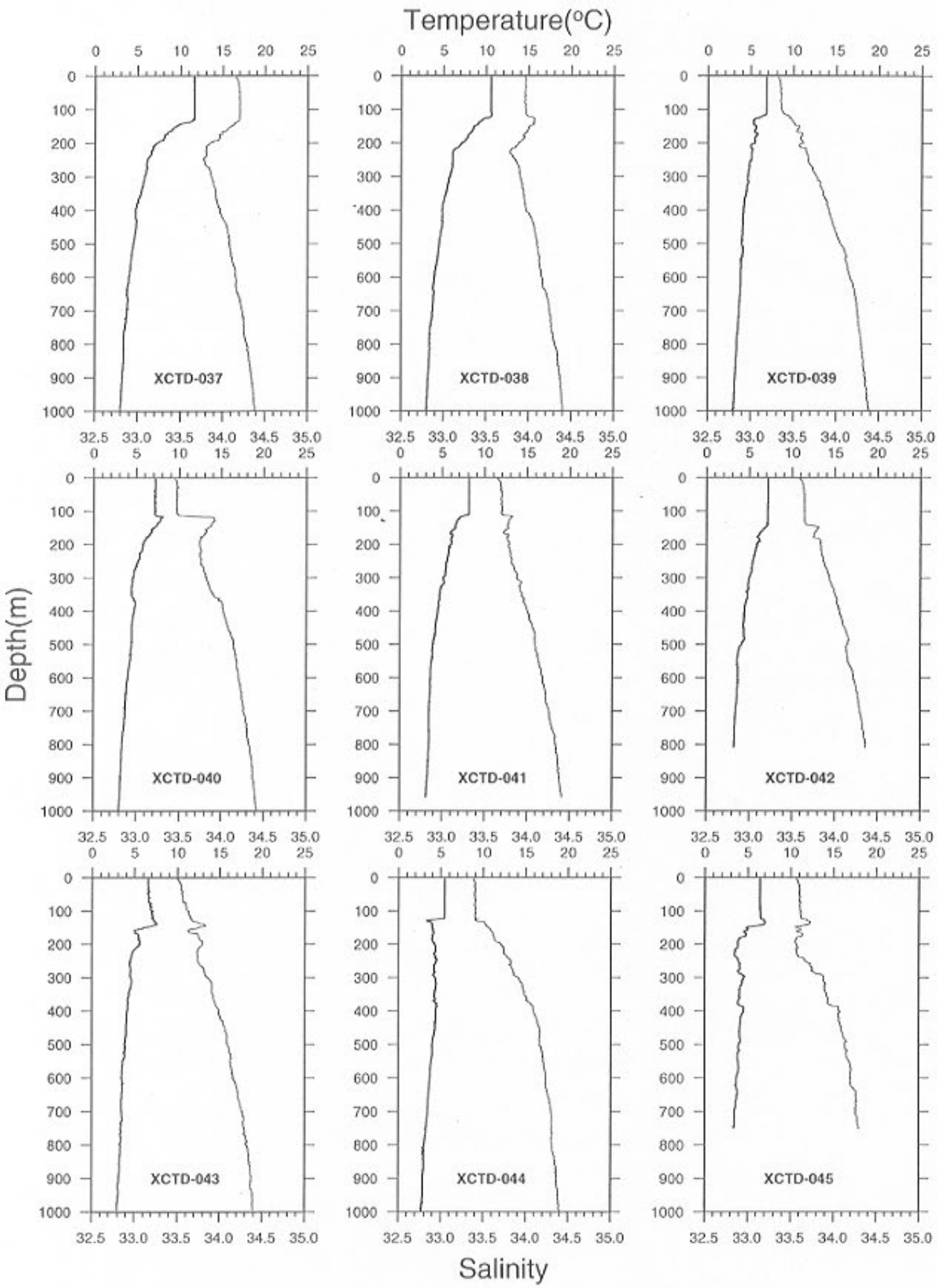

Temperature(°C)
Depth(m)
0 5 10 15 20
0 100 200 300 400 500 600 700 800 900 1000
XBT-100
XBT-101
XBT-102
XBT-103
XBT-104

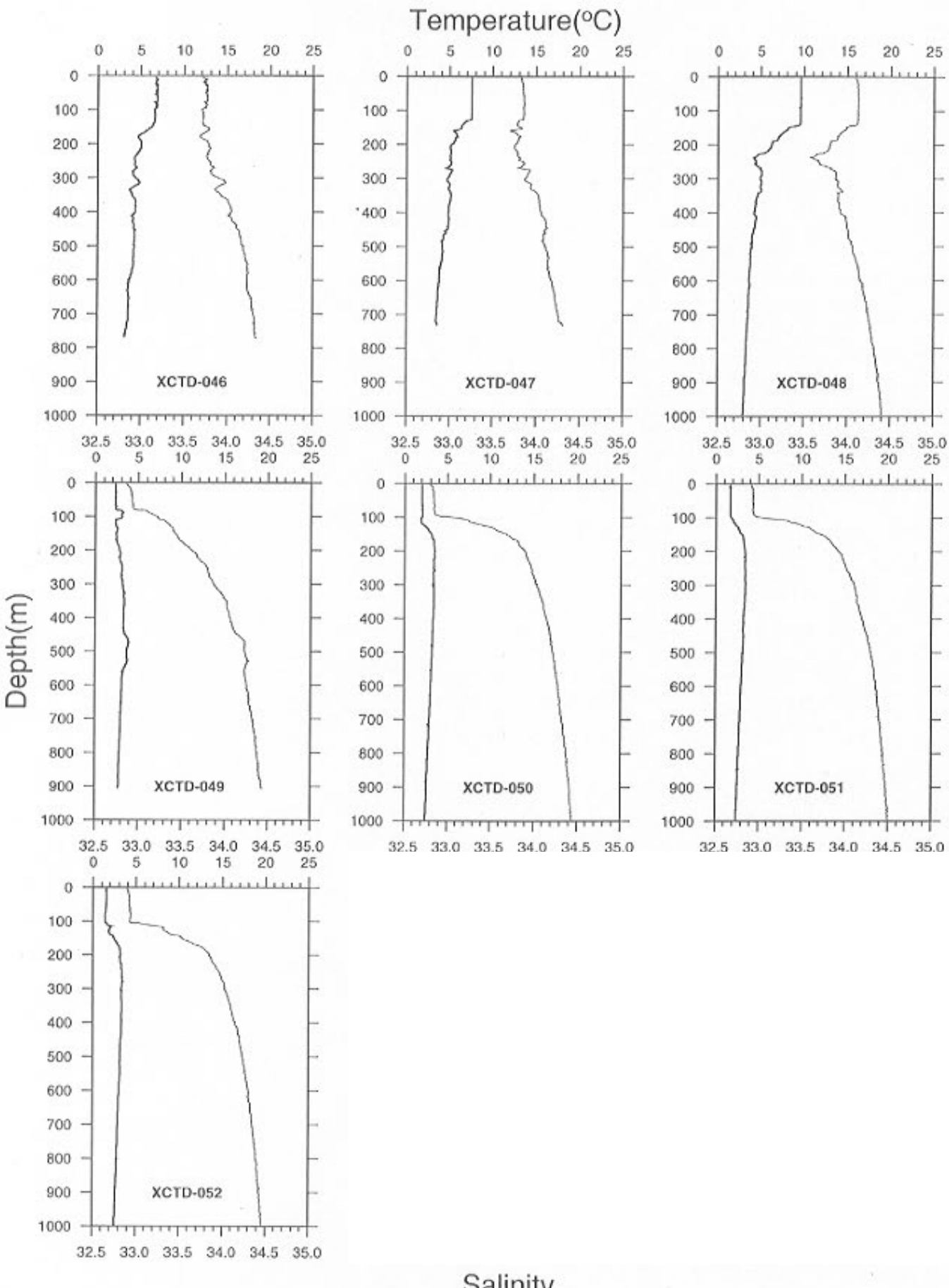

Temperature(°C)
Depth(m)
Salinity
XCTD-001
XCTD-002
XCTD-003
XCTD-004
XCTD-005
XCTD-006
XCTD-007
XCTD-008
XCTD-009

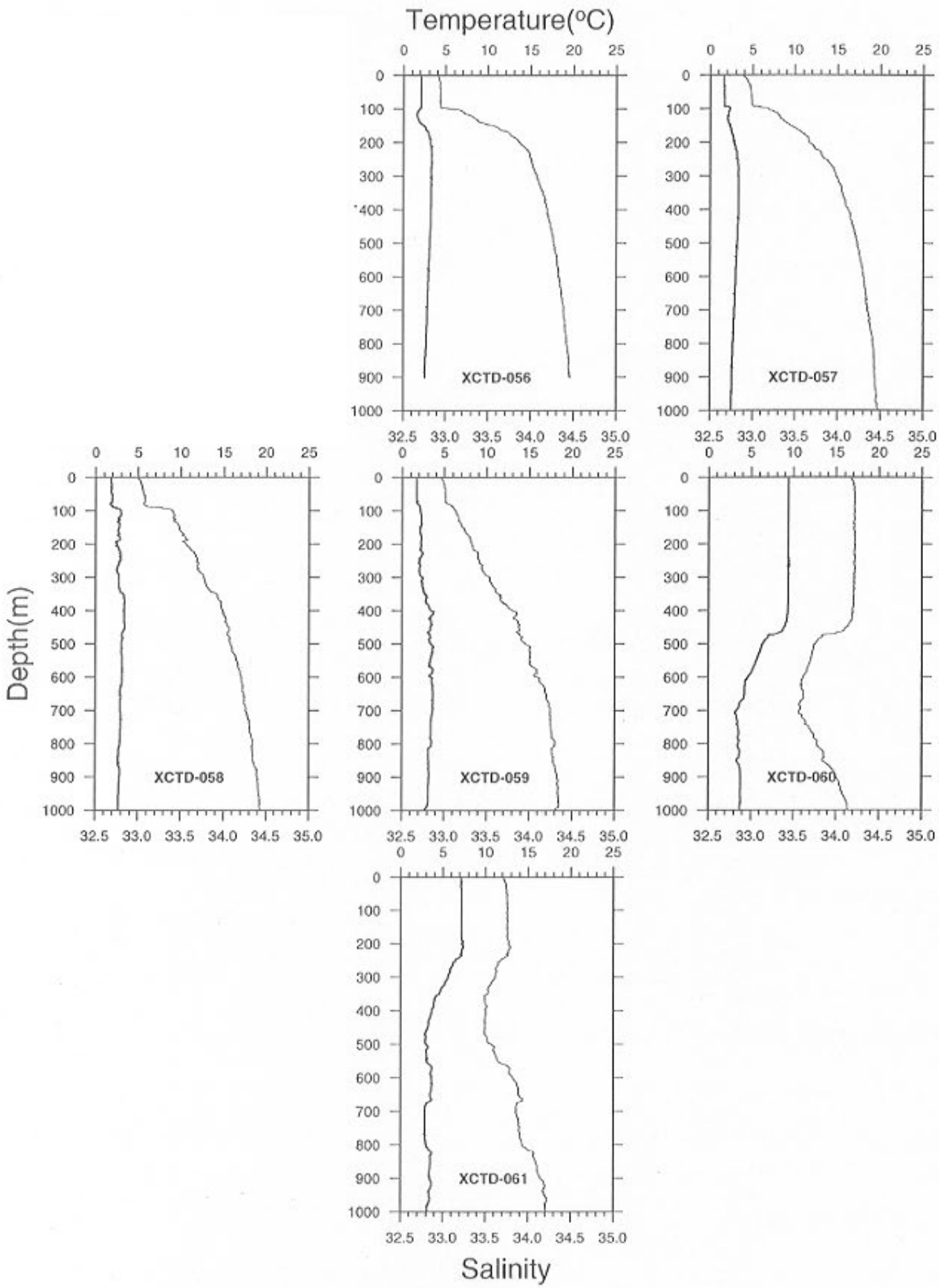

Temperature(°C)
Depth(m)
Salinity
XCTD-010
XCTD-011
XCTD-012
XCTD-013
XCTD-014
XCTD-015
XCTD-016
XCTD-017
XCTD-018

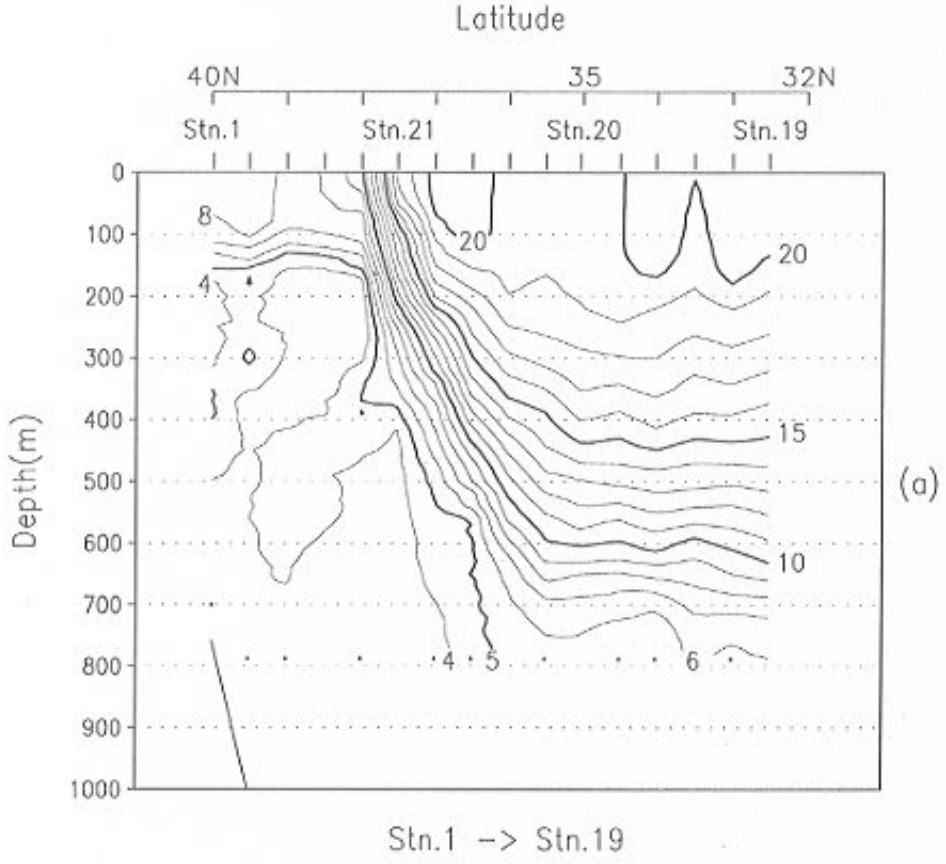

Temperature(°C)
Depth(m)
Salinity
XCTD-019
XCTD-020
XCTD-021
XCTD-022
XCTD-023
XCTD-024
XCTD-025
XCTD-026
XCTD-027

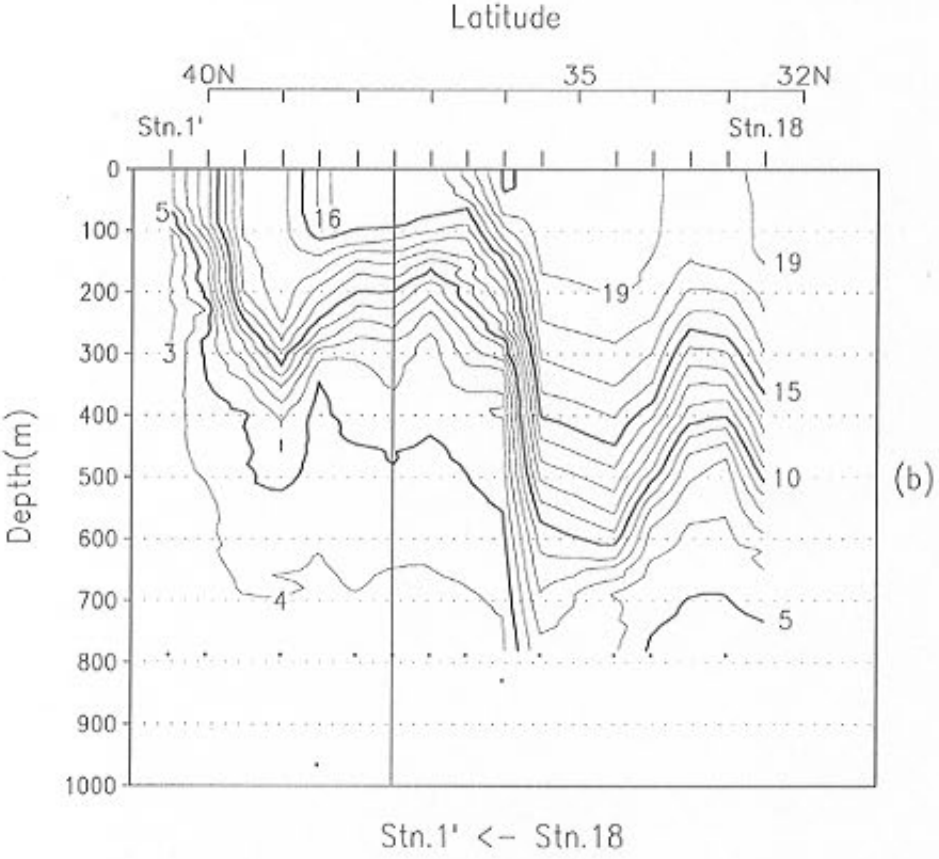

Temperature(°C)
Depth(m)
Salinity
XCTD-028
XCTD-029
XCTD-030
XCTD-031
XCTD-032
XCTD-033
XCTD-034
XCTD-035
XCTD-036

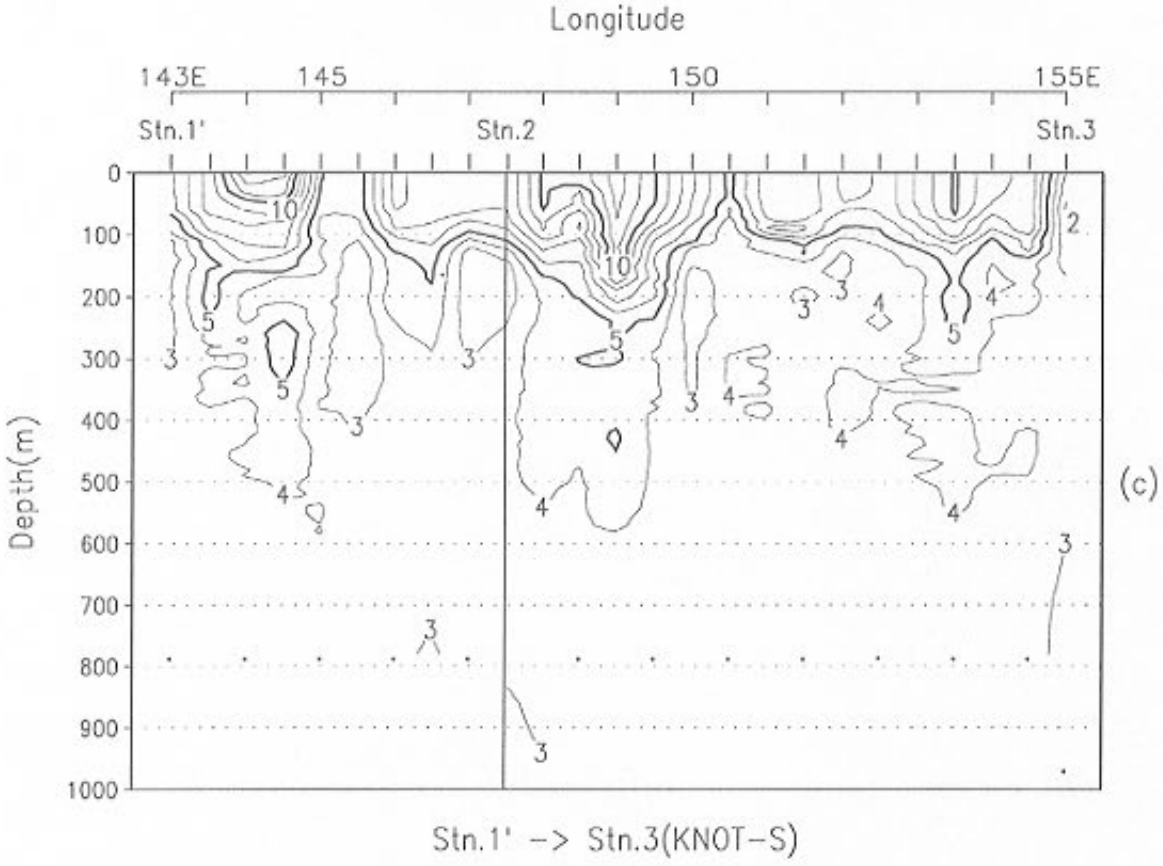

Temperature(°C)
Depth(m)
Salinity
XCTD-037
XCTD-038
XCTD-039
XCTD-040
XCTD-041
XCTD-042
XCTD-043
XCTD-044
XCTD-045

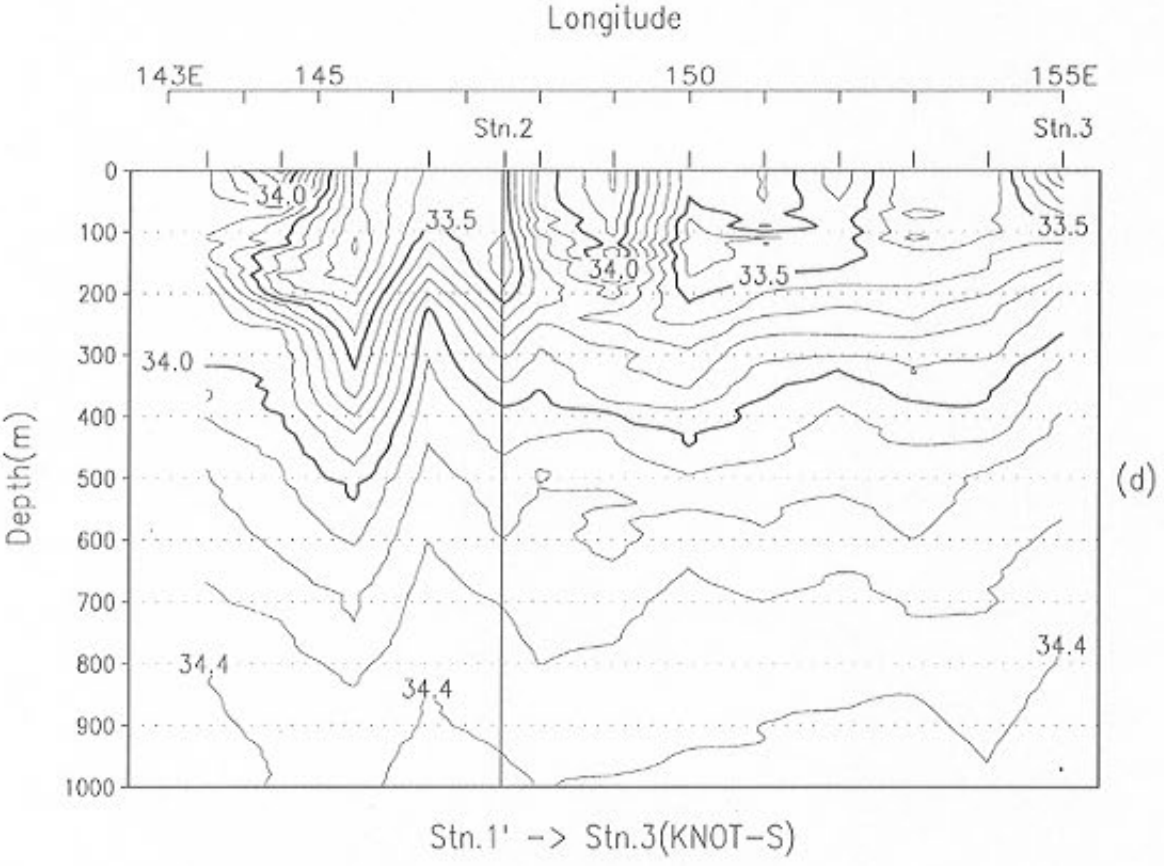

Temperature(°C)
Depth(m)
Salinity
XCTD-046
XCTD-047
XCTD-048
XCTD-049
XCTD-050
XCTD-051
XCTD-052

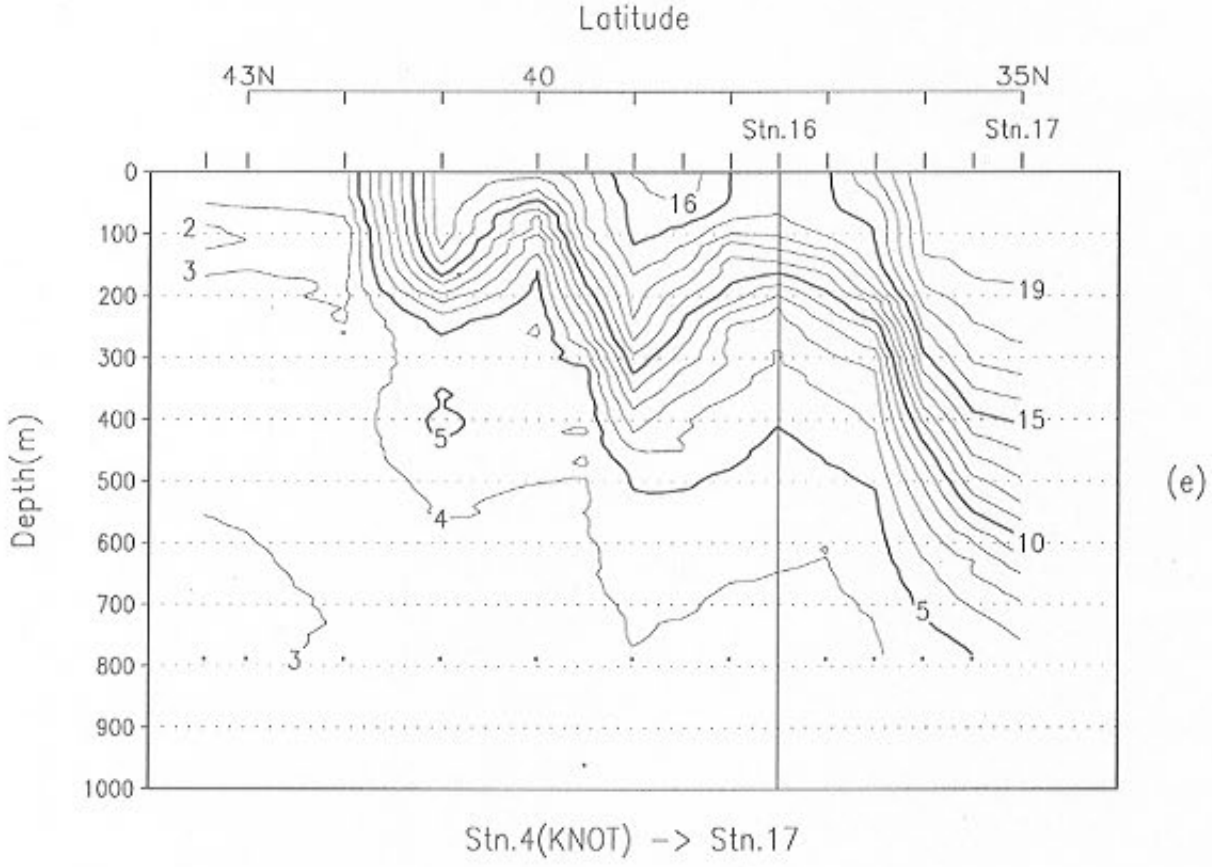

Temperature(°C)
Depth(m)
Salinity
XCTD-056
XCTD-057
XCTD-058
XCTD-059
XCTD-060
XCTD-061


Latitude
40N
35
32N
Stn.1
Stn.21
Stn.20
Stn.19
Depth(m)
0
100
200
300
400
500
600
700
800
900
1000
8
4
20
20
15
10
4
5
6
(a)
Stn.1 -> Stn.19


Latitude
40N
35
32N
Stn.1'
Stn.18
Depth(m)
0
100
200
300
400
500
600
700
800
900
1000
5
16
19
19
3
15
10
4
5
(b)
Stn.1' <- Stn.18

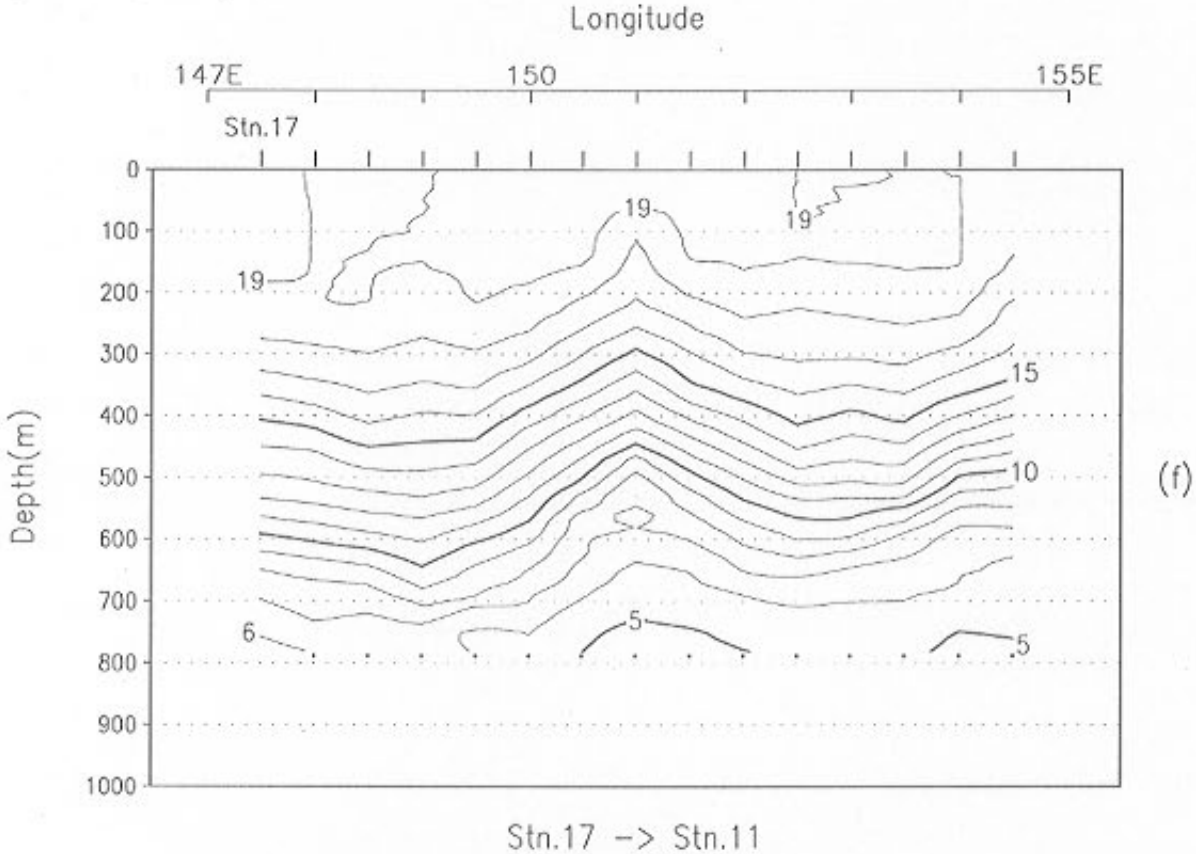

Longitude
143E
145
150
155E
Stn.1'
Stn.2
Stn.3
Depth(m)
0
100
200
300
400
500
600
700
800
900
1000
(c)
Stn.1' -> Stn.3(KNOT-S)


Longitude
143E
145
150
155E
Stn.2
Stn.3
Depth(m)
0
100
200
300
400
500
600
700
800
900
1000
34.0
33.5
34.4
(d)
Stn.1' -> Stn.3(KNOT-S)



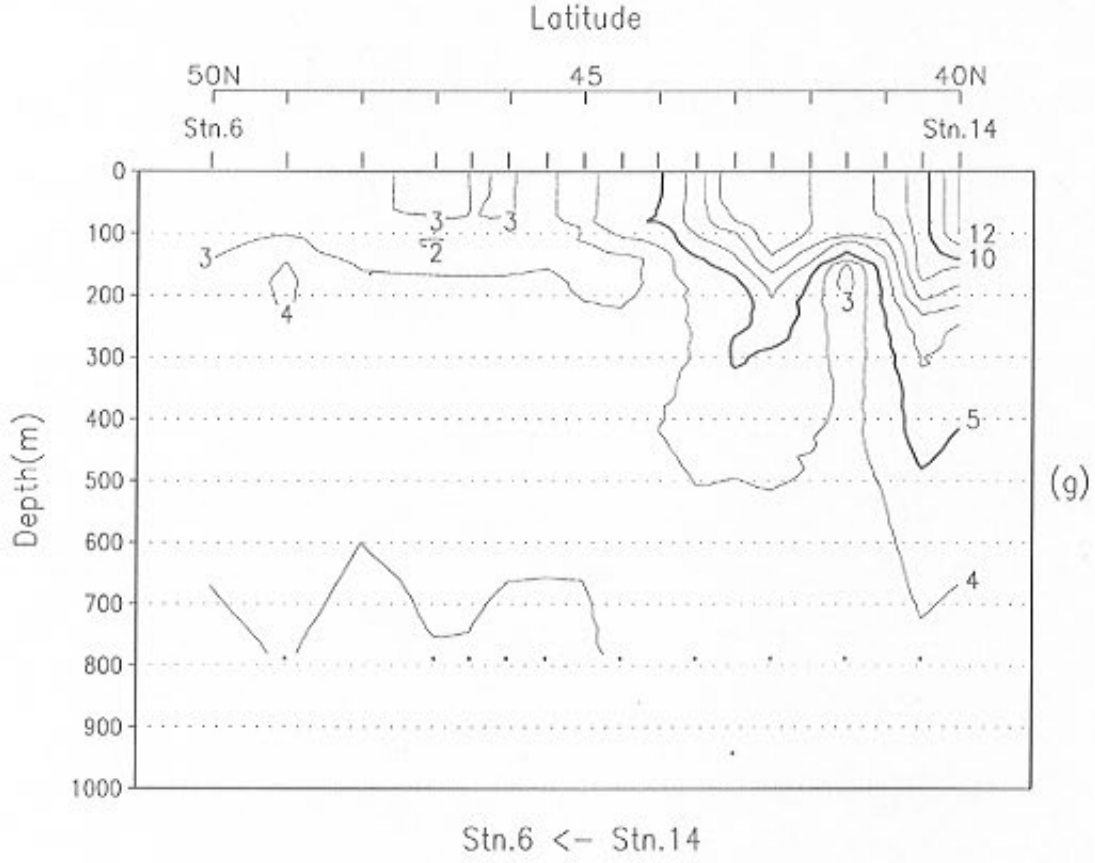
(e)

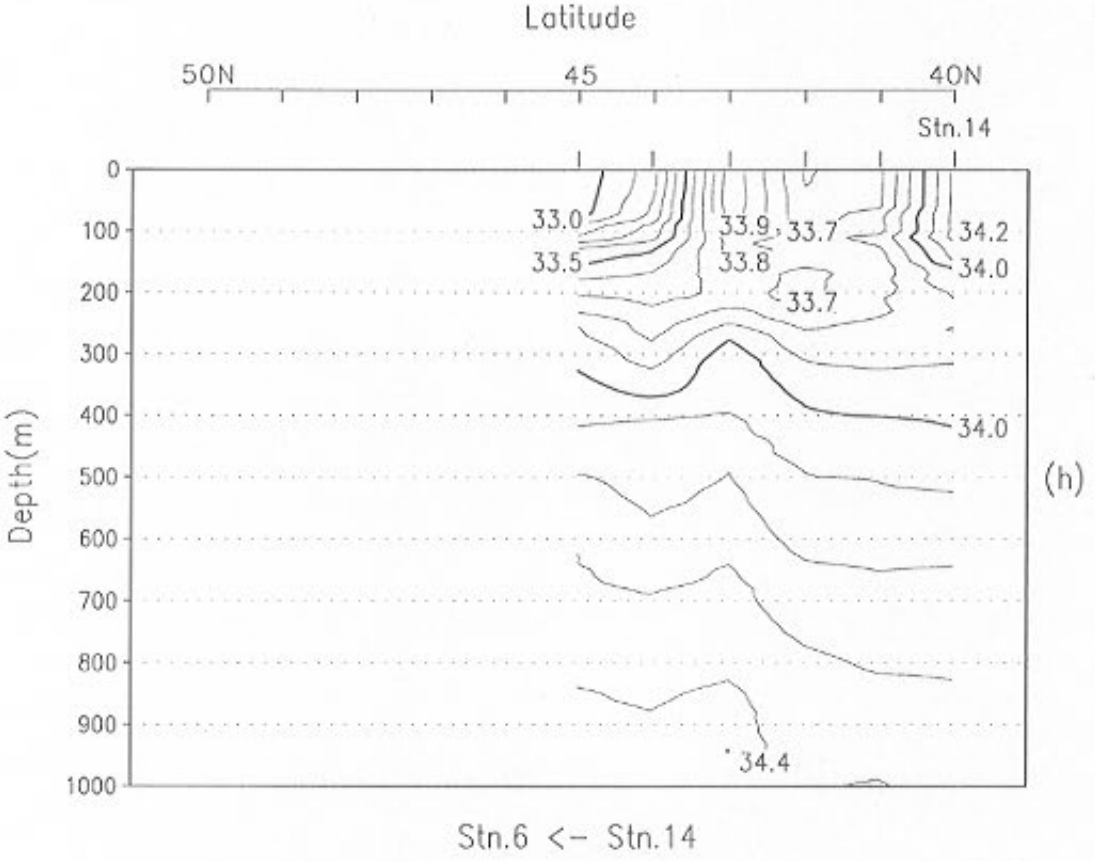
Stn.4(KNOT) -> Stn.17

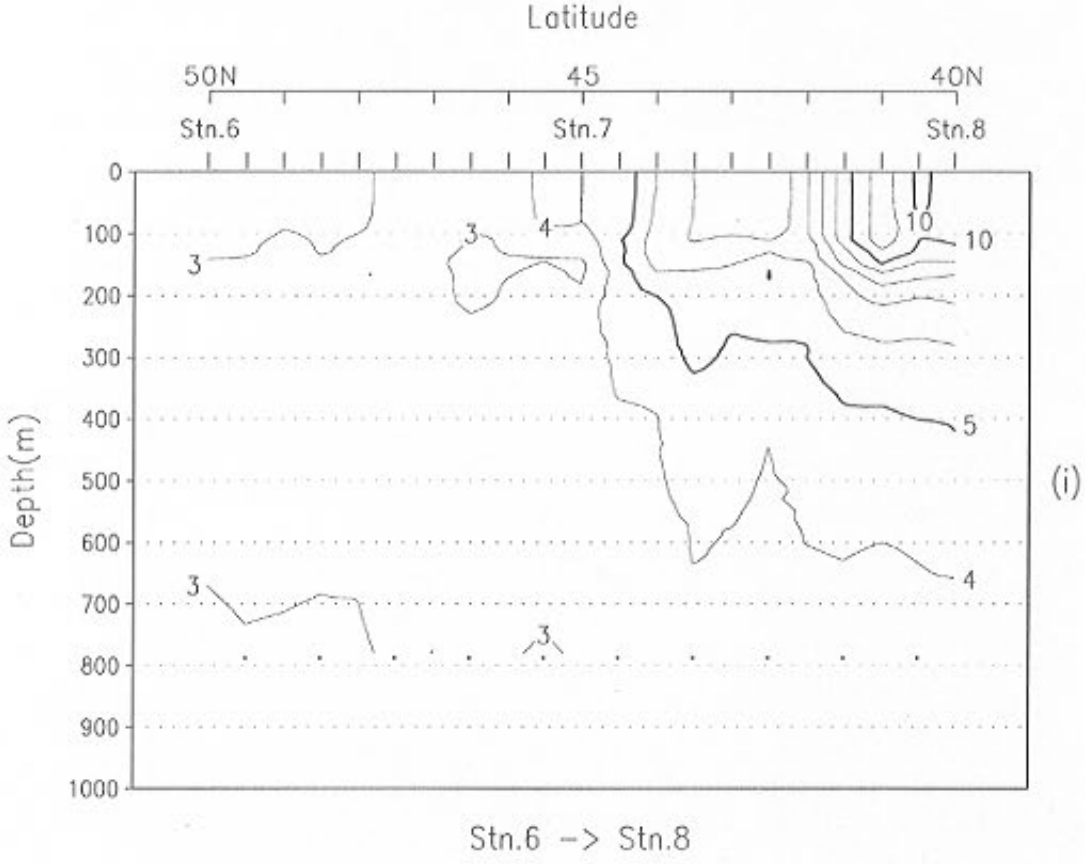


(f)

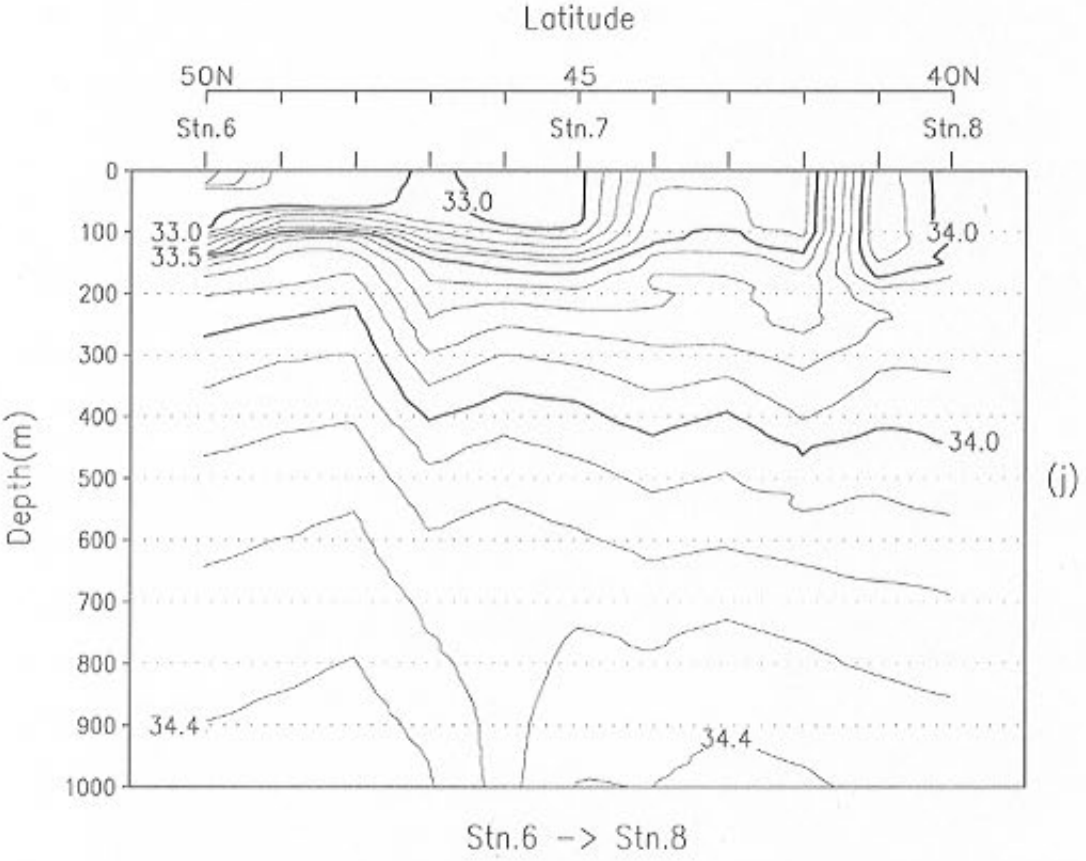
Stn.17 -> Stn.11


Latitude
50N
45
40N
Stn.6
Stn.14
Depth(m)
0
100
200
300
400
500
600
700
800
900
1000
3
3
3
2
4
3
12
10
5
4
(g)
Stn.6 <- Stn.14

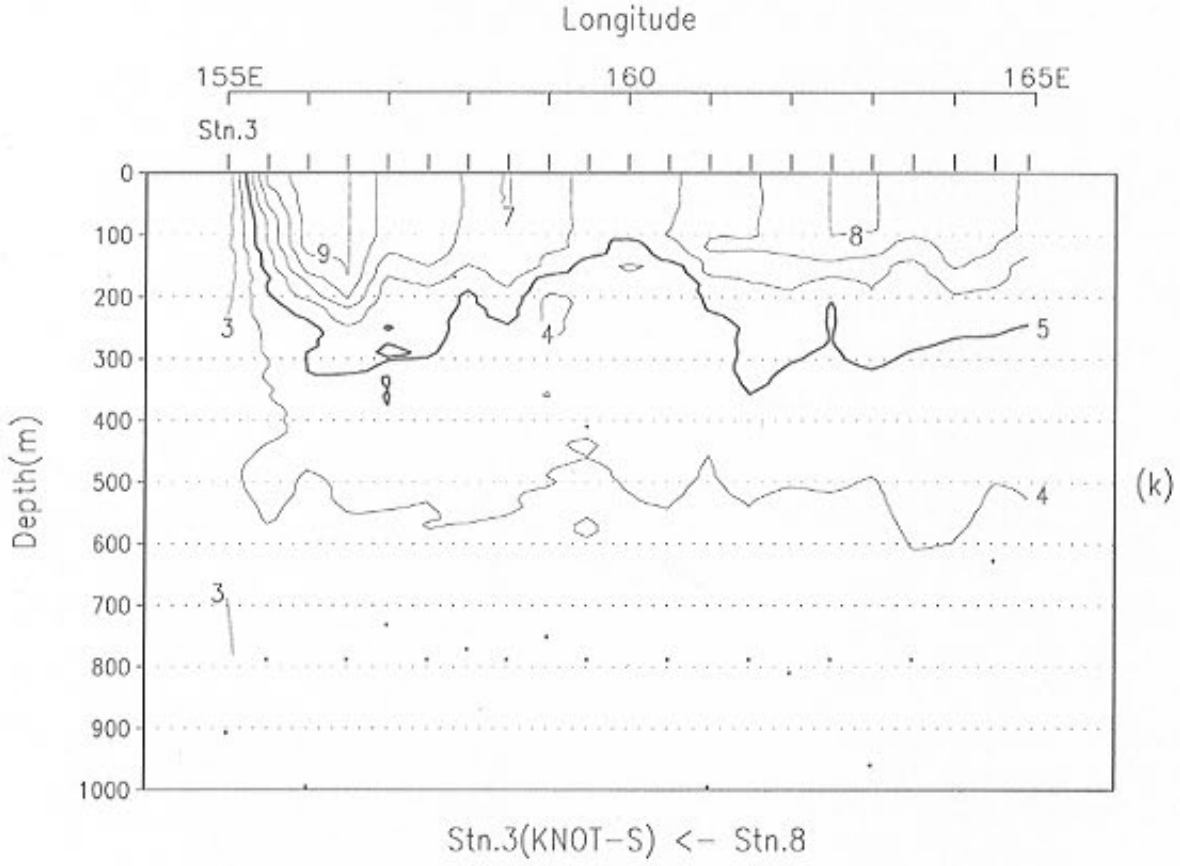

Latitude
50N
45
40N
Stn.14
Depth(m)
0
100
200
300
400
500
600
700
800
900
1000
33.0
33.5
33.9
33.8
33.7
33.7
34.2
34.0
34.0
34.4
(h)
Stn.6 <- Stn.14


Latitude
50N
45
40N
Stn.6
Stn.7
Stn.8
Depth(m)
0
100
200
300
400
500
600
700
800
900
1000
3
3
4
10
10
5
4
3
3
Stn.6 -> Stn.8

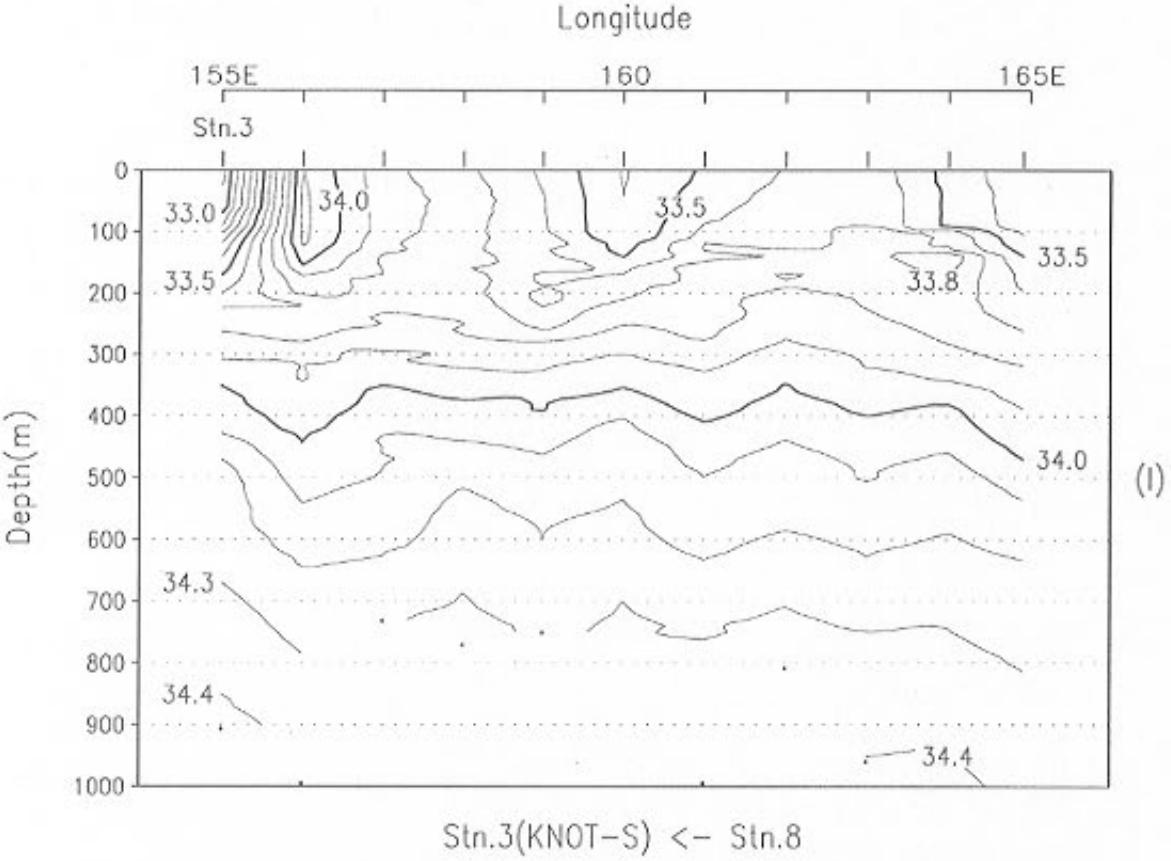
(i)


Latitude
50N
45
40N
Stn.6
Stn.7
Stn.8
Depth(m)
0
100
200
300
400
500
600
700
800
900
1000
33.0
33.0
33.5
34.0
34.0
34.4
34.4
Stn.6 -> Stn.8

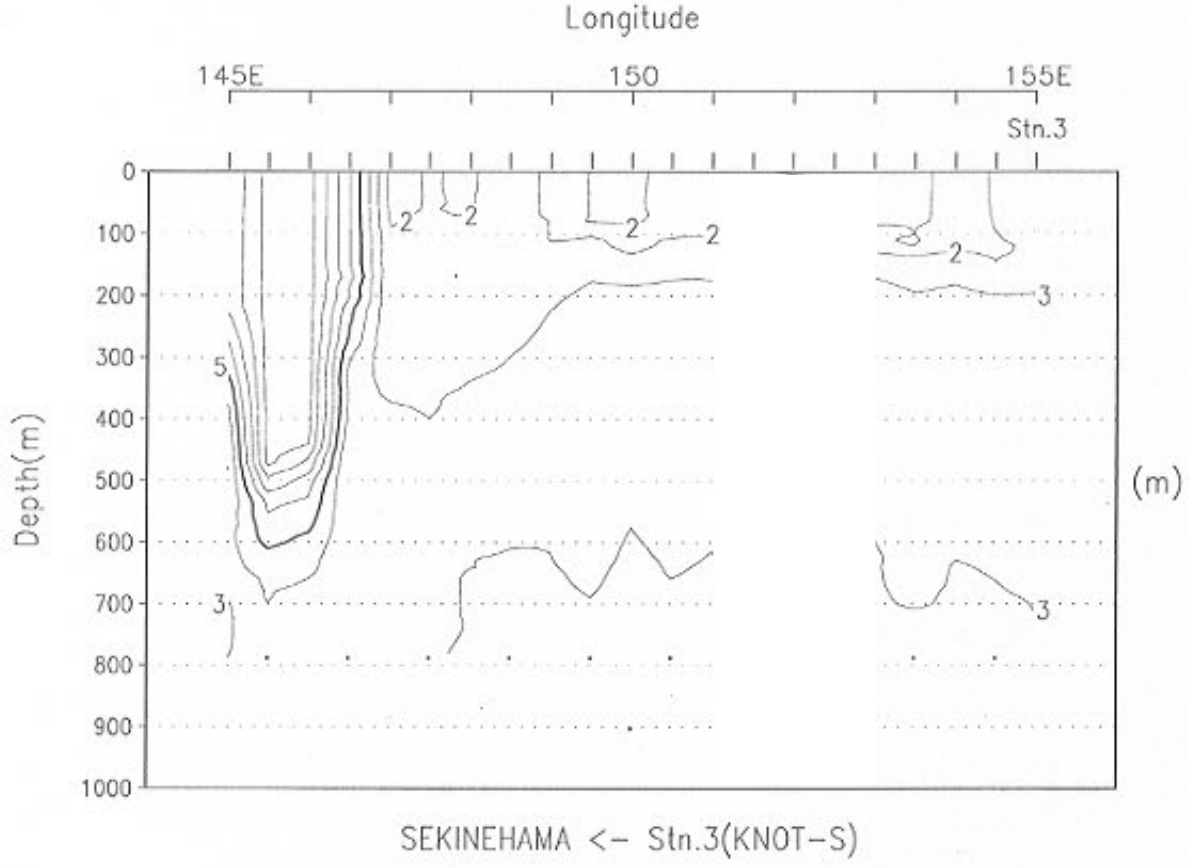
(j)

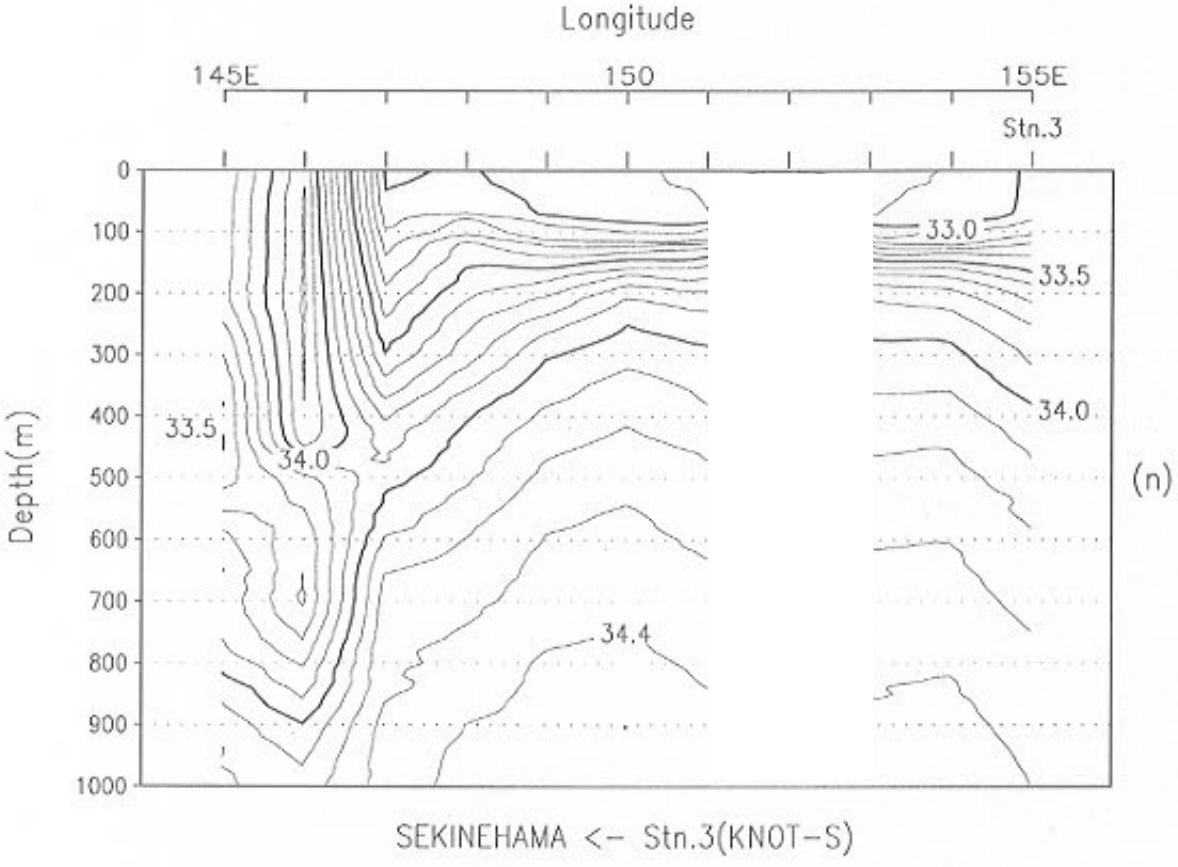

Longitude
155E
160
165E
Stn.3
0
100
200
300
400
500
600
700
800
900
1000
Depth(m)
9
7
8
3
4
5
8
4
3
Stn.3(KNOT-S) <- Stn.8

(k)


Longitude
155E
160
165E
Stn.3
0
100
200
300
400
500
600
700
800
900
1000
Depth(m)
33.0
34.0
33.5
33.5
33.5
33.8
34.0
34.3
34.4
34.4
Stn.3(KNOT-S) <- Stn.8

(l)


Longitude
145E
150
155E
Stn.3
0
100
200
300
400
500
600
700
800
900
1000
Depth(m)
2
2
2
2
2
3
5
3
3
(m)
SEKINEHAMA <- Stn.3(KNOT-S)


Longitude
145E
150
155E
Stn.3
0
100
200
300
400
500
600
700
800
900
1000
Depth(m)
33.0
33.5
34.0
33.5
34.0
34.4
(n)
SEKINEHAMA <- Stn.3(KNOT-S)

3.20 P-ALACE

NAKANO Toshiya (JMA)

1. Introduction

Two P-ALACE floats have been deployed to research the structure and variation of sub-surface temperature and current in the subarctic circulation area, and to research the formation, advection and diffusion process of the North Pacific Intermediate Water (NPIW).

2. Specification

S/N 96 (AGROS ID:25552) and S/N 97 (ARGOS ID:25554)

Depth	1500db
Temperature	2.5℃
Salinity	34.45psu
in situ density	1.034426g/cm^3
Cycle period	10days
Transmission period	24hours

	Range	Accuracy
Pressure	0 to 2000db	±1db
Temperature	-2 to 32℃	±0.003℃
Conductivity	1 to 7 S/m	±0.001 S/m
Dimension	1980mm length x 165mm diameter	
Weight in air	24kg	

3. Summary

Deployed

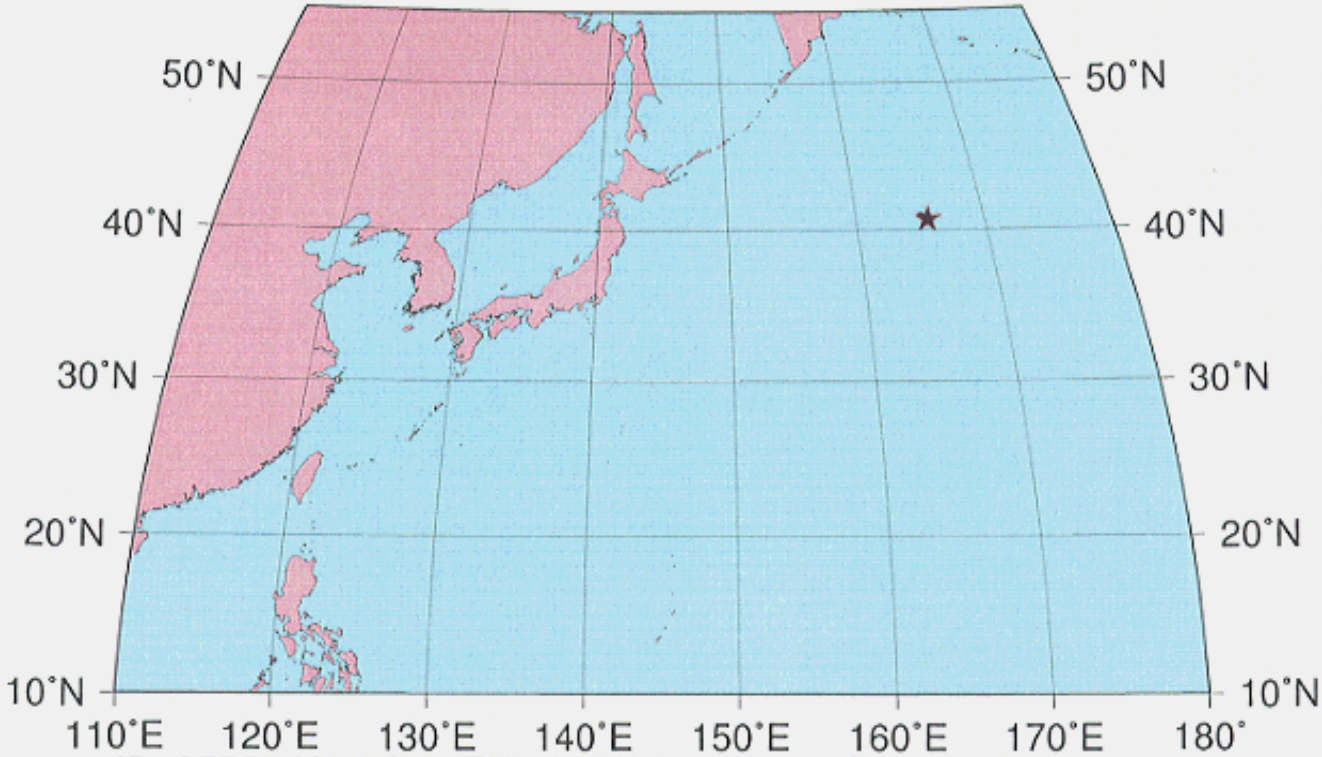
S/N 97 (ARGOS ID:25554)
Date: 2000/01/29 00:50(UTC)
Position: 40-59.11 N 164-59.96 E (5283m)

S/N 96 (ARGOS ID:25552)
Date: 2000/01/30 21:55(UTC)
Position: 40-00.21 N 165-00.73 E (5465m)

Most recent location of ALACE and vertical profile of temperature and salinity follows.

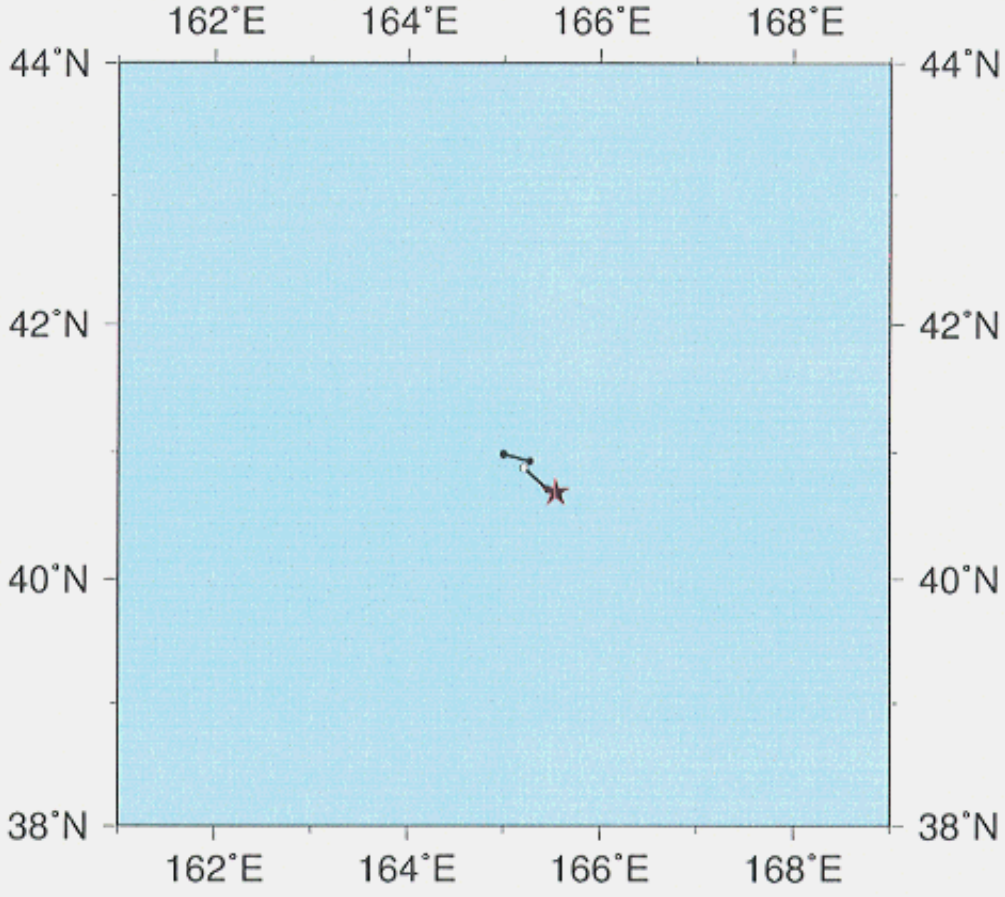
4. Acknowledgement

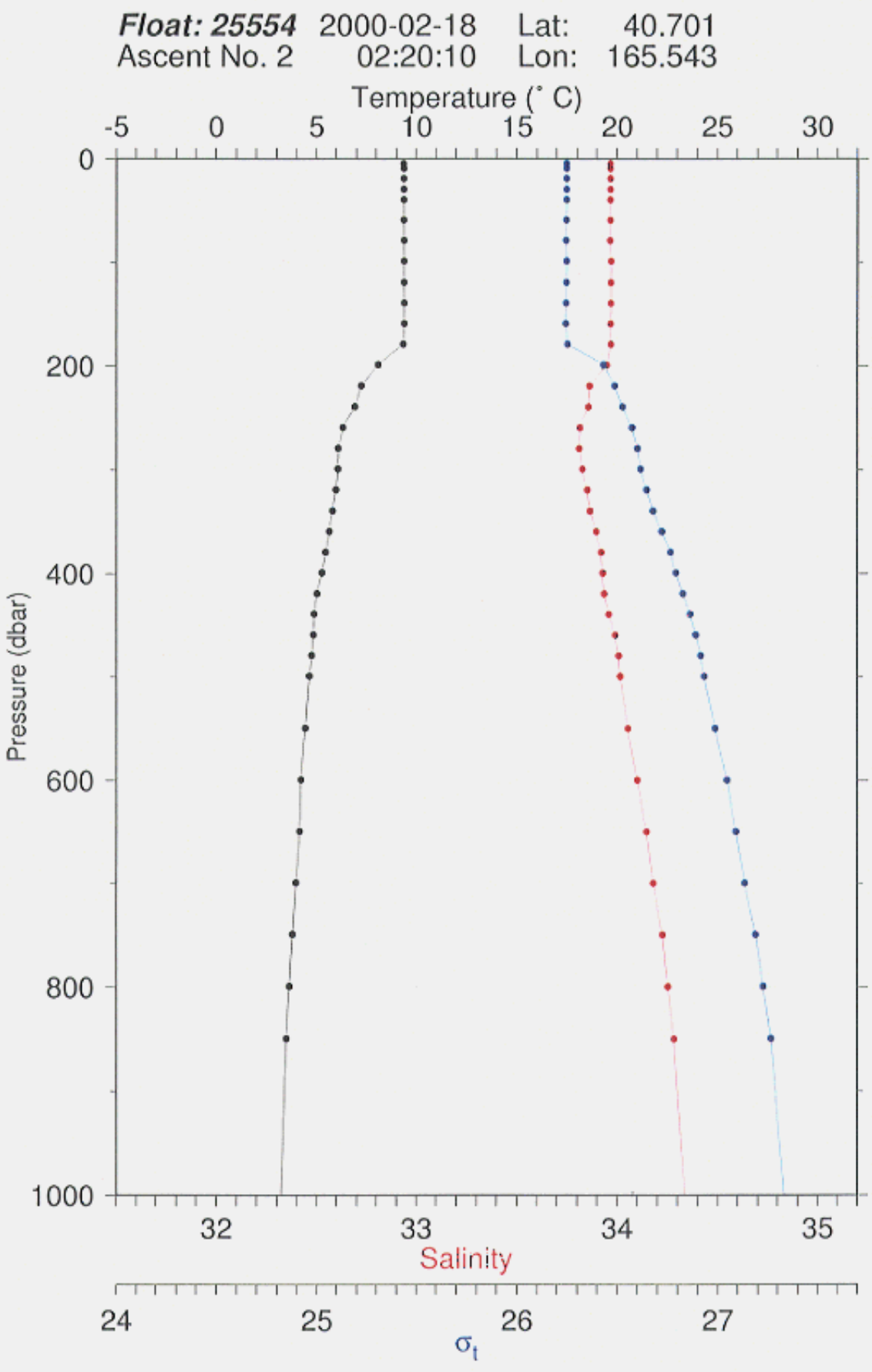
I thank Captain HASHIMOTO, the officers, and crew of R/V MIRAI for their cooperation in the fieldwork.

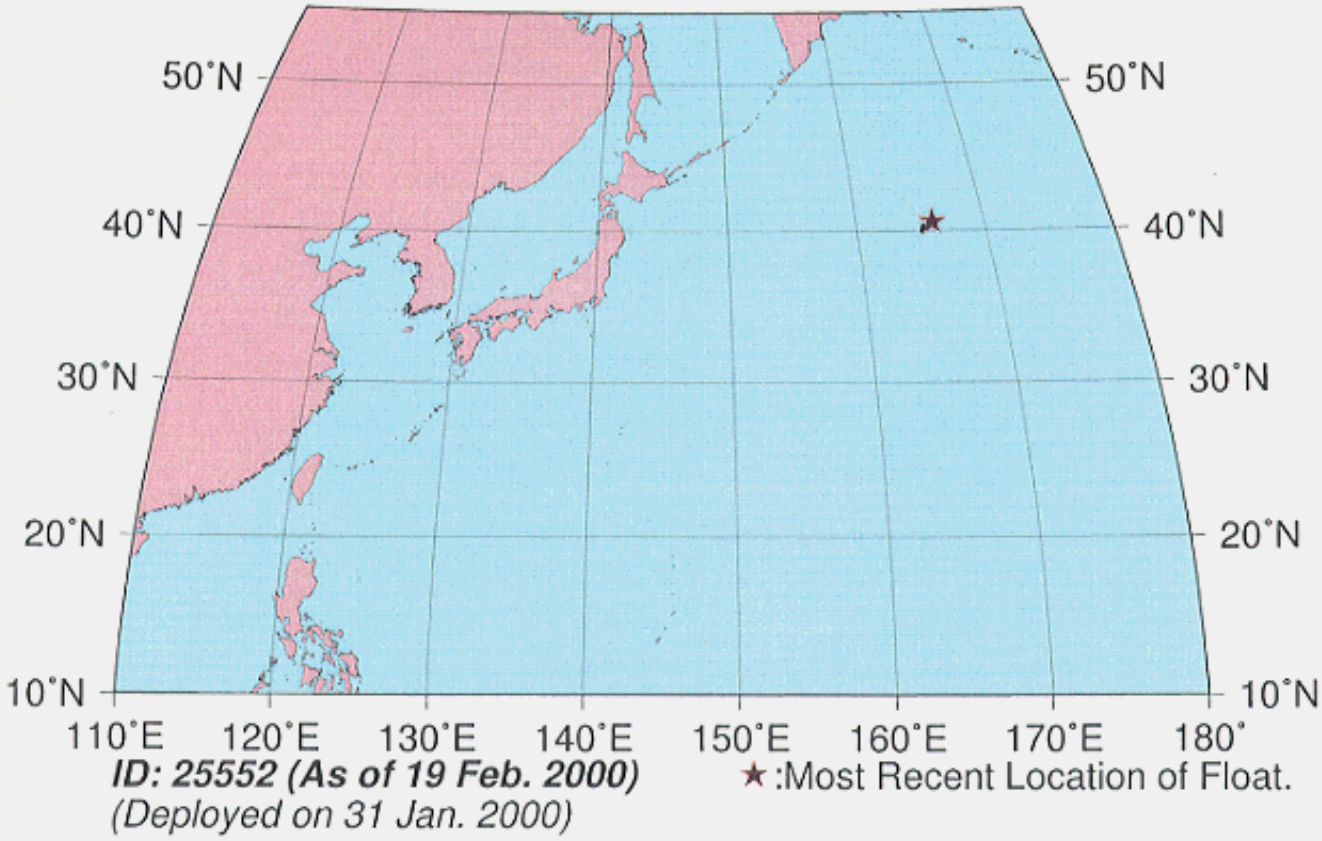


ID: 25554 (As of 17 Feb. 2000)
(Deployed on 29 Jan. 2000)

★:Most Recent Location of Float.

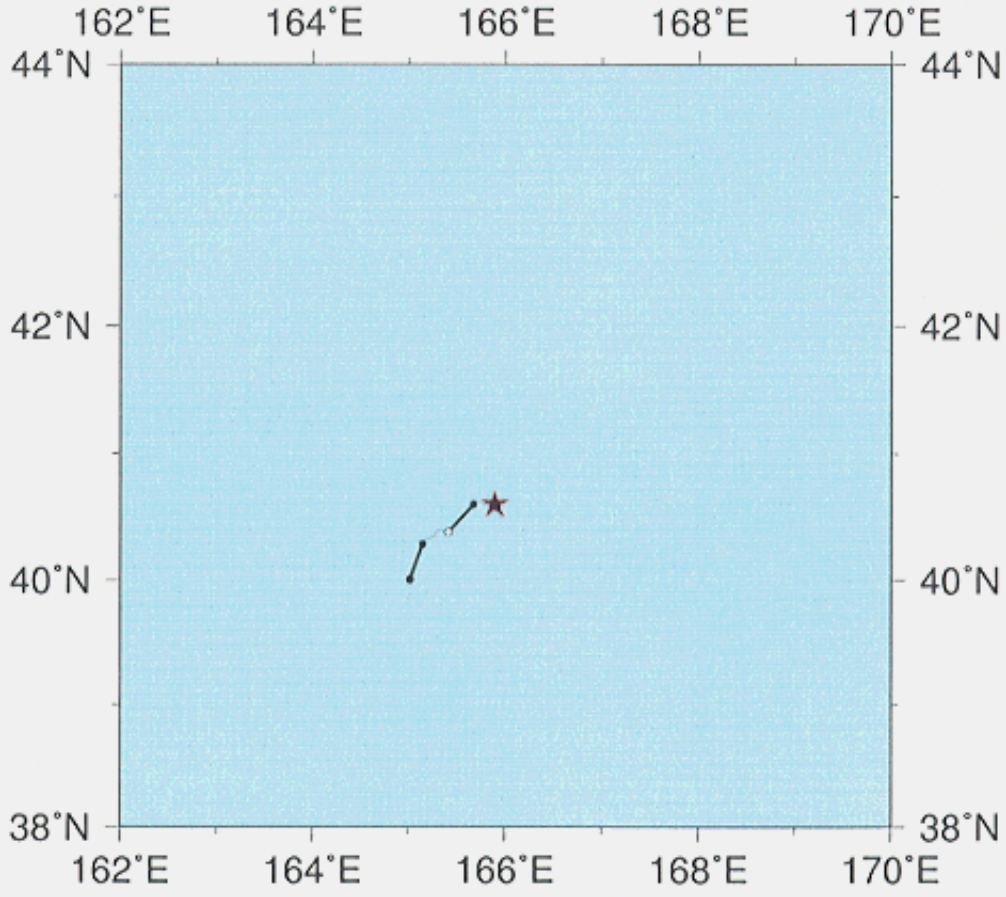


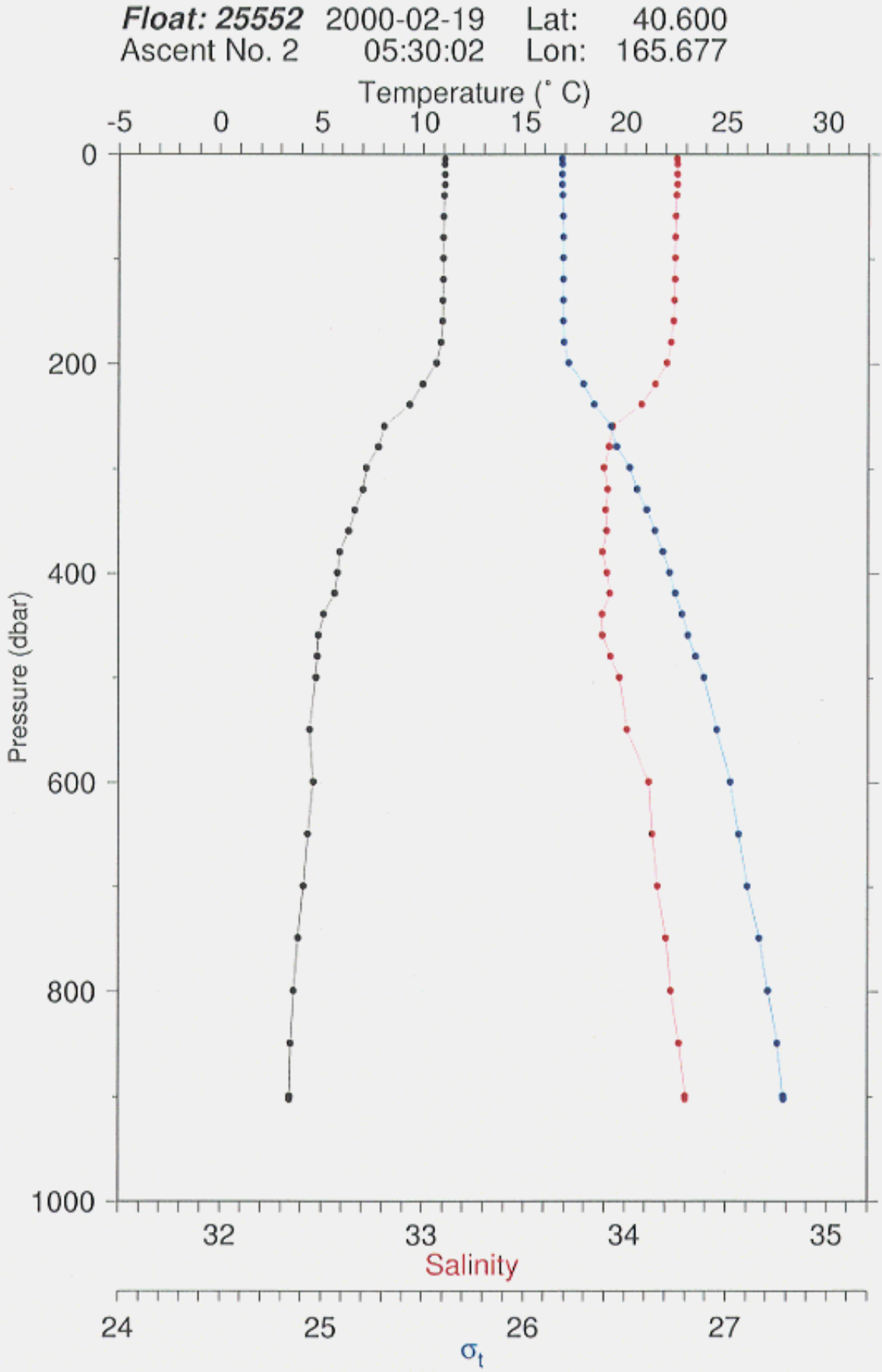

Float: 25554 2000-02-18 Lat: 40.701
Ascent No. 2 02:20:10 Lon: 165.543
Temperature (° C)
-5
0
5
10
15
20
25
30
0
200
400
600
800
1000
Pressure (dbar)
32
33
34
35
Salinity
24
25
26
27
σt



ID: 25552 (As of 19 Feb. 2000)
(Deployed on 31 Jan. 2000)

★:Most Recent Location of Float.




Float: 25552 2000-02-19 Lat: 40.600
Ascent No. 2 05:30:02 Lon: 165.677
Temperature (° C)
-5
0
5
10
15
20
25
30
0
200
400
600
800
1000
Pressure (dbar)
32
33
34
35
Salinity
24
25
26
27
σt

3.21 Shipboard ADCP

Satoshi Okumura
(Global Ocean Development Inc.)

Introduction

Acoustic Doppler Current Profiler (ADCP) measurements were performed continuously throughout MR00-K01 cruise from the departure of Sekinehama on 6 January 2000 to the return to Sekinehama on 7 February 2000.

Methods

The current profile data were measured by VM-75 shipboard ADCP system arranged by RD Instruments, Inc. U.S.A..

Major parameters for the measurement configuration are as follows:

Frequency:	75 kHz
Average:	every 300 sec.
Depth cell length:	1600 cm
No. of depth cells:	40
First depth call position:	30.9 m
Last depth cell position:	654.9 m
Ping per ADCP raw data:	16

Preliminary results

Two-hourly current vectors of 2-hour running mean averaged data are plotted for 30.9 m layer (Fig. 3.21.1), 206.9 m layer (Fig.3.21.2) respectively.

Data archive

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

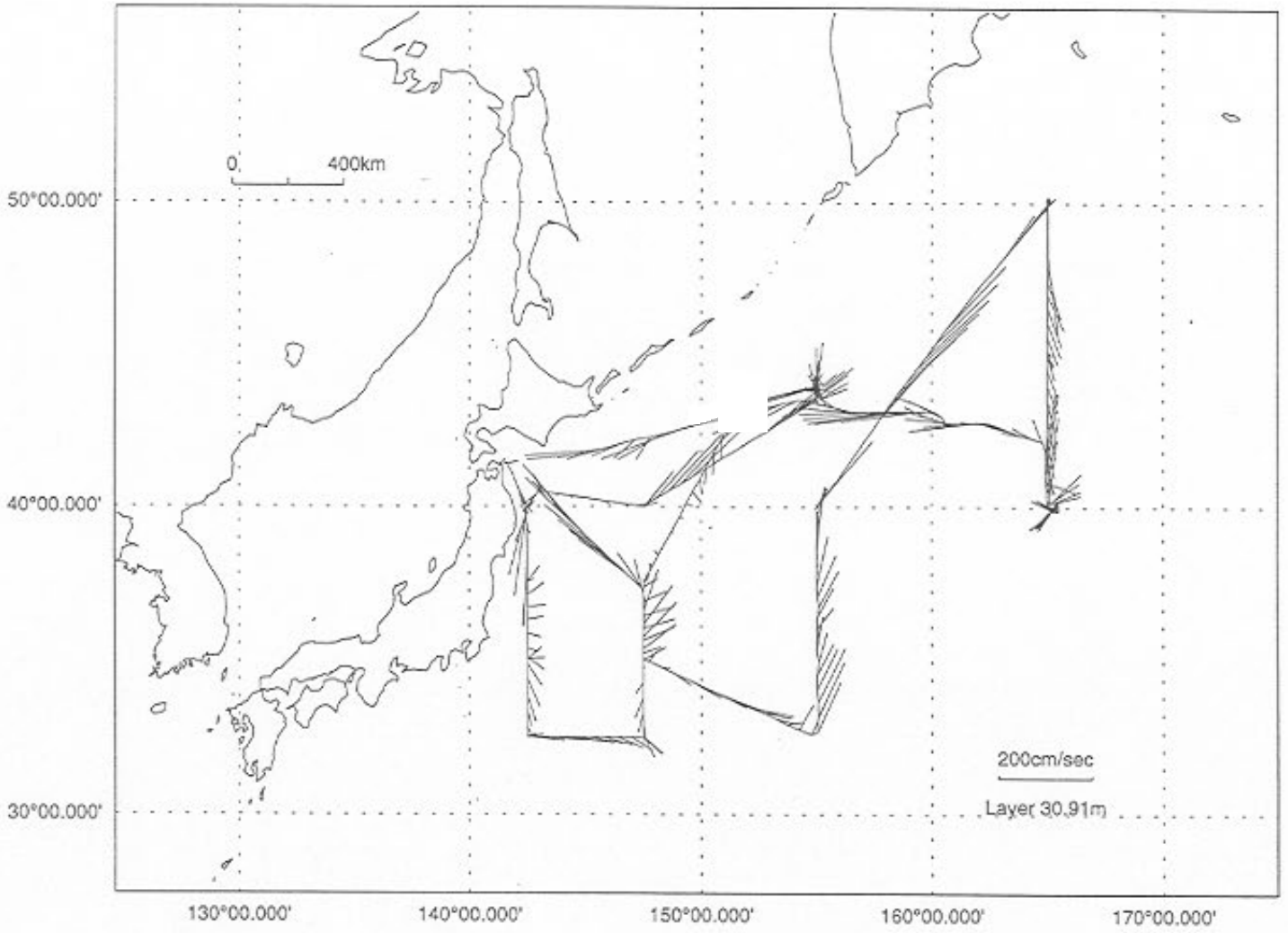

0
400km
50°00.000'
40°00.000'
30°00.000'
130°00.000'
140°00.000'
150°00.000'
160°00.000'
170°00.000'
200cm/sec
Layer 30.91m

Fig. 3.21.1

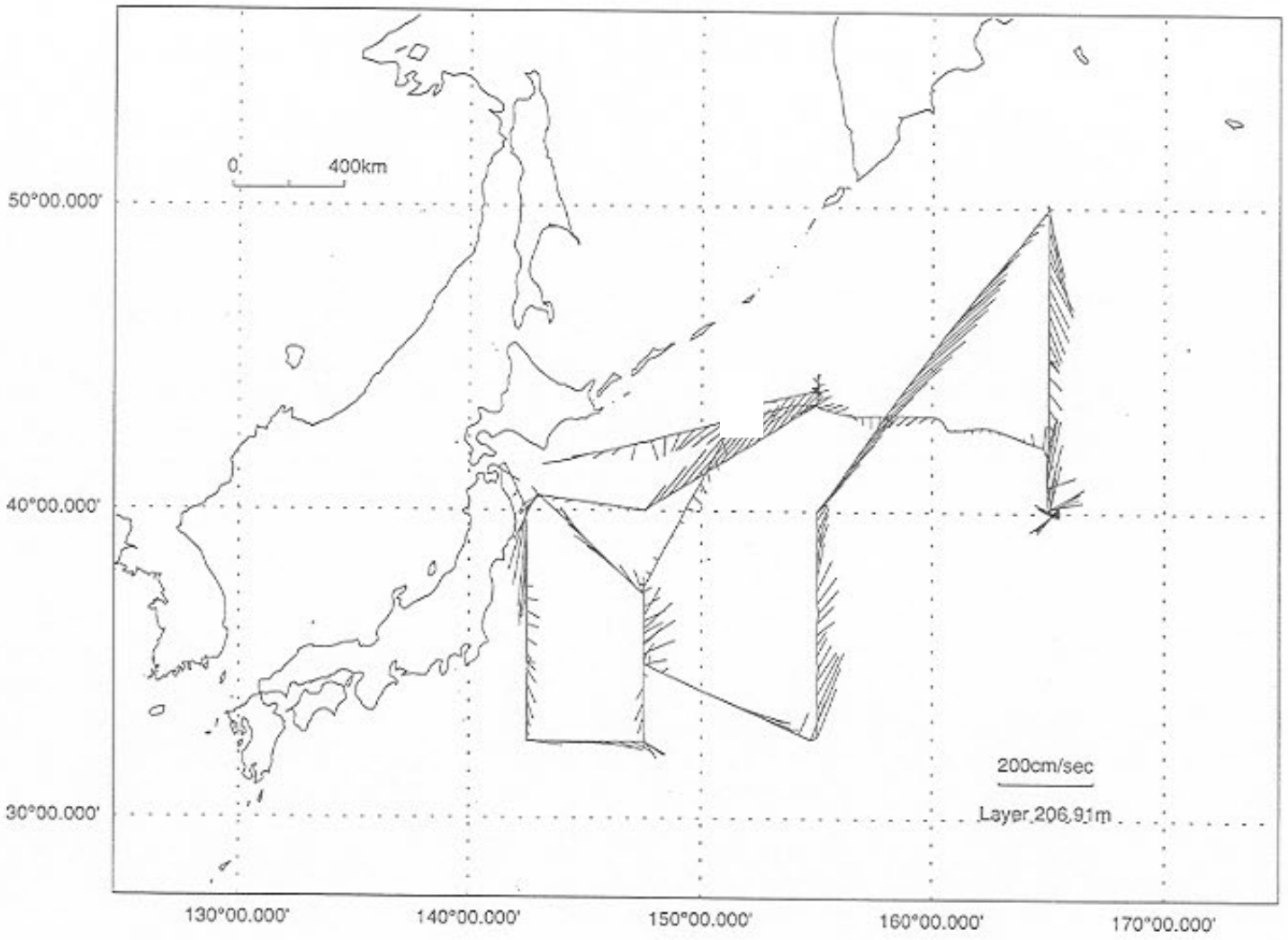

0
400km
50°00.000'
40°00.000'
30°00.000'
130°00.000'
140°00.000'
150°00.000'
160°00.000'
170°00.000'
200cm/sec
Layer 206.91m

Fig.3.21.2

3.22 Geological / Geophysical Observation

Toshio Furuta and Satoshi Okumura
(Global Ocean Development Inc.)

3.22.1 Sea Beam Observation

1. Objectives

(1) To obtain the continuous swath water depth for contribution of geological/geophysical and physical oceanographically investigation.

(2) To obtain bathymetric data for deep water sampling.

To perform the above 2 items, the Sea Beam observation is carried out routinely along the ship tracks through the cruise (Fig. 3.22.1.1) . In addition to the swath survey along the tracks , the determination of water depth is performed on the CTD cast sites.

2. Instruments

A 12kHz Seabeam 2112 Multi Narrow Beam Bathymetric Survey System with 4KHz Subbottom Profiler manufactured by the Sea Beam Instruments, Inc., USA is used for measuring water depth.

3. Summary

We carried out bathymetric survey during MR00-K01 cruise. Sound velocity profiles to be used ray path correction of acoustic multibeam were provided from data of CTD casts along the ship tracks and short XBT data.

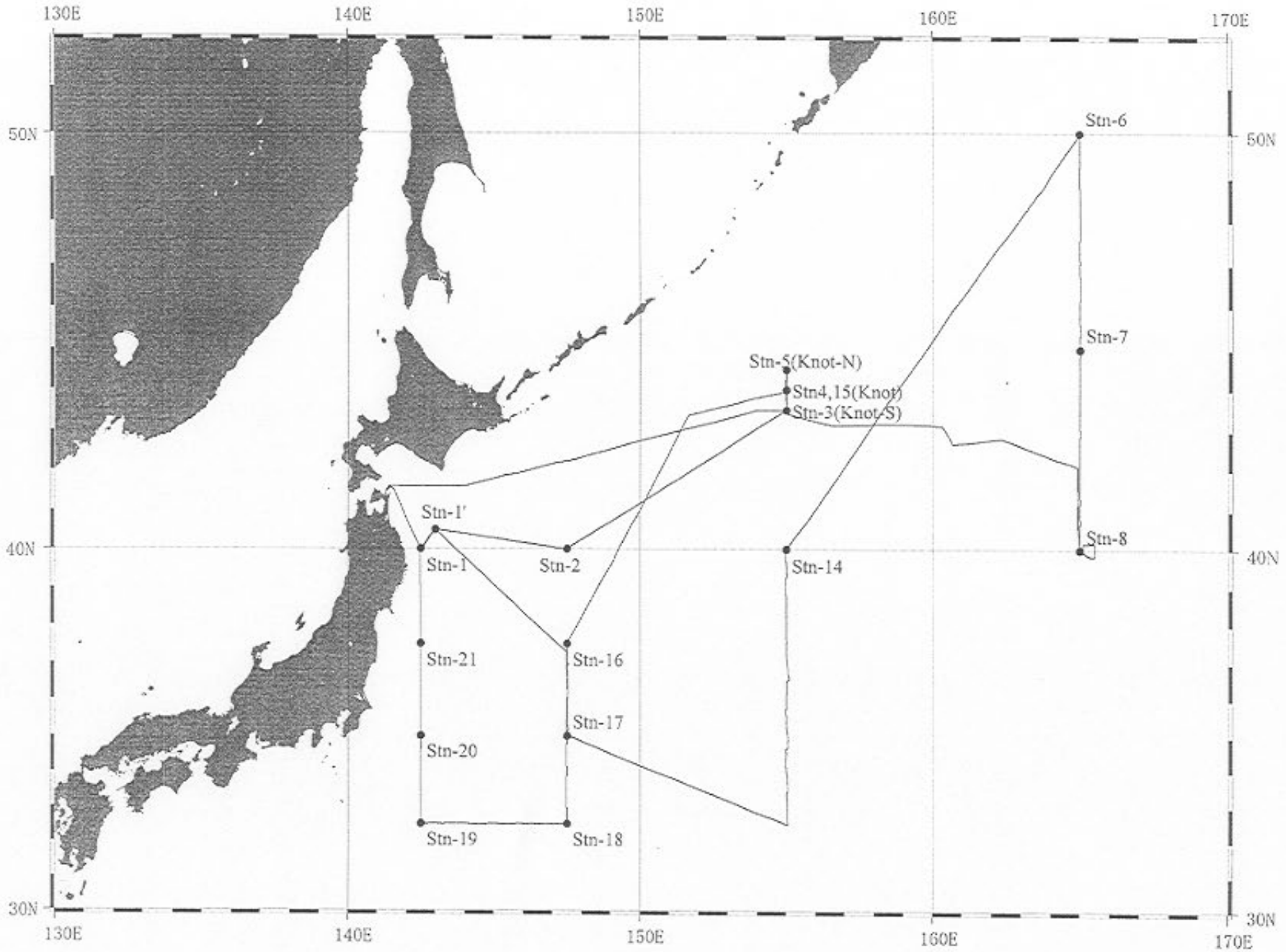
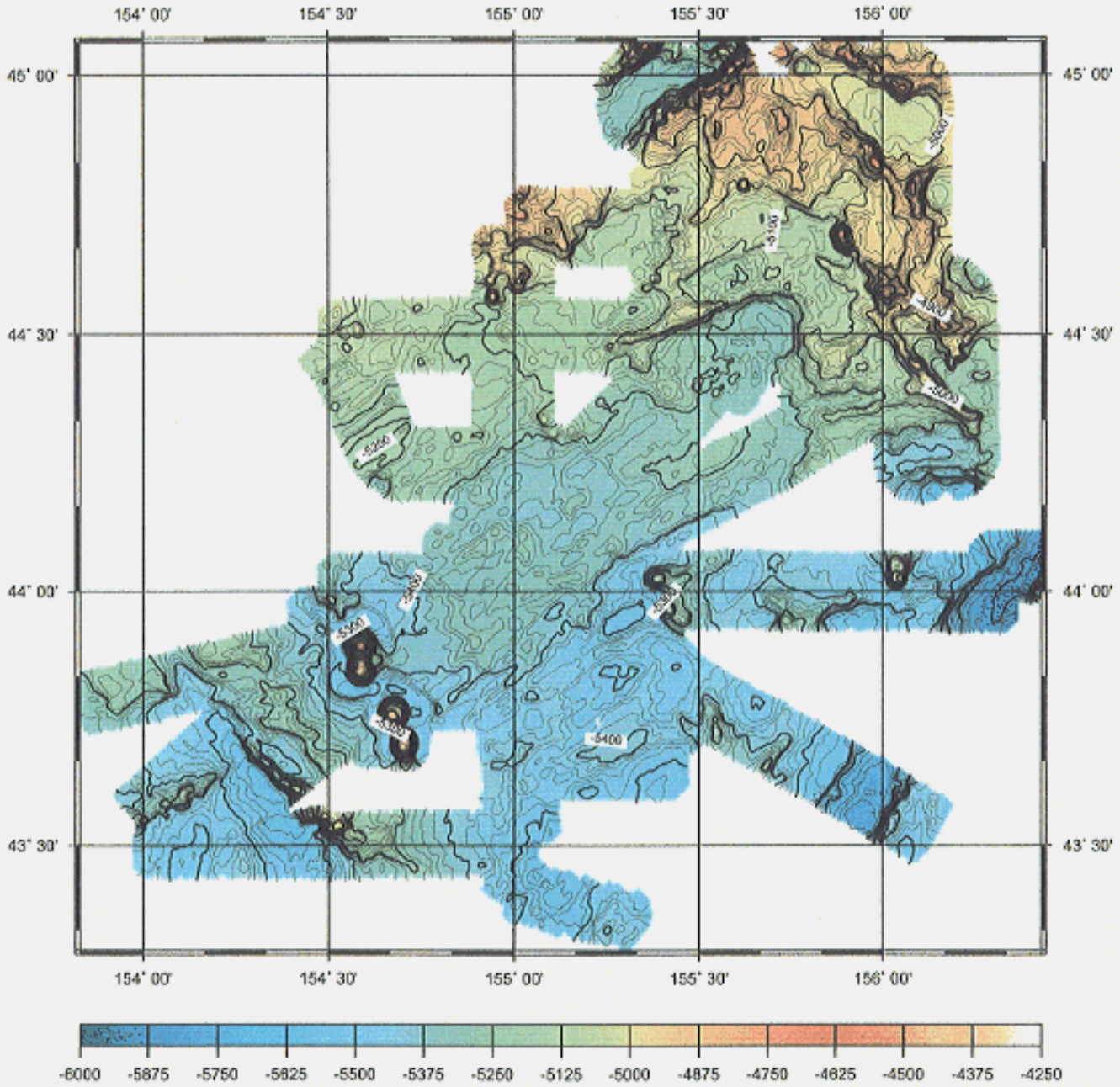
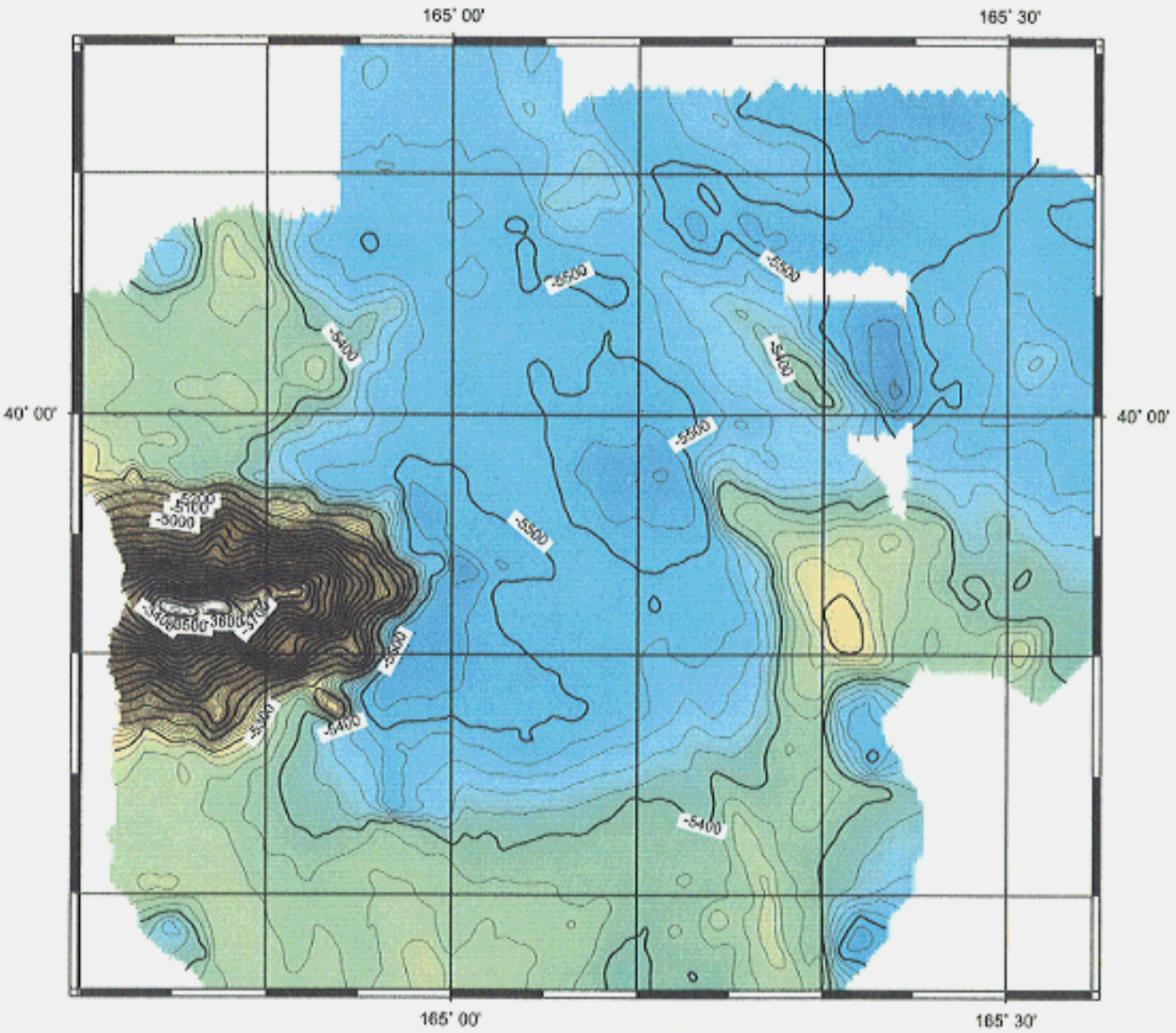


Fig. 3.22.1.1. Ship Track, MR00-K01

KNOT and Adjacent Area



Station 8



3.22.2 Sea Surface Gravity Measurement

1.Objective

To obtain the continuous gravity measurement for contribution of geophysical investigation.

To perform the above item, the sea surface gravity is measured relative variation of gravity values through the cruise.

2. Instruments

Gravity measurement on the sea is using by a LaCoste-Romberg gravitymeter S-116. To determine of drift ratio of the surface gravity sensor, we measured the gravity values at the each port using by an Automated Gravity Meter CG-3M Autogav, SCINTREX, in comparison with the surface gravity sensor.

3. Summary

We carried out gravity measurement during MR00-K01 cruise. Detailed data analysis based on the measurements will be done on the shore base. Drift ratio during the cruise was determined by the relative gravity values between the start and finished ones at the Sekinehama Port. The value is fairly good less than 0.1mgal during 35days.

3.22.3 Surface Three Component Magnetometer

1.Objective

To obtain the continuous three component magnetic field measurement for contribution of geophysical investigation.

To perform the above item, the three component measurement of total geomagnetic filed is carried out through the cruise.

2. Instruments

A three component magnetometer system of SFG-1214 is manufactured by Tierra Tecnica, Inc.

3. Summary

We get three component magnetic data during MR00-K01 cruise. The database containing high ratio of ship attitude is a very useful not only for geomagnetic investigation but also for precise ship movement analysis.

4. Remarks

The system is no trouble and we get a good three component magnetic data.

Appendix

1. CTD BOTTLE LIST

Note:

Routine data is available for only cruise participants.

Routine data has not been corrected yet. Please contact parson in charge for each analysis.

Station: Stn.1

	Start	Bottom	End
Date/Time:	1/6/00, 09:05	1/6/00, 09:13	1/6/00, 09:33
Lat.:	39°59.40'N	39°59.26'N	
Long.:	142°30.09'E	142°30.05'E	
Depth (m):	759	756	756

(GMT)

Remarks:
Water samples for radionuclide (JAMSTEC Kawakami)

CTD file #: 0001L01.DAT

Bottle #	CTD data Depth [m]	Pressure [db]	Temp. [. C]	Pot-Temp [. C]	Salinity [PSU]	Sigma-t [kg/m^3]	DO [µmol/kg]
1	300.7	303.2	4.765	4.742	33.925	26.849	
2	300.7	303.3	4.812	4.789	33.943	26.858	
3	250.8	252.9	3.708	3.691	33.701	26.782	
4	251.0	253.1	3.804	3.787	33.706	26.776	
5	200.7	202.4	3.503	3.490	33.540	26.674	
6	200.7	202.4	3.504	3.491	33.539	26.673	
7	149.0	150.2	4.091	4.081	33.484	26.571	
8	150.7	151.9	4.067	4.057	33.481	26.571	
9	100.0	100.8	6.802	6.793	33.464	26.236	
10	99.9	100.7	7.179	7.170	33.512	26.221	
11	74.4	75.0	8.077	8.070	33.661	26.211	
12	75.5	76.1	8.080	8.073	33.661	26.210	
13	59.8	60.3	8.083	8.077	33.661	26.210	
14	60.2	60.7	8.083	8.077	33.661	26.210	
15	49.7	50.1	8.081	8.076	33.661	26.210	
16	50.6	51.0	8.081	8.076	33.661	26.210	
17	39.1	39.4	8.082	8.078	33.661	26.210	
18	39.4	39.7	8.082	8.078	33.661	26.210	
19	29.7	29.9	8.080	8.077	33.661	26.211	
20	29.4	29.7	8.081	8.078	33.661	26.210	
21	19.6	19.8	8.076	8.074	33.661	26.211	
22	20.2	20.3	8.076	8.074	33.661	26.211	
23	9.6	9.6	8.077	8.076	33.660	26.211	
24	9.7	9.8	8.077	8.076	33.661	26.211	

Station: Stn.1

	Start	Bottom	End
Date/Time:	1/6/00, 10:08	1/6/00, 10:33	1/6/00,
Lat.:	39°59.00'N	39°58.75'N	39°58.05'N
Long.:	142°30.08'E	142°30.13'E	142°30.28'E
Depth (m):	759	754	753

(GMT)

Remarks:
Water samples #6-24 for routine and etc.
Water samples #1-5 for coccolith (JAMSTEC Harada)
DO sensor not available

CTD file #: 0001L02.DAT

Bottle #	CTD data														
	Depth [m]	Pressure [db]	Temp. [deg C]	Pot-Temp [deg C]	Salinity [PSU]	Sigma-t [kg/m^3]	DO [µmol/kg]	Salinity [psu]	DO [µmol/kg]	pH (T) 25C	TA [µmol/kg]	TDIC [µmol/kg]	NO2 [µmol/kg]	NO3 [µmol/kg]	PO4 [µmol/kg]	SiO4 [µmol/kg]
1	199.2	200.8	3.922	3.909	33.566	26.653		-	-	-	-	-	-	-	-	-
2	149.2	150.4	4.969	4.958	33.557	26.535		-	-	-	-	-	-	-	-	-
3	100.2	101.0	7.050	7.041	33.508	26.236		-	-	-	-	-	-	-	-	-
4	50.0	50.4	8.048	8.043	33.653	26.209		-	-	-	-	-	-	-	-	-
5	9.9	10.0	8.047	8.046	33.652	26.208		-	-	-	-	-	-	-	-	-
6	699.7	706.3	3.564	3.515	34.313	27.283		-	-	-	-	-	-	-	-	-
7	699.1	705.7	3.566	3.517	34.313	27.283		34.314	44.8	7.389	2356.4	2333.7	0.08	42.84	3.12	123.3
8	600.0	605.5	3.443	3.402	34.204	27.208		34.204	-	7.343	2343.7	2334.7	0.07	42.85	3.10	118.0
9	499.4	503.9	3.753	3.718	34.129	27.118		34.129	49.4	7.352	2329.1	2319.9	0.07	41.56	3.02	106.3
10	399.0	402.5	4.951	4.920	34.150	27.007		34.148	83.2	7.447	2319.0	2274.2	0.08	36.89	2.68	85.54
11	299.3	301.8	3.322	3.303	33.697	26.816		33.704	141.0	7.443	2283.0	2239.4	0.08	34.54	2.59	72.82
12	248.9	251.0	3.853	3.836	33.674	26.746		33.675	183.1	7.536	2271.8	2207.7	0.07	29.56	2.23	58.11
13	198.9	200.6	3.922	3.908	33.567	26.654		33.568	221.2	7.597	2263.4	2170.8	0.08	26.26	2.01	48.12
14	147.5	148.7	4.731	4.720	33.533	26.542		33.539	244.5	7.665	2255.3	2144.3	0.07	22.26	1.70	37.72
15	124.4	125.4	6.789	6.778	33.683	26.410		33.694	231.6	7.72	2257.7	2126.2	0.08	19.28	1.49	31.82
16	100.3	101.1	6.969	6.960	33.491	26.234		33.500	284.0	7.822	2246.5	2068.7	0.27	11.64	1.00	19.85
17	80.0	80.7	7.981	7.973	33.640	26.208		33.643	283.2	7.851	2255.7	2061.8	0.30	10.11	0.87	16.90
18	59.1	59.5	8.040	8.035	33.651	26.208		33.653	282.4	7.856	2252.0	2062.9	0.29	10.04	0.88	16.69
19	48.8	49.2	8.048	8.043	33.653	26.209		-	282.6	7.857	2252.8	2065.6	0.29	10.01	0.82	16.72
20	39.5	39.8	8.048	8.044	33.653	26.209		33.654	282.7	7.856	2250.6	2064.7	0.29	10.03	0.83	16.72
21	28.8	29.0	8.046	8.043	33.652	26.209		33.654	282.5	7.856	2245.8	2065.6	0.30	10.04	0.83	16.72
22	19.5	19.7	8.046	8.044	33.652	26.208		33.653	282.9	7.856	2243.0	2064.6	0.30	10.06	0.83	16.78
23	9.7	9.8	8.046	8.045	33.652	26.208		33.653	281.5	7.857	2247.5	2062.5	0.29	10.09	0.84	16.75
24	5.2	5.2	8.046	8.045	33.651	26.208		33.655	282.8	7.856	2245.1	2066.6	0.29	10.10	0.83	16.83
								1/19/00	Jan.30'00		2/4/00	2/16/00	1.16.00	Jan.25'00	Jan.25'00	Jan.25'00

Station: Stn.1

	Start	Bottom	End
Date/Time:	1/7/00, 01:03	1/7/00, 01:26	1/7/00, 01:49
Lat.:	40°00.03'N	39°59.68'N	39°59.23'N
Long.:	142°29.87'E	142°29.79'E	142°29.81'E
Depth (m):	759	753	753

(GMT)

Remarks:
Water samples #7-12 for trace element (JAMSTEC Nakabayashi)

CTD file #: 0001S01.DAT

Bottle #	CTD data Depth [m]	Pressure [db]	Temp. [deg C]	Pot-Temp [deg C]	Salinity [PSU]	Sigma-t [kg/m^3]	DO [μmol/kg]
7	699.6	706.2	3.486	3.437	34.278	27.264	
8	597.8	603.3	3.946	3.903	34.200	27.155	
9	498.9	503.4	4.535	4.497	34.148	27.051	
10	399.5	403.0	4.983	4.951	34.061	26.933	
11	301.3	303.8	3.470	3.451	33.681	26.789	
12	249.6	251.7	3.283	3.267	33.536	26.691	
13							
14							
15							
16							
17							
18							
19							
20							
21							
22							
23							
24							

Station: Stn.1

	Start	Bottom	End
Date/Time:	1/7/00, 02:25	1/7/00, 02:32	1/7/00, 02:49
Lat.:	39° 58.85'N	39° 58.78'N	39° 58.60'N
Long.:	142° 29.23'E	142° 29.10'E	142° 28.82'E
Depth (m):	739	739	731

(GMT)

Remarks:
Water samples for trace element (JAMSTEC Nakabayashi)

CTD file #: 0001S02.DAT

Bottle #	CTD data						
	Depth [m]	Pressure [db]	Temp. [。C]	Pot-Temp [。C]	Salinity [PSU]	Sigma-t [kg/m^3]	DO [μmol/kg]
1	201.6	203.2	3.393	3.381	33.460	26.620	
2	150.3	151.5	4.490	4.479	33.467	26.516	
3	124.7	125.7	5.107	5.098	33.488	26.464	
4	99.2	100.0	6.862	6.853	33.518	26.270	
5	80.9	81.6	6.803	6.796	33.477	26.245	
6	60.8	61.3	6.808	6.803	33.477	26.245	
7	49.7	50.1	6.741	6.736	33.465	26.244	
8	40.2	40.5	6.702	6.698	33.453	26.240	
9	29.5	29.8	6.661	6.658	33.445	26.240	
10	20.0	20.1	6.632	6.630	33.439	26.238	
11	9.2	9.3	7.279	7.278	33.527	26.220	
12	5.6	5.7	7.498	7.498	33.566	26.220	
13							
14							
15							
16							
17							
18							
19							
20							
21							
22							
23							
24							

Station: Stn.21

	Start	Bottom	End
Date/Time:	1/7/00, 13:23	1/7/00, 13:30	1/7/00, 13:45
Lat.:	37°30.43'N	37°30.43'N	37°30.53'N
Long.:	142°29.90'E	142°29.81'E	142°29.66'E
Depth (m):	1196	1197	1189

(GMT)

Remarks:
Water samples for trace elements (JAMSTEC Nakabayashi)

CTD file #: 0021S01.DAT

Bottle #	CTD data Depth [m]	Pressure [db]	Temp. [°C]	Pot-Temp [°C]	Salinity [PSU]	Sigma-t [kg/m^3]	DO [µmol/kg]
1	198.7	200.3	11.133	11.108	34.353	26.248	
2	148.4	149.6	12.793	12.773	34.406	25.974	
3	126.4	127.3	13.608	13.590	34.318	25.741	
4	101.8	102.6	13.721	13.706	34.252	25.667	
5	79.1	79.7	14.859	14.847	34.404	25.543	
6	61.1	61.6	16.648	16.638	34.630	25.313	
7	49.5	49.9	17.267	17.259	34.642	25.176	
8	40.0	40.3	17.936	17.930	34.635	25.008	
9	30.0	30.2	18.177	18.171	34.635	24.949	
10	20.1	20.2	18.227	18.224	34.636	24.937	
11	10.6	10.7	18.225	18.223	34.636	24.937	
12	3.7	3.8	18.223	18.222	34.636	24.938	
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Station: Stn.21

	Start	Bottom	End
Date/Time:	1/7/00, 14:31	1/7/00, 14:55	1/7/00, 15:25
Lat.:	37° 30.77'N	37° 30.86'N	37° 30.94'N
Long.:	142° 29.92'E	142° 29.74'E	142° 29.48'E
Depth (m):	1208	1202	1193

(GMT)

Remarks:
Water samples for trace elements (JAMSTEC Nakabayashi)

CTD file #: 0021S02.DAT

Bottle #	CTD data						
	Depth [m]	Pressure [db]	Temp. [。C]	Pot-Temp [。C]	Salinity [PSU]	Sigma-t [kg/m^3]	DO [μmol/kg]
1	1001.3	1011.3	2.858	2.791	34.392	27.412	
2	1000.5	1010.4	2.859	2.792	34.391	27.412	
3	998.3	1008.2	2.859	2.792	34.391	27.412	
4	998.2	1008.1	2.859	2.792	34.391	27.412	
5	998.8	1008.7	2.859	2.792	34.391	27.412	
6	800.0	807.5	3.102	3.048	34.329	27.340	
7	697.8	704.2	3.386	3.338	34.296	27.287	
8	599.3	604.7	3.450	3.409	34.207	27.210	
9	499.1	503.4	3.617	3.583	34.103	27.111	
10	398.8	402.1	4.987	4.956	34.167	27.016	
11	299.3	301.7	7.047	7.019	34.260	26.830	
12	248.6	250.6	8.049	8.024	34.208	26.644	
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Station: Stn.21

	Start	Bottom	End
Date/Time:	1/7/00, 15:44	1/7/00, 16:27	1/7/00, 17:19
Lat.:	37°30.83'N	37°31.26'N	37°31.74'N
Long.:	142°29.57'E	142°29.59'E	142°29.45'E
Depth (m):	1190	1204	1208

(GMT)

Remarks:
Water samples for routine and etc.

CTD file #: 0021L01.DAT

Bottle #	CTD data														
	Depth [m]	Pressure [db]	Temp. [°C]	Pot-Temp [°C]	Salinity [PSU]	Sigma-t [kg/m^3]	DO [µmol/kg]	Salinity [psu]	DO [µmol/kg]	pH (T) 25C	TA [µmol/kg]	TDIC [µmol/kg]	NO2 [µmol/kg]	NO3 [µmol/kg]	PO4 [µmol/kg]	SiO4 [µmol/kg]
1	1001.5	1011.5	2.840	2.773	34.400	27.421	31.6	-	-		-	-	-	-	-	-
2	1002.0	1012.0	2.842	2.774	34.400	27.420	31.6	-	-		-	-	-	-	-	-
3	1002.9	1012.8	2.842	2.774	34.400	27.420	31.6	-	-		-	-	-	-	-	-
4	1002.9	1012.9	2.842	2.774	34.400	27.420	31.6	-	-		-	-	-	-	-	-
5	1004.1	1014.1	2.839	2.771	34.401	27.421	31.8	34.402	34.8	7.372	2380.8	2356.6	0.00	40.95	3.18	142.9
6	799.4	807.0	3.085	3.032	34.332	27.344	30.4	34.332	33.3	7.359	2372.7	2338.9	0.00	41.04	3.17	133.9
7	700.6	707.0	3.276	3.228	34.294	27.296	32.9	34.294	35.9	7.357	2358.7	2336.9	0.00	40.78	3.14	127.3
8	599.8	605.1	3.470	3.429	34.192	27.197	34.7	34.193	-	7.340	2341.2	2331.1	0.00	40.77	3.14	117.5
9	500.1	504.5	3.639	3.604	34.108	27.113	44.2	34.107	46.7	7.341	2327.8	2307.9	0.00	40.13	3.08	107.1
10	400.1	403.5	3.957	3.929	34.033	27.021	69.5	34.033	70.7	7.382	2317.4	2295.8	0.00	37.73	2.92	93.80
11	303.3	305.8	6.944	6.915	34.271	26.852	109.5	34.270	109.3	7.571	2312.6	2221.9	0.00	29.43	2.26	66.87
12	251.1	253.1	8.089	8.063	34.222	26.650	135.8	34.223	135.3	7.636	-	2185.0	0.00	25.28	1.96	51.80
13	198.1	199.7	10.866	10.842	34.345	26.290	162.5	34.348	163.3	7.756	2283.1	2125.2	0.00	18.24	1.40	28.64
14	150.0	151.1	12.427	12.407	34.332	25.988	184.0	34.335	184.9	7.833	2278.8	2085.1	0.01	13.39	1.06	20.90
15	127.0	128.0	13.638	13.620	34.340	25.752	198.2	[redacted]	201.3	7.896	2272.7	2058.4	0.01	9.46	0.79	14.09
16	100.6	101.4	13.323	13.309	34.119	25.646	225.1	34.124	226.5	7.936	2265.9	2032.2	0.02	6.57	0.60	10.42
17	80.1	80.8	14.314	14.302	34.297	25.577	205.8	[redacted]	208.5	7.928	2271.3	2036.5	0.02	7.55	0.66	11.38
18	59.5	59.9	16.548	16.539	34.617	25.327	195.3	34.619	199.4	7.961	2279.8	2024.3	0.33	6.38	0.58	9.32
19	50.6	51.0	17.376	17.368	34.653	25.158	193.0	-	199.7	7.978	2273.9	2019.4	0.21	5.60	0.51	7.66
20	39.6	39.9	17.996	17.989	34.641	24.999	209.6	34.644	215.4	8.015	2277.1	1997.5	0.42	3.32	0.36	5.35
21	29.5	29.7	18.129	18.124	34.642	24.966	215.0	34.644	222.4	8.030	2276.0	1990.6	0.42	2.45	0.32	4.51
22	19.5	19.6	18.149	18.146	34.642	24.961	216.9	34.643	223.8	8.033	2270.1	1994.8	0.41	2.30	0.30	4.29
23	7.8	7.8	18.151	18.150	34.642	24.961	217.4	34.643	224.0	8.040	2279.8	1987.8	0.41	2.33	0.30	4.32
24	7.9	8.0	18.149	18.147	34.642	24.961	216.1	34.645	223.9	8.032	2276.0	1986.6	0.42	2.30	0.30	4.29
								1/22/00	Jan.30'00		2/4/00	2/16/00	1.16.00	Jan.25'00	Jan.25'00	Jan.25'00

Station: Stn.20

	Start	Bottom	End
Date/Time:	18/00, 05:44	1/8/00, 05:59	1/8/00, 06:23
Lat.:	35°00.48'N	35°00.76'N	35°01.15'N
Long.:	142°30.30'E	142°30.42'E	142°30.67'E
Depth (m):	6526	6520	6517

(GMT)

Remarks:
Water samples for trace elements (JAMSTEC Nakabayashi)

CTD file #: 0020S01.DAT

Bottle #	CTD data						
	Depth [m]	Pressure [db]	Temp. [°C]	Pot-Temp [°C]	Salinity [PSU]	Sigma-t [kg/m^3]	DO [µmol/kg]
1	502.2	506.5	13.324	13.253	34.501	25.941	
2	398.6	401.9	15.736	15.673	34.674	25.557	
3	297.9	300.3	17.596	17.546	34.777	25.200	
4	250.6	252.5	18.389	18.345	34.797	25.020	
5	200.6	202.1	19.107	19.070	34.733	24.790	
6	150.1	151.3	19.357	19.329	34.702	24.702	
7	100.8	101.5	19.913	19.895	34.699	24.555	
8	71.1	71.6	19.976	19.963	34.700	24.539	
9	50.8	51.1	19.976	19.967	34.700	24.539	
10	29.8	30.0	19.978	19.973	34.700	24.539	
11	11.6	11.7	19.990	19.988	34.701	24.536	
12	5.8	5.9	19.981	19.980	34.701	24.538	
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Station: Stn.20

	Start	Bottom	End	
Date/Time:	1/8/00, 08:22	1/8/00, 09:56	1/8/00, 11:03	(GMT)
Lat.:	35°02.31'N	35°02.79'N	35°03.10'N	
Long.:	142°31.89'E	142°32.82'E	142°33.46'E	
Depth (m):	6468	6470	6455	

Remarks:
Water samples for routine
Water samples #1,2,3,5,6,8 for trace elements
(JAMSTEC Nakabayashi)

CTD file #: 0020S02.DAT

Bottle #	CTD data															
	Depth [m]	Pressure [db]	Temp. [deg C]	Pot-Temp [deg C]	Salinity [PSU]	Sigma-t [kg/m^3]	DO [µmol/kg]	Salinity [µmol/kg]	DO [µmol/kg]	pH (T) 25C	TA [µmol/kg]	TDIC [µmol/kg]	NO2 [µmol/kg]	NO3 [µmol/kg]	PO4 [µmol/kg]	SiO4 [µmol/kg]
1	2996.9	3040.5	1.617	1.394	34.650	27.721		34.657	136.2		2432.9	2335.1	0.02	37.68	2.87	153.45
2	1998.4	2022.7	2.087	1.948	34.574	27.623		34.579	77.4	7.436	2422.8	2353.8	0.02	40.26	3.10	153.09
3	1499.0	1515.4	2.631	2.527	34.471	27.496		34.476	45.9	7.395	2404.2	2358.1	0.03	41.85	3.25	146.77
4	1248.4	1261.3	3.174	3.085	34.391	27.383		34.396	46.7	7.393	2391.7	2351.6	0.02	41.12	3.22	132.04
5	1000.9	1010.6	4.052	3.975	34.276	27.205		34.280	57.7	7.411	2362.8	2312.1	0.03	39.32	3.08	109.97
6	800.6	808.0	5.582	5.513	34.159	26.940		-	97.1	7.502	2329.0	2255.3	0.03	33.76	2.66	78.40
7	698.3	704.6	7.008	6.940	34.187	26.777		34.192	120.2	7.584	2317.7	2213.5	0.03	29.37	2.34	62.11
8	601.1	606.4	9.928	9.857	34.297	26.415		34.306	152.3	7.724	2302.4	2143.1	0.03	21.31	1.71	37.17
9	500.5	504.8	13.068	12.998	34.478	25.975		34.487	179.3	7.850	2292.9	2089.2	0.03	13.75	1.07	17.99
10	400.3	403.6	15.873	15.809	34.682	25.532		34.690	192.5	7.944	2294.7	2047.7	0.03	8.13	0.67	8.46
11	299.8	302.2	17.819	17.767	34.782	25.149		34.790	196.7	7.999	2298.3	2020.1	0.04	5.02	0.43	4.69
12	250.4	252.4	18.559	18.515	34.786	24.969		34.793	200.7	8.019	2299.5	2009.6	0.04	3.65	0.32	3.66
								1/19/00	Jan.30'00		2/4/00	2/16/00	1.16.00	Jan,25'00	Jan,25'00	Jan,25'00

Station: Stn.20

	Start	Bottom	End
Date/Time:	1/8/00, 11:57	1/8/00, 12:04	1/8/00, 12:21
Lat.:	35°02.80'N	35°02.89'N	35°03.09'N
Long.:	142°31.53'E	142°31.65'E	142°31.81'E
Depth (m):	6477	6478	6480

(GMT)

Remarks:
Water samples for routine

CTD file #: 0020S03.DAT

Bottle #	CTD data Depth [m]	Pressure [db]	Temp. [. C]	Pot-Temp [. C]	Salinity [PSU]	Sigma-t [kg/m^3]	DO [µmol/kg]	Salinity [psu]	DO [µmol/kg]	pH (T) 25C	TA [µmol/kg]	TDIC [µmol/kg]	NO2 [µmol/kg]	NO3 [µmol/kg]	PO4 [µmol/kg]	SiO4 [µmol/kg]
1	199.8	201.3	19.273	19.237	34.790	24.791		34.796	200.3	8.031	2344.7	1999.5	0.04	2.87	0.28	3.14
2	150.8	151.9	19.643	19.615	34.722	24.643		34.717	216.9	8.072	2340.5	1978.1	0.26	1.08	0.21	2.24
3	124.0	124.9	19.938	19.915	34.699	24.548		34.706	219.9	8.087	2331.1	1966.2	0.36	0.62	0.13	2.09
4	99.8	100.5	19.995	19.976	34.701	24.535		34.706	220.9	8.087	2325.1	1961.2	0.36	0.53	0.12	1.99
5	79.3	79.8	19.992	19.977	34.701	24.536		34.707	221.0	8.086	2310.2	1969.7	0.36	0.53	0.12	1.99
6	60.4	60.9	19.991	19.980	34.702	24.537		-	221.2	8.086	2292.8	1967.2	0.35	0.51	0.10	2.02
7	50.4	50.8	19.989	19.979	34.701	24.537		-	221.2	8.087	2287.7	1962.4	0.36	0.51	0.14	2.06
8	40.5	40.7	19.983	19.976	34.702	24.539		34.708	221.4	8.088	2280.4	1969.6	0.35	0.51	0.13	1.99
9	28.8	29.0	19.985	19.980	34.702	24.538		34.709	221.2	8.086	2274.1	1962.1	0.34	0.52	0.15	2.02
10	19.4	19.5	19.984	19.980	34.702	24.538		34.707	221.3	8.084	2276.3	1965.8	0.35	0.54	0.14	2.14
11	10.2	10.3	19.981	19.979	34.702	24.540		34.706	221.3	8.081	2275.6	1965.1	0.36	0.52	0.12	2.12
12	4.0	4.0	19.978	19.977	34.702	24.541		34.707	221.5	8.083	2279.6	1968.5	0.36	0.51	0.14	2.12
								1/22/00	Jan.30'00		2/4/00	2/16/00	1.16.00	Jan,25'00	Jan,25'00	Jan,25'00

Station: Stn.19

	Start	Bottom	End
Date/Time:	1/8/00, 23:00	1/8/00, 23:13	1/8/00, 23:37
Lat.:	32°30.21'N	32°30.22'N	32°30.16'N
Long.:	142°29.57'E	142°29.46'E	142°29.38'E
Depth (m):	7604	7609	7627

(GMT)

Remarks:
Water samples for trace elements (JAMSTEC Nakabayashi)

CTD file #: 0019S01.DAT

Bottle #	CTD data						
	Depth [m]	Pressure [db]	Temp. [. C]	Pot-Temp [. C]	Salinity [PSU]	Sigma-t [kg/m^3]	DO [µmol/kg]
1	499.5	503.6	13.391	13.320	34.505	25.931	
2	399.8	403.0	15.563	15.500	34.665	25.589	
3	300.1	302.4	17.377	17.326	34.770	25.248	
4	249.5	251.4	18.077	18.033	34.779	25.084	
5	200.9	202.4	18.741	18.705	34.785	24.922	
6	147.9	149.0	19.828	19.801	34.767	24.629	
7	98.3	99.0	20.255	20.237	34.675	24.446	
8	69.9	70.4	20.405	20.392	34.673	24.405	
9	49.5	49.9	20.411	20.402	34.675	24.405	
10	30.2	30.4	20.409	20.403	34.675	24.406	
11	10.3	10.4	20.406	20.404	34.675	24.407	
12	5.2	5.2	20.404	20.403	34.675	24.407	
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Station: Stn.19

	Start	Bottom	End
Date/Time:	1/9/00, 00:43	1/9/00, 01:53	1/9/00, 03:33
Lat.:	32°30.39'N	32°31.04'N	32°31.83'N
Long.:	142°29.09'E	142°28.95'E	142°28.60'E
Depth (m):	7655	7662	7775

(GMT)

Remarks:
Water samples for routine and etc.

CTD file #: 0019L01.DAT
CTD file #: 19L01_2.DAT

Bottle #	CTD data														
	Depth [m]	Pressure [db]	Temp. [。C]	Pot-Temp [。C]	Salinity [PSU]	Sigma-t [kg/m^3]	DO [μmol/kg]	Salinity [psu]	DO [μmol/kg]	pH (T) 25C	TA [μmol/kg]	TDIC [μmol/kg]	NO2 [μmol/kg]	NO3 [μmol/kg]	PO4 [μmol/kg]	SiO4 [μmol/kg]
1	2999.3	3042.3	1.588	1.365	34.661	27.732	130.7	34.661	126.8	7.550	2413.5	2335.6	0.03	37.72	2.83	150.5
2	1999.8	2023.7	2.088	1.948	34.576	27.625	66.7	-	-	-	-	-	-	-	-	-
3	1501.4	1517.5	2.566	2.462	34.483	27.511	41.1	34.482	45.2	7.394	2388.2	2354.5	0.03	42.38	3.27	148.7
4	1249.6	1262.3	3.234	3.144	34.397	27.382	45.4	34.397	49.4	7.402	2366.3	2343.9	0.03	41.34	3.20	129.9
5	999.3	1008.8	4.230	4.153	34.241	27.158	57.2	34.240	60.2	7.415	2337.0	2293.9	0.04	39.22	3.06	103.7
6	798.9	806.1	5.757	5.686	34.099	26.871	113.2	34.094	113.1	7.526	2300.0	2224.3	0.04	32.26	2.54	69.78
7	699.7	705.8	7.299	7.230	34.036	26.618	171.7	34.034	171.0	7.662	2282.4	2165.5	0.04	24.24	1.95	44.27
8	599.2	604.4	10.612	10.538	34.314	26.311	167.9	34.317	167.9	7.765	2278.3	2118.6	0.04	18.91	1.65	28.58
9	499.6	503.8	13.321	13.251	34.503	25.943	179.1	34.501	180.1	7.858	2278.5	2081.0	0.03	13.45	1.05	16.40
10	400.0	403.2	15.405	15.343	34.658	25.619	190.1	34.659	194.3	7.936	2279.8	2043.5	0.04	8.59	0.67	7.96
11	300.1	302.4	17.256	17.206	34.771	25.277	188.7	34.771	194.9	7.982	2282.7	2019.5	0.05	5.97	0.47	4.63
12	250.9	252.9	18.054	18.010	34.784	25.093	188.3	34.786	-	-	-	-	0.04	4.91	0.39	3.78
13	198.5	200.0	18.864	18.829	34.797	24.900	195.1	34.798	204.5	8.030	2282.9	2002.4	0.05	2.84	0.27	2.02
14	148.7	149.8	20.086	20.058	34.687	24.501	209.4	34.688	219.4	8.081	2277.1	1966.7	0.28	0.47	0.11	0.97
15	124.1	125.0	20.110	20.087	34.674	24.484	209.3	34.675	220.7	8.081	2277.9	1971.8	0.31	0.33	0.11	0.91
16	101.3	102.1	20.250	20.231	34.678	24.450	211.0	-	-	-	-	-	-	-	-	-
17	79.3	79.9	20.243	20.228	34.660	24.439	211.0	34.661	222.7	8.089	2275.6	1965.7	0.21	0.14	0.10	0.81
18	60.2	60.7	20.293	20.282	34.666	24.430	210.5	34.666	222.8	8.090	2277.7	1961.8	0.19	0.15	0.09	0.72
19	49.9	50.2	20.344	20.335	34.673	24.421	209.2	34.674	222.8	8.090	2276.2	1950.3	0.21	0.15	0.10	0.75
20	39.8	40.0	20.364	20.357	34.675	24.418	210.0	34.675	223.2	8.091	2276.8	1954.1	0.20	0.16	0.10	0.82
21	27.7	27.9	20.369	20.364	34.676	24.417	210.2	34.676	223.3	8.090	2278.6	1953.0	0.20	0.15	0.10	1.06
22	18.7	18.8	20.368	20.364	34.676	24.417	212.1	34.677	223.5	8.091	2264.5	1955.7	0.20	0.15	0.11	0.93
23	8.5	8.6	20.372	20.370	34.676	24.416	211.7	34.677	223.5	8.089	2274.6	1954.2	0.20	0.17	0.12	0.87
24	6.1	6.1	20.374	20.372	34.676	24.415	210.8	-	223.5	8.090	2276.5	1950.1	0.21	0.17	0.12	0.94
								1/21/00	Jan.30'00		2/4/00	2/16/00	1.16.00	Jan.25'00	Jan.25'00	Jan.25'00

Station: Stn.19

	Start	Bottom	End
Date/Time:	1/9/00, 04:34	1/9/00, 06:34	1/9/00, 08:32
Lat.:	32°31.28'N	32°31.69'N	32°31.75'N
Long.:	142°29.38'E	142°29.25'E	142°28.95'E
Depth (m):	7628	7692	7731

(GMT)

Remarks:
Water samples for trace elements (JAMSTEC Nakabayashi)

CTD file #: 0019S02.DAT

Bottle #	CTD data						
	Depth [m]	Pressure [db]	Temp. [°C]	Pot-Temp [°C]	Salinity [PSU]	Sigma-t [kg/m^3]	DO [µmol/kg]
1	6000.0	6128.3	1.638	1.054	34.685	27.747	
2	5000.2	5095.5	1.515	1.069	34.685	27.757	
3	4499.8	4580.3	1.480	1.096	34.683	27.757	
4	4001.9	4068.7	1.482	1.156	34.678	27.753	
5	3501.6	3556.0	1.512	1.240	34.670	27.744	
6	2999.4	3042.4	1.588	1.365	34.656	27.728	
7	2500.8	2533.7	1.743	1.564	34.631	27.696	
8	2000.3	2024.2	2.068	1.928	34.575	27.626	
9	1500.9	1517.0	2.574	2.470	34.477	27.505	
10	999.9	1009.4	4.245	4.167	34.233	27.150	
11	798.8	806.0	5.816	5.745	34.085	26.853	
12	597.6	602.7	10.852	10.777	34.326	26.277	
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Station: Stn.18

	Start	Bottom	End
Date/Time:	1/10/00, 02:37	1/10/00, 03:39	1/10/00, 05:14
Lat.:	32°29.60'N	32°28.90'N	32°28.37'N
Long.:	147°30.26'E	147°31.31'E	147°32.88'E
Depth (m):	6016	6012	6012

(GMT)

Remarks:
Water samples for routine and etc.

CTD file #: 0018L01.DAT

Bottle #	CTD data														
	Depth [m]	Pressure [db]	Temp. [°C]	Pot-Temp [°C]	Salinity [PSU]	Sigma-t [kg/m^3]	DO [µmol/kg]	Salinity [psu]	DO [µmol/kg]	pH (T) 25C	TA [µmol/kg]	TDIC [µmol/kg]	NO2 [µmol/kg]	NO3 [µmol/kg]	PO4 [µmol/kg]	SiO4 [µmol/kg]
1	3004.7	3047.8	1.559	1.336	34.664	27.736	132.185	34.671	128.2	7.558	2416.8	2335.4	0.03	37.13	2.86	150.7
2	2000.7	2024.6	1.982	1.844	34.591	27.645	71.299	34.591	74.2	7.458	2410.5	2364.2	0.03	40.50	3.15	156.4
3	1499.1	1515.2	2.493	2.390	34.497	27.529	39.985	34.497	43.9	7.398	2396.0	2373.6	0.03	42.12	3.29	148.9
4	1250.8	1263.4	2.914	2.826	34.425	27.434	38.728	34.426	43.0	7.387	2381.2	2358.8	0.02	41.68	3.29	137.6
5	1000.1	1009.6	3.573	3.500	34.306	27.277	40.213	34.306	43.5	7.381	2355.9	2340.5	0.03	40.91	3.23	119.4
6	799.6	806.8	4.344	4.283	34.133	27.060	65.712	34.131	68.2	7.408	2322.9	2301.2	0.03	38.08	3.02	94.77
7	699.6	705.7	5.304	5.246	34.108	26.933	99.322	-	100.3	7.489	2310.1	2255.1	0.03	33.79	2.69	76.96
8	599.7	604.8	6.628	6.572	34.075	26.741	142.633	34.074	142.3	7.595	2293.1	2197.7	0.03	27.69	2.21	55.64
9	499.8	504.0	9.607	9.550	34.229	26.416	163.433	34.232	163.1	7.720	2286.2	2148.4	0.03	20.74	1.66	35.43
10	400.3	403.5	13.473	13.416	34.503	25.912	178.895	34.509	180.2	7.856	2275.7	2087.6	0.04	12.78	1.00	17.10
11	300.8	303.1	16.626	16.576	34.734	25.398	185.697	34.736	190.4	7.947	2289.9	2043.5	0.05	7.24	0.55	7.12
12	249.4	251.3	17.663	17.620	34.786	25.190	193.481	34.788	199.3	7.986	2280.4	2025.7	0.04	4.89	0.37	4.34
13	200.9	202.4	18.212	18.177	34.791	25.060	196.321	34.794	203.3	8.004	2278.7	2010.3	0.05	3.82	0.30	3.47
14	151.1	152.3	18.904	18.877	34.758	24.861	190.253	34.764	199.9	8.011	2289.6	2009.7	0.08	3.53	0.30	3.89
15	125.0	125.9	19.246	19.224	34.725	24.748	213.038	34.727	224.6	8.059	2279.0	1980.7	0.25	0.79	0.11	2.00
16	99.4	100.1	19.252	19.234	34.726	24.747	214.327	34.726	224.9	8.060	2278.5	1984.0	0.25	0.75	0.10	1.97
17	81.3	81.8	19.246	19.231	34.723	24.746	213.968	34.724	224.9	8.062	2283.5	1975.8	0.25	0.76	0.11	1.97
18	58.5	58.9	19.239	19.228	34.720	24.746	211.460	34.722	224.6	8.060	2276.3	1979.7	0.25	0.78	0.12	2.02
19	50.3	50.7	19.231	19.222	34.716	24.745	213.233	34.720	224.5	8.062	2285.1	1979.3	0.26	0.82	0.12	2.00
20	38.8	39.1	19.226	19.219	34.713	24.744	214.355	34.717	224.9	8.062	2278.3	1977.8	0.25	0.81	0.12	2.02
21	30.3	30.5	19.224	19.219	34.712	24.744	213.586	34.716	225.1	8.062	2277.1	1979.8	0.25	0.81	0.12	2.02
22	20.0	20.2	19.242	19.239	34.713	24.740	212.923	34.716	226.2	8.062	2282.8	1975.0	0.24	0.75	0.12	2.02
23	9.6	9.7	19.281	19.279	34.717	24.733	215.379	34.718	226.9	8.062	2279.7	1978.4	0.23	0.71	0.12	1.94
24	3.7	3.7	19.280	19.279	34.717	24.733	212.931	34.718	226.8	8.062	2278.3	1979.8	0.24	0.72	0.14	2.02
								1/19/00	Jan.30'00		2/4/00	2/16/00	1.16.00	Jan.25'00	Jan.25'00	Jan.25'00

Station: Stn.18

	Start	Bottom	End
Date/Time:	1/10/00, 01:46	1/10/00, 01:58	1/10/00, 02:21
Lat.:	32°29.96'N	32°29.92'N	32°29.82'N
Long.:	147°29.53'E	147°29.70'E	147°30.01'E
Depth (m):	6019	6017	6019

(GMT)

Remarks:
Water samples for trace elements (JAMSTEC Nakabayashi)
Water smaples #8,10,11, and 12 for primary productivity (CREST)

CTD file #: 0018S01.DAT

Bottle #	CTD data						
	Depth [m]	Pressure [db]	Temp. [, C]	Pot-Temp [, C]	Salinity [PSU]	Sigma-t [kg/m^3]	DO [µmol/kg]
1	500.3	504.4	10.484	10.423	34.300	26.322	
2	401.0	404.2	13.928	13.870	34.531	25.839	
3	299.7	302.1	16.771	16.722	34.733	25.364	
4	250.5	252.4	17.739	17.696	34.782	25.169	
5	199.6	201.1	18.390	18.355	34.788	25.013	
6	150.3	151.5	19.234	19.207	34.726	24.752	
7	100.2	101.0	19.235	19.217	34.716	24.744	
8	69.3	69.8	19.231	19.219	34.717	24.746	
9	49.8	50.2	19.235	19.226	34.719	24.746	
10	29.7	29.9	19.228	19.223	34.716	24.746	
11	9.9	10.0	19.268	19.266	34.717	24.736	
12	5.0	5.0	19.254	19.253	34.716	24.739	
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Station: Stn.18

	Start	Bottom	End	
Date/Time:	1/10/00, 05:46	1/10/00, 07:35	1/10/00, 09:35	(GMT)
Lat.:	32°28.36'N	32°27.58'N	32°27.11'N	
Long.:	147°32.89'E	147°34.06'E	147°34.98'E	
Depth (m):	6013	6036	6043	

Remarks:
Water samples for trace elements (JAMSTEC Nakabayashi)

CTD file #: 0018S02.DAT

Bottle #	CTD data						
	Depth [m]	Pressure [db]	Temp. [°C]	Pot-Temp [°C]	Salinity [PSU]	Sigma-t [kg/m^3]	DO [µmol/kg]
1	6004.8	6133.2	1.619	1.035	34.687	27.750	
2	4999.8	5095.1	1.517	1.071	34.685	27.756	
3	4501.0	4581.5	1.488	1.104	34.683	27.756	
4	3999.5	4066.3	1.481	1.156	34.678	27.753	
5	3502.6	3557.0	1.510	1.238	34.670	27.745	
6	2999.9	3042.9	1.575	1.352	34.657	27.730	
7	2499.4	2532.2	1.707	1.530	34.634	27.701	
8	2000.0	2023.9	1.977	1.839	34.588	27.644	
9	1500.2	1516.3	2.474	2.371	34.495	27.529	
10	999.4	1008.9	3.583	3.510	34.297	27.269	
11	799.2	806.4	4.471	4.409	34.132	27.046	
12	599.1	604.2	7.264	7.206	34.082	26.659	
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Station: Stn.2

	Start	Bottom	End
Date/Time:	1/13/00, 02:59	1/13/00, 03:52	1/13/00, 05:12
Lat.:	40°00.88'N	40°00.97'N	40°01.03'N
Long.:	147°31.48'E	147°32.04'E	147°32.77'E
Depth (m):	5318	5320	5321

(GMT)

Remarks:
Water samples for routine and etc.

CTD file #: 0002L02.DAT

Bottle #	CTD data															
	Depth [m]	Pressure [db]	Temp. [°C]	Pot-Temp [°C]	Salinity [PSU]	Sigma-t [kg/m^3]	DO [µmol/kg]	Salinity [psu]	DO [µmol/kg]	pH (T) 25C	TA [µmol/kg]	TDIC [µmol/kg]	NO2 [µmol/kg]	NO3 [µmol/kg]	PO4 [µmol/kg]	SiO4 [µmol/kg]
1	3000.4	3045.4	1.514	1.292	34.668	27.743	134.4	34.667	131.8	7.555	2414.1	2334.7	0.00	38.21	2.56	151.32
2	1999.1	2024.3	1.836	1.700	34.611	27.673	82.3	34.610	85.3	7.473	2409.9	2357.3	0.00	41.20	2.80	157.99
3	1499.6	1516.6	2.175	2.076	34.542	27.591	49.9	34.542	54.5	7.408	2400.3	2374.5	0.00	43.09	2.97	157.00
4	1249.8	1263.2	2.396	2.314	34.492	27.532	38.9	34.489	43.7	7.384	2391.9	2372.3	0.00	43.61	3.01	152.45
5	999.6	1009.8	2.715	2.649	34.415	27.444	30.9	34.413	35.8	7.362	2376.0	2365.3	0.00	43.75	3.03	144.30
6	799.7	807.4	3.078	3.025	34.340	27.351	31.4	34.339	36.0	7.358	2366.5	2350.7	0.00	43.39	3.01	132.46
7	700.1	706.7	3.357	3.309	34.302	27.295	35.8	34.302	35.9	7.360	2356.7	2344.3	0.00	42.98	2.98	124.22
8	599.6	605.1	3.386	3.345	34.216	27.224	32.0	34.217	36.3	7.334	2344.9	2339.0	0.00	43.35	3.00	119.76
9	499.7	504.2	3.764	3.729	34.141	27.126	43.9	34.141	49.0	7.349	2331.9	2319.7	0.00	42.07	2.92	106.64
10	400.4	403.9	3.968	3.940	34.033	27.020	66.3	34.029	70.9	7.372	2314.3	2296.9	0.00	39.99	2.77	92.79
11	300.4	303.0	3.414	3.395	33.785	26.878	113.9	33.796	115.0	7.409	2291.8	2263.5	0.00	36.83	2.61	79.28
12	250.5	252.6	3.159	3.143	33.674	26.813	141.7	33.675	143.4	7.437	2281.7	2248.9	0.00	35.02	2.50	72.43
13	203.1	204.8	2.837	2.825	33.523	26.720	188.1	33.523	188.4	7.501	2267.2	2210.4	0.00	31.75	2.29	61.95
14	150.9	152.1	2.761	2.752	33.337	26.578	256.2	33.333	256.2	7.605	2250.4	2161.6	0.00	26.66	1.97	45.91
15	125.8	126.8	4.162	4.154	33.439	26.528	246.4	33.441	246.9	7.643	2255.1	2150.0	0.01	24.41	1.80	42.98
16	100.8	101.6	4.927	4.919	33.379	26.398	265.4	33.373	267.0	7.705	2249.2	2122.1	0.04	21.01	1.57	34.83
17	81.3	81.9	6.859	6.852	33.432	26.203	289.6	33.434	292.6	7.831	2244.2	2066.0	0.32	11.71	0.94	19.54
18	61.1	61.6	6.912	6.906	33.437	26.200	291.0	33.437	292.4	7.833	2244.1	2068.5	0.32	11.69	0.94	19.40
19	49.1	49.5	6.983	6.979	33.445	26.196	290.6	33.448	291.5	7.835	2242.3	2071.0	0.33	11.55	0.92	19.05
20	40.0	40.3	7.037	7.034	33.450	26.193	289.9	33.450	291.3	7.838	2244.0	2064.6	0.33	11.48	0.91	18.88
21	29.2	29.4	7.058	7.055	33.451	26.191	290.3	33.453	291.1	7.839	2243.3	2063.4	0.33	11.45	0.92	18.88
22	20.0	20.2	7.070	7.068	33.452	26.190	290.3	-	291.0	7.837	2243.1	2067.2	0.33	11.43	0.91	18.82
23	8.8	8.8	7.111	7.110	33.454	26.186	290.4	33.455	291.0	7.840	2244.1	2066.3	0.33	11.38	0.91	18.70
24	5.2	5.2	7.107	7.106	33.455	26.187	289.9	33.456	291.1	7.839	2246.3	2066.5	0.34	11.36	0.91	18.73
								1/19/00	Jan.30'00		2/4/00	2/16/00	1.16.00	Jan.25'00	Jan.25'00	Jan.25'00

Station: Stn.2

	Start	Bottom	End
Date/Time:	1/13/00, 01:24	1/13/00, 01:32	1/13/00, 01:57
Lat.:	40°00.23'N	40°00.27'N	40°00.35'N
Long.:	147°30.70'E	147°30.82'E	147°31.11'E
Depth (m):	5337	5332	5326

(GMT)

Remarks:
Water samples for radionuclide (JAMSTEC Kawakami)

CTD file #: 0002L01.DAT

Bottle #	CTD data						
	Depth [m]	Pressure [db]	Temp. [deg C]	Pot-Temp [deg C]	Salinity [PSU]	Sigma-t [kg/m^3]	DO [μmol/kg]
1	301.3	303.9	3.503	3.483	33.803	26.883	113.061
2	300.2	302.7	3.491	3.472	33.798	26.880	113.019
3	250.7	252.8	3.339	3.323	33.675	26.797	149.552
4	249.3	251.4	3.335	3.319	33.673	26.795	149.036
5	200.6	202.3	2.873	2.861	33.501	26.700	194.051
6	200.7	202.4	2.877	2.865	33.502	26.700	197.151
7	151.8	153.0	2.291	2.283	33.309	26.594	237.097
8	149.7	151.0	2.305	2.297	33.308	26.592	236.461
9	98.8	99.6	4.947	4.940	33.366	26.386	227.221
10	99.5	100.3	5.120	5.112	33.374	26.373	227.789
11	74.6	75.2	7.011	7.004	33.441	26.189	228.524
12	75.5	76.1	7.059	7.052	33.444	26.185	227.428
13	60.9	61.3	7.077	7.072	33.453	26.190	226.902
14	59.7	60.2	7.110	7.104	33.455	26.187	227.140
15	50.2	50.6	7.124	7.120	33.456	26.186	228.986
16	48.9	49.2	7.130	7.125	33.456	26.185	229.444
17	40.5	40.8	7.138	7.134	33.458	26.186	231.050
18	40.7	41.0	7.138	7.134	33.459	26.186	231.432
19	30.9	31.1	7.137	7.134	33.459	26.186	233.120
20	30.2	30.4	7.137	7.134	33.459	26.186	233.514
21	20.3	20.5	7.138	7.136	33.458	26.186	234.216
22	21.1	21.2	7.139	7.137	33.459	26.186	234.352
23	10.6	10.7	7.144	7.143	33.458	26.185	292.297
24	10.4	10.5	7.146	7.145	33.458	26.184	291.683

Station: Stn.2

	Start	Bottom	End	
Date/Time:	1/13/00, 02:15	1/13/00, 02:26	1/13/00, 02:46	(GMT)
Lat.:	40°00.48'N	40°00.61'N	40°00.81'N	
Long.:	147°31.08'E	147°31.17'E	147°31.33'E	
Depth (m):	5322	5322	5320	

Remarks:
Water samples for trace elements (JAMSTEC Nakabayashi)
Water samples #9,10,11,12 for primary productivity (CREST)

CTD file #: 0002S01.DAT

Bottle #	CTD data						
	Depth [m]	Pressure [db]	Temp. [deg. C]	Pot-Temp [deg. C]	Salinity [PSU]	Sigma-t [kg/m^3]	DO [µmol/kg]
1	500.3	504.7	3.753	3.718	34.142	27.129	
2	399.8	403.3	3.981	3.953	34.038	27.023	
3	300.3	302.8	3.807	3.787	33.820	26.867	
4	250.6	252.7	3.237	3.222	33.643	26.780	
5	199.6	201.2	2.695	2.683	33.470	26.691	
6	149.5	150.7	2.421	2.413	33.314	26.588	
7	100.0	100.8	5.105	5.097	33.382	26.381	
8	70.1	70.6	6.933	6.927	33.430	26.192	
9	50.0	50.4	7.142	7.138	33.453	26.181	
10	30.1	30.3	7.141	7.138	33.453	26.181	
11	9.5	9.6	7.135	7.134	33.454	26.182	
12	4.7	4.8	7.167	7.166	33.455	26.179	
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Station: Stn.2

	Start	Bottom	End
Date/Time:	1/13/00, 02:59	1/13/00, 03:52	1/13/00, 05:12
Lat.:	40°00.88'N	40°00.97'N	40°01.03'N
Long.:	147°31.48'E	147°32.04'E	147°32.77'E
Depth (m):	5318	5320	5321

(GMT)

Remarks:
Water samples for routine and etc.

CTD file #: 0002L02.DAT

Bottle #	CTD data														
	Depth [m]	Pressure [db]	Temp. [°C]	Pot-Temp [°C]	Salinity [PSU]	Sigma-t [kg/m^3]	DO [µmol/kg]	Salinity [psu]	DO [µmol/kg]	pH (T) 25C	TA [µmol/kg]	TDIC [µmol/kg]	NO2 [µmol/kg]	NO3 [µmol/kg]	PO4 [µmol/kg]	SiO4 [µmol/kg]
1	3000.4	3045.4	1.514	1.292	34.668	27.743	134.4	34.667	131.8	7.555	2414.1	2334.7	0.00	38.21	2.56	151.32
2	1999.1	2024.3	1.836	1.700	34.611	27.673	82.3	34.610	85.3	7.473	2409.9	2357.3	0.00	41.20	2.80	157.99
3	1499.6	1516.6	2.175	2.076	34.542	27.591	49.9	34.542	54.5	7.408	2400.3	2374.5	0.00	43.09	2.97	157.00
4	1249.8	1263.2	2.396	2.314	34.492	27.532	38.9	34.489	43.7	7.384	2391.9	2372.3	0.00	43.61	3.01	152.45
5	999.6	1009.8	2.715	2.649	34.415	27.444	30.9	34.413	35.8	7.362	2376.0	2365.3	0.00	43.75	3.03	144.30
6	799.7	807.4	3.078	3.025	34.340	27.351	31.4	34.339	36.0	7.358	2366.5	2350.7	0.00	43.39	3.01	132.46
7	700.1	706.7	3.357	3.309	34.302	27.295	35.8	34.302	35.9	7.360	2356.7	2344.3	0.00	42.98	2.98	124.22
8	599.6	605.1	3.386	3.345	34.216	27.224	32.0	34.217	36.3	7.334	2344.9	2339.0	0.00	43.35	3.00	119.76
9	499.7	504.2	3.764	3.729	34.141	27.126	43.9	34.141	49.0	7.349	2331.9	2319.7	0.00	42.07	2.92	106.64
10	400.4	403.9	3.968	3.940	34.033	27.020	66.3	34.029	70.9	7.372	2314.3	2296.9	0.00	39.99	2.77	92.79
11	300.4	303.0	3.414	3.395	33.785	26.878	113.9	33.796	115.0	7.409	2291.8	2263.5	0.00	36.83	2.61	79.28
12	250.5	252.6	3.159	3.143	33.674	26.813	141.7	33.675	143.4	7.437	2281.7	2248.9	0.00	35.02	2.50	72.43
13	203.1	204.8	2.837	2.825	33.523	26.720	188.1	33.523	188.4	7.501	2267.2	2210.4	0.00	31.75	2.29	61.95
14	150.9	152.1	2.761	2.752	33.337	26.578	256.2	33.333	256.2	7.605	2250.4	2161.6	0.00	26.66	1.97	45.91
15	125.8	126.8	4.162	4.154	33.439	26.528	246.4	33.441	246.9	7.643	2255.1	2150.0	0.01	24.41	1.80	42.98
16	100.8	101.6	4.927	4.919	33.379	26.398	265.4	33.373	267.0	7.705	2249.2	2122.1	0.04	21.01	1.57	34.83
17	81.3	81.9	6.859	6.852	33.432	26.203	289.6	33.434	292.6	7.831	2244.2	2066.0	0.32	11.71	0.94	19.54
18	61.1	61.6	6.912	6.906	33.437	26.200	291.0	33.437	292.4	7.833	2244.1	2068.5	0.32	11.69	0.94	19.40
19	49.1	49.5	6.983	6.979	33.445	26.196	290.6	33.448	291.5	7.835	2242.3	2071.0	0.33	11.55	0.92	19.05
20	40.0	40.3	7.037	7.034	33.450	26.193	289.9	33.450	291.3	7.838	2244.0	2064.6	0.33	11.48	0.91	18.88
21	29.2	29.4	7.058	7.055	33.451	26.191	290.3	33.453	291.1	7.839	2243.3	2063.4	0.33	11.45	0.92	18.88
22	20.0	20.2	7.070	7.068	33.452	26.190	290.3	-	291.0	7.837	2243.1	2067.2	0.33	11.43	0.91	18.82
23	8.8	8.8	7.111	7.110	33.454	26.186	290.4	33.455	291.0	7.840	2244.1	2066.3	0.33	11.38	0.91	18.70
24	5.2	5.2	7.107	7.106	33.455	26.187	289.9	33.456	291.1	7.839	2246.3	2066.5	0.34	11.36	0.91	18.73
								1/19/00	Jan.30'00		2/4/00	2/16/00	1.16.00	Jan.25'00	Jan.25'00	Jan.25'00

Station: Stn.2

	Start	Bottom	End
Date/Time:	1/13/00, 05:37	1/13/00, 06:33	1/13/00, 07:32
Lat.:	40°01.18'N	40°01.69'N	40°02.19'N
Long.:	147°33.05'E	147°33.51'E	147°34.27'E
Depth (m):	5317	5311	5311

(GMT)

Remarks:
Water samples for trace elements (JAMSTEC Nakabayashi)

CTD file #: 0002S02.DAT

Bottle #	CTD data						
	Depth [m]	Pressure [db]	Temp. [. C]	Pot-Temp [. C]	Salinity [PSU]	Sigma-t [kg/m^3]	DO [µmol/kg]
1	2999.2	3044.2	1.507	1.286	34.663	27.739	
2	2999.5	3044.5	1.507	1.286	34.663	27.739	
3	2999.0	3044.0	1.507	1.286	34.663	27.739	
4	2999.1	3044.0	1.507	1.286	34.663	27.739	
5	2998.4	3043.4	1.508	1.287	34.663	27.739	
6	2997.3	3042.3	1.508	1.287	34.663	27.739	
7	2500.3	2534.8	1.637	1.461	34.641	27.712	
8	1999.2	2024.4	1.850	1.714	34.604	27.666	
9	1500.6	1517.7	2.217	2.117	34.533	27.580	
10	1000.7	1010.9	2.797	2.730	34.404	27.427	
11	800.1	807.8	3.132	3.078	34.336	27.343	
12	600.1	605.6	3.406	3.365	34.197	27.206	
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Station: **Stn.4 (KNOT1)**

	Start	Bottom	End
Date/Time:	1/16/00, 00:43	1/16/00, 01:01	1/16/00, 01:29
Lat.:	44°00.06'N	44°00.29'N	44°00.54'N
Long.:	155°02.43'E	155°02.61'E	155°02.61'E
Depth (m):	5303	5310	5316

(GMT)

Remarks:
Water samples for radionuclide (Narita and harada)
w. N2/Ar/O2 and Ne (Roberta)

CTD file #: 0004L01.DAT

Bottle #	CTD data						
	Depth [m]	Pressure [db]	Temp. [deg C]	Pot-Temp [deg C]	Salinity [PSU]	Sigma-t [kg/m^3]	DO [µmol/kg]
1	302.5	305.1	3.281	3.261	33.954	27.024	33.3
2	249.7	251.8	3.181	3.165	33.841	26.944	53.6
3	197.2	198.8	3.034	3.022	33.714	26.856	85.6
4	150.0	151.2	2.398	2.390	33.488	26.729	163.2
5	124.7	125.7	1.753	1.747	33.313	26.638	232.4
6	99.2	100.0	1.394	1.390	33.149	26.532	291.3
7	74.8	75.4	3.319	3.314	32.862	26.150	317.5
8	48.3	48.7	3.642	3.639	32.818	26.086	322.7
9	31.0	31.3	3.640	3.638	32.817	26.085	323.0
10	19.0	19.1	3.656	3.655	32.815	26.082	323.1
11	8.4	8.5	3.693	3.692	32.810	26.075	323.3
12	6.4	6.4	3.693	3.693	32.811	26.075	323.2
13	299.5	302.2	3.280	3.261	33.948	27.020	32.8
14	199.7	201.4	3.031	3.018	33.712	26.854	87.1
15	150.4	151.7	2.391	2.382	33.485	26.727	165.1
16	125.1	126.1	1.750	1.744	33.312	26.638	234.5
17	102.3	103.2	1.387	1.382	33.149	26.532	294.2
18	79.7	80.4	2.742	2.738	32.936	26.260	309.1
19	59.8	60.3	3.610	3.606	32.830	26.098	322.3
20	50.8	51.2	3.629	3.626	32.826	26.093	323.1
21	39.9	40.2	3.632	3.629	32.820	26.088	322.9
22	29.6	29.9	3.640	3.638	32.816	26.084	323.5
23	20.5	20.7	3.661	3.660	32.814	26.080	323.5
24	8.2	8.3	3.690	3.690	32.811	26.075	323.2

Station: **Stn.4**

	Start	Bottom	End	
Date/Time:	1/16/00, 02:27	1/16/00, 02:35	1/16/00, 02:49	(GMT)
Lat.:	44°00.63'N	44°00.63'N	44°00.61'N	
Long.:	155°02.71'E	155°02.71'E	155°02.69'E	
Depth (m):	5319	5319	5318	

Remarks:

Water samples #1-5 for coccolith (JAMSTEC Harada)
Water sample #9-12 for primary productivity

CTD file #: 0004S01.DAT

Bottle #	CTD data						
	Depth [m]	Pressure [db]	Temp. [deg C]	Pot-Temp [deg C]	Salinity [PSU]	Sigma-t [kg/m^3]	DO [µmol/kg]
1	200.0	201.7	3.051	3.039	33.719	26.858	
2	148.2	149.4	2.246	2.238	33.445	26.707	
3	100.4	101.2	1.395	1.390	33.149	26.532	
4	50.8	51.2	3.701	3.698	32.813	26.076	
5	10.4	10.4	3.730	3.729	32.794	26.058	
6	201.2	202.9	3.060	3.047	33.722	26.859	
7	200.7	202.4	3.054	3.042	33.719	26.858	
8	201.1	202.9	3.058	3.046	33.722	26.859	
9	50.4	50.8	3.708	3.705	32.807	26.071	
10	18.5	18.7	3.724	3.723	32.797	26.061	
11	4.3	4.3	3.730	3.730	32.795	26.058	
12	4.3	4.4	3.730	3.730	32.795	26.058	
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Station: **Stn.4**

	Start	Bottom	End
Date/Time:	1/16/00, 03:38	1/16/00, 05:27	1/16/00, 07:22
Lat.:	43° 59.99'N	43° 59.46'N	43° 58.85'N
Long.:	155° 00.07'E	154° 59.45'E	154° 58.48'E
Depth (m):	5294	5306	5302

(GMT)

Remarks:
Water samples for trace elements (JAMSTEC Nakabayashi)
Water samples for trace elements (CREST Nojiri)

CTD file #: 0004S02.DAT

Bottle #	CTD data						
	Depth [m]	Pressure [db]	Temp. [. C]	Pot-Temp [. C]	Salinity [PSU]	Sigma-t [kg/m^3]	DO [µmol/kg]
1	5096.1	5199.7	1.538	1.078	34.683	27.753	
2	4995.3	5095.7	1.526	1.079	34.683	27.754	
3	4495.3	4580.3	1.473	1.089	34.683	27.758	
4	3995.5	4066.4	1.451	1.127	34.679	27.756	
5	3494.7	3552.6	1.463	1.192	34.673	27.751	
6	2998.3	3044.3	1.514	1.293	34.662	27.738	
7	2497.0	2532.4	1.617	1.441	34.643	27.715	
8	1997.5	2023.4	1.812	1.676	34.609	27.673	
9	1498.5	1516.2	2.091	1.992	34.549	27.603	
10	997.3	1007.8	2.479	2.415	34.437	27.481	
11	796.1	804.1	2.736	2.684	34.367	27.403	
12	599.7	605.5	3.005	2.966	34.274	27.305	
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Station: **Stn.4**

	Start	Bottom	End
Date/Time:	1/16/00, 17:57	1/16/00, 18:05	1/16/00, 18:18
Lat.:	43°59.97'N	43°59.93'N	43°59.83'N
Long.:	155°00.04'E	154°59.98'E	154°59.97'E
Depth (m):	-	-	-

(GMT)

Remarks:
Water samples for in situ primary productivity (CREST Egashira)

CTD file #: 0004S03.DAT

Bottle #	CTD data Depth [m]	Pressure [db]	Temp. [。C]	Pot-Temp [。C]	Salinity [PSU]	Sigma-t [kg/m^3]	DO [μmol/kg]
1	53.3	53.7	3.648	3.645	32.814	26.081	
2	26.7	26.9	3.628	3.627	32.803	26.075	
3	18.4	18.6	3.618	3.617	32.800	26.073	
4	9.9	10.0	3.612	3.611	32.799	26.073	
5	4.8	4.9	3.606	3.606	32.799	26.073	
6	4.7	4.7	3.620	3.620	32.799	26.072	
7	52.0	52.4	3.640	3.637	32.809	26.079	
8	25.8	26.0	3.628	3.626	32.803	26.075	
9	19.4	19.6	3.616	3.615	32.800	26.073	
10	9.5	9.5	3.614	3.613	32.800	26.073	
11	4.7	4.7	3.607	3.607	32.799	26.073	
12	4.2	4.2	3.617	3.616	32.799	26.073	
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Station: Stn.4

	Start	Bottom	End	
Date/Time:	1/16/00, 21:18	1/16/00, 21:35	1/16/00, 22:02	(GMT)
Lat.:	44° 00.05'N	44° 00.01'N	43° 59.98'N	
Long.:	154° 59.67'E	154° 59.65'E	154° 59.57'E	
Depth (m):	-	-	5301	

Remarks:
Water samples for radionuclide (JAMSTEC Kawakami)
CTD data not available

CTD file #: 0004L02.DAT

Bottle #	CTD data Depth [m]	Pressure [db]	Temp. [deg C]	Pot-Temp [deg C]	Salinity [PSU]	Sigma-t [kg/m^3]	DO [µmol/kg]
1	300.0						
2	300.0						
3	250.0						
4	250.0						
5	200.0						
6	200.0						
7	150.0						
8	150.0						
9	100.0						
10	100.0						
11	75.0						
12	75.0						
13	60.0						
14	60.0						
15	50.0						
16	50.0						
17	40.0						
18	40.0						
19	30.0						
20	30.0						
21	20.0						
22	20.0						
23	10.0						
24	10.0						

No data!

Station: **Stn.4**

	Start	Bottom	End
Date/Time:	1/16/00, 22:43	1/16/00, 23:19	1/16/00, 23:59
Lat.:	44°00.08'N	44°00.05'N	44°00.10'N
Long.:	154°59.34'E	154°59.03'E	154°58.63'E
Depth (m):	5301	5316	5329

(GMT)

Remarks:
Water samples for pigment (HUF Sasaoka etc.)

CTD file #: 0004L03.DAT

Bottle #	CTD data						
	Depth [m]	Pressure [db]	Temp. [deg. C]	Pot-Temp [deg. C]	Salinity [PSU]	Sigma-t [kg/m^3]	DO [µmol/kg]
1	600.1	605.8	3.026	2.987	34.267	27.298	18.9
2	499.6	504.3	3.161	3.128	34.199	27.231	17.5
3	399.5	403.1	3.254	3.228	34.095	27.140	22.8
4	299.2	301.9	3.281	3.262	33.976	27.041	30.1
5	200.4	202.1	3.000	2.988	33.722	26.865	83.7
6	150.0	151.3	2.122	2.114	33.413	26.691	191.0
7	125.2	126.3	1.633	1.627	33.276	26.617	246.6
8	100.2	101.0	1.373	1.369	33.153	26.536	290.1
9	79.1	79.8	2.473	2.469	32.939	26.284	304.0
10	59.8	60.3	3.324	3.320	32.790	26.093	323.6
11	51.6	52.0	3.347	3.344	32.790	26.090	324.1
12	41.5	41.9	3.360	3.358	32.790	26.089	322.9
13	32.6	32.8	3.371	3.369	32.790	26.088	323.4
14	19.9	20.1	3.371	3.370	32.790	26.088	323.9
15	16.6	16.7	3.372	3.371	32.789	26.088	323.7
16	8.4	8.4	3.378	3.377	32.790	26.087	324.0
17	7.9	7.9	3.377	3.377	32.789	26.087	324.8
18	149.9	151.2	2.083	2.075	33.401	26.685	198.5
19	101.3	102.2	1.367	1.362	33.157	26.540	290.9
20	74.2	74.8	2.790	2.786	32.874	26.206	314.8
21	51.1	51.5	3.350	3.347	32.790	26.090	324.2
22	31.2	31.5	3.371	3.369	32.790	26.088	323.8
23	20.4	20.6	3.370	3.369	32.790	26.088	324.6
24	9.5	9.6	3.376	3.376	32.789	26.087	324.6

Station: **Stn.4**

	Start	Bottom	End
Date/Time:	1/17/00, 00:20	1/17/00, 00:34	1/17/00, 01:00
Lat.:	44°00.00'N	43°59.88'N	43°59.66'N
Long.:	154°58.32'E	154°58.00'E	154°57.50'E
Depth (m):	5327	5325	5330

(GMT)

Remarks:
Water samples for trace elements (JAMSTEC Nakabayashi)

CTD file #: 0004S04.DAT

Bottle #	CTD data						
	Depth [m]	Pressure [db]	Temp. [deg. C]	Pot-Temp [deg. C]	Salinity [PSU]	Sigma-t [kg/m^3]	DO [μmol/kg]
1	498.9	503.6	3.179	3.146	34.187	27.220	
2	398.7	402.3	3.270	3.244	34.094	27.137	
3	299.9	302.5	3.281	3.261	33.978	27.043	
4	250.9	253.1	3.212	3.197	33.864	26.959	
5	199.8	201.5	3.019	3.007	33.715	26.858	
6	150.3	151.6	2.142	2.134	33.418	26.694	
7	100.3	101.2	1.408	1.404	33.136	26.520	
8	70.2	70.8	3.037	3.033	32.830	26.150	
9	50.4	50.8	3.354	3.351	32.785	26.086	
10	29.6	29.9	3.351	3.350	32.785	26.086	
11	9.7	9.8	3.349	3.348	32.785	26.087	
12	5.8	5.9	3.351	3.351	32.785	26.086	
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Station: **Stn.4 (KNOT1)**

	Start	Bottom	End
Date/Time:	1/17/00, 06:23	1/17/00, 06:48	1/17/00, 07:28
Lat.:	44°00.96'N	44°01.02'N	44°01.29'N
Long.:	154°58.53'E	154°58.31'E	154°57.85'E
Depth (m):	5312	5315	5315

(GMT)

Remarks:
Water samples for routine and etc.
#24 nutrients and salinity data are bucket sampling data

CTD file #: 0004L04.DAT

Bottle #	CTD data															
	Depth [m]	Pressure [db]	Temp. [°C]	Pot-Temp [°C]	Salinity [PSU]	Sigma-t [kg/m^3]	DO [µmol/kg]	Salinity [psu]	DO [µmol/kg]	pH (T) 25C	TA [µmol/kg]	TDIC [µmol/kg]	NO2 [µmol/kg]	NO3 [µmol/kg]	PO4 [µmol/kg]	SiO4 [µmol/kg]
1	800.2	808.2	2.747	2.695	34.367	27.402	20.8	34.367	25.7	-	2374.9	2371.4	0.00	45.48	3.11	143.9
2	702.1	709.0	2.844	2.798	34.327	27.362	20.9	34.326	26.9	7.322	2368.7	2370.8	0.00	45.48	3.11	139.5
3	600.4	606.1	3.014	2.975	34.272	27.302	17.1	34.271	22.2	7.305	2358.1	2360.7	0.00	45.84	3.11	133.4
4	500.2	504.9	3.158	3.125	34.204	27.235	17.2	34.203	22.3	7.293	2347.7	2352.7	0.00	45.97	3.13	125.8
5	400.0	403.7	3.253	3.227	34.114	27.155	21.0	34.115	25.3	7.281	2332.3	2343.4	0.00	45.97	3.12	117.4
6	300.7	303.3	3.283	3.264	33.986	27.050	29.6	33.989	36.5	7.267	2314.0	2332.7	0.00	45.85	3.12	105.8
7	250.4	252.5	3.281	3.265	33.909	26.988	38.0	33.911	41.7	7.269	2305.5	2328.2	0.00	45.43	3.09	99.56
8	224.6	226.5	3.196	3.182	33.841	26.942	52.3	33.840	57.1	7.283	2300.1	2318.7	0.00	44.44	3.05	94.34
9	200.4	202.1	3.148	3.136	33.784	26.901	66.0	33.782	70.8	7.296	2292.7	2306.0	0.00	43.64	3.00	90.03
10	176.7	178.2	2.980	2.969	33.686	26.838	94.3	33.683	97.6	7.330	2284.0	2278.7	0.00	41.82	2.87	83.11
11	150.4	151.6	2.302	2.294	33.466	26.719	175.3	33.457	177.2	7.430	2266.6	2231.7	0.00	36.61	2.55	67.95
12	125.7	126.7	1.610	1.604	33.273	26.616	247.7	33.270	250.0	7.524	2253.0	2188.7	0.00	32.36	2.30	55.76
13	100.7	101.6	1.751	1.746	33.086	26.457	296.4	33.089	296.2	7.611	2236.0	2147.1	0.01	27.93	2.05	44.50
14	90.0	90.8	2.587	2.583	32.919	26.259	307.0	-	308.0	7.676	2226.3	2119.8	0.07	23.97	1.81	37.81
15	80.5	81.1	3.219	3.215	32.799	26.109	322.4	32.797	324.0	7.746	2220.0	2080.5	0.18	19.16	1.52	29.33
16	71.2	71.8	3.349	3.344	32.790	26.090	322.2	32.793	325.2	7.753	2219.2	2078.2	0.18	18.68	1.50	28.46
17	61.5	62.1	3.355	3.351	32.790	26.090	322.8	32.790	325.4	7.754	2219.9	2078.0	0.18	18.63	1.51	28.49
18	51.1	51.5	3.352	3.349	32.789	26.089	323.1	32.790	325.1	7.754	2222.9	2077.8	0.18	18.70	1.49	28.34
19	40.7	41.1	3.357	3.354	32.789	26.089	323.0	-	325.1	7.754	2218.7	2081.3	0.18	18.70	1.49	28.46
20	29.3	29.5	3.355	3.353	32.789	26.089	323.6	32.792	325.2	7.754	2222.6	2080.1	0.18	18.66	1.49	28.25
21	20.6	20.8	3.358	3.357	32.790	26.089	323.4	32.792	325.4	7.754	2220.0	2084.6	0.18	18.63	1.49	28.16
22	10.6	10.6	3.357	3.357	32.789	26.089	323.3	32.791	325.6	7.754	2220.8	2079.4	0.17	18.64	1.49	28.25
23	6.3	6.4	3.356	3.356	32.789	26.089	324.0	32.790	324.5	7.754	2222.6	2081.3	0.18	18.61	1.49	28.28
24	5.6	5.6	3.356	3.355	32.789	26.089	323.4	32.810	-	-	-	-	0.20	18.55	1.52	28.02
								1/25/00	Jan.30'00		2/4/00	2/16/00	1.18.00	Jan.25'00	Jan.25'00	Jan.25'00

Station: **Stn.4**

	Start	Bottom	End
Date/Time:	1/17/00, 12:19	1/17/00, 13:52	1/17/00, 15:41
Lat.:	44°00.12'N	43°59.89'N	43°59.87'N
Long.:	154°57.11'E	154°56.70'E	154°56.55'E
Depth (m):	5347	5356	5362

(GMT)

Remarks:
Water samples for routine and etc.
Water sample #16-24 taken for N2/Ar/O2 and Ne (WU Roberta)

CTD file #: 0004L05.DAT

Bottle #	CTD data							Salinity	DO	pH (T)	TA	TDIC	NO2	NO3	PO4	SiO4
	Depth [m]	Pressure [db]	Temp. [. C]	Pot-Temp [. C]	Salinity [PSU]	Sigma-t [kg/m^3]	DO [µmol/kg]	[psu]	[µmol/kg]	25C	[µmol/kg]	[µmol/kg]	[µmol/kg]	[µmol/kg]	[µmol/kg]	[µmol/kg]
1	5099.8	5203.6	1.536	1.076	34.691	27.760	166.3	34.692	159.4	7.594	2433.2	2314.2	0.00	37.08	2.43	145.7
2	4999.2	5099.8	1.524	1.077	34.691	27.761	165.4	34.691	158.4	7.594	2432.3	2318.1	0.00	37.05	2.43	145.6
3	4499.3	4584.5	1.471	1.088	34.690	27.764	161.0	34.690	158.0	7.592	2435.0	-	0.00	37.10	2.46	145.3
4	3998.8	4069.8	1.450	1.125	34.686	27.762	153.6	34.685	153.5	7.584	2433.6	2322.4	0.00	37.45	2.47	146.2
5	3499.9	3557.9	1.463	1.192	34.680	27.756	143.2	34.679	144.3	7.570	2430.9	2328.2	0.00	38.19	2.51	148.5
6	2999.9	3046.0	1.520	1.298	34.668	27.742	127.6	34.667	130.6	7.546	2432.7	2333.2	0.00	39.11	2.58	152.1
7	2499.9	2535.4	1.621	1.444	34.649	27.719	106.6	34.648	111.7	7.511	2429.9	2349.7	0.00	40.30	2.68	156.3
8	2250.2	2280.7	1.701	1.546	34.634	27.702	94.5	34.631	99.3	7.489	2430.9	2358.2	0.00	41.10	2.73	157.5
9	2000.1	2026.0	1.815	1.679	34.614	27.677	81.0	34.613	85.9	7.464	2429.5	2363.8	0.00	42.01	2.80	158.3
10	1750.0	1771.6	1.943	1.826	34.588	27.646	65.9	34.586	70.8	7.435	2427.5	2367.7	0.00	42.84	2.88	159.1
11	1499.7	1517.3	2.103	2.004	34.551	27.604	50.7	34.550	56.3	7.403	2419.1	2378.7	0.00	44.01	2.96	158.6
12	1250.2	1264.1	2.253	2.172	34.506	27.556	38.7	34.505	43.9	7.372	2410.8	2377.6	0.00	44.43	3.01	157.1
13	999.6	1010.1	2.465	2.400	34.446	27.490	27.6	34.445	32.8	7.343	2404.4	2379.9	0.00	45.08	3.04	152.2
14	900.2	909.4	2.583	2.525	34.415	27.455	23.9	34.414	30.0	7.332	2398.3	2377.4	0.00	45.22	3.05	148.2
15	799.4	807.4	2.733	2.682	34.372	27.407	21.5	34.373	26.5	7.320	2388.3	2362.8	0.00	45.46	3.07	143.7
16	4999.4	5099.9	1.524	1.077	34.691	27.761	165.4	34.690	-		-	-	-	-	-	-
17	3999.4	4070.4	1.450	1.125	34.686	27.762	153.6	34.687	-		-	-	-	-	-	-
18	2999.9	3046.0	1.520	1.298	34.668	27.742	127.4	34.667	-		-	-	-	-	-	-
19	2000.0	2026.0	1.815	1.679	34.614	27.677	81.1	34.613	-		-	-	-	-	-	-
20	1499.8	1517.5	2.104	2.005	34.551	27.603	50.6	34.550	-		-	-	-	-	-	-
21	999.8	1010.4	2.474	2.410	34.443	27.486	27.3	34.442	-		-	-	-	-	-	-
22	799.4	807.5	2.738	2.686	34.371	27.406	21.6	34.372	-		-	-	-	-	-	-
23	599.8	605.6	3.014	2.975	34.273	27.304	19.4	34.271	-		-	-	-	-	-	-
24	400.1	403.7	3.262	3.236	34.107	27.148	20.9	34.110	-		-	-	-	-	-	-
								1/21/00	Jan,30'00		2/4/00	2/16/00	1.18.00	Jan.25'00	Jan.25'00	Jan.25'00

Station: Stn.16

	Start	Bottom	End
Date/Time:	1/19/00, 11:44	1/19/00, 11:56	1/19/00, 12:16
Lat.:	37°30.10'N	37°30.25'N	37°30.44'N
Long.:	147°30.22'E	147°30.40'E	147°30.55'E
Depth (m):	5683	5662	5653

(GMT)

Remarks:
Water samples for trace elements (JAMSTEC Nakabayashi)

CTD file #: 0016S01.DAT

Bottle #	CTD data Depth [m]	Pressure [db]	Temp. [deg C]	Pot-Temp [deg C]	Salinity [PSU]	Sigma-t [kg/m^3]	DO [µmol/kg]
1	500.3	504.7	4.605	4.566	34.224	27.104	
2	399.8	403.2	5.049	5.017	34.141	26.989	
3	300.3	302.7	5.468	5.443	33.992	26.822	
4	251.9	253.9	6.812	6.789	34.072	26.714	
5	199.0	200.6	8.052	8.032	34.134	26.586	
6	149.9	151.1	10.614	10.596	34.252	26.262	
7	99.2	99.9	12.911	12.897	34.203	25.793	
8	69.6	70.1	14.019	14.009	34.273	25.622	
9	49.8	50.2	14.203	14.196	34.307	25.609	
10	30.7	30.9	14.209	14.205	34.308	25.608	
11	10.4	10.5	14.201	14.199	34.309	25.611	
12	5.2	5.2	14.202	14.201	34.309	25.611	

Station: Stn.16

	Start	Bottom	End
Date/Time:	1/19/00, 12:32	1/19/00, 13:47	1/19/00, 14:59
Lat.:	37°30.65'N	37°30.96'N	37°30.89'N
Long.:	147°30.76'E	147°31.88'E	147°32.42'E
Depth (m):	5671	5673	5672

(GMT)

Remarks:
Water samples for routine and etc.

CTD file #: 0016L01.DAT

Bottle #	CTD data														
	Depth [m]	Pressure [db]	Temp. [deg C]	Pot-Temp [deg C]	Salinity [PSU]	Sigma-t [kg/m^3]	DO [µmol/kg]	Salinity [psu]	DO [µmol/kg]	pH (T) 25C	TA [µmol/kg]	TDIC [µmol/kg]	NO2 [µmol/kg]	NO3 [µmol/kg]	PO4 [µmol/kg]	SiO4 [µmol/kg]
1	3002.3	3046.7	1.549	1.327	34.665	27.738	129.0	34.663	126.7	7.558	2416.9	2338.5	0.01	37.06	2.74	152.1
2	2000.3	2025.0	1.865	1.729	34.608	27.668	79.3	34.607	80.6	7.470	2413.0	2361.8	0.00	39.90	2.96	157.7
3	1500.1	1516.9	2.208	2.108	34.545	27.590	50.3	34.544	51.7	7.413	2404.4	2375.7	0.02	41.58	3.10	155.0
4	1250.5	1263.7	2.465	2.381	34.494	27.528	38.8	34.493	40.5	7.386	2396.3	2370.3	0.02	41.96	3.14	150.0
5	999.9	1009.8	2.894	2.826	34.441	27.448	43.4	34.439	44.7	7.393	2381.2	2354.4	0.01	41.26	3.10	136.9
6	800.3	807.9	3.461	3.404	34.398	27.361	54.6	34.397	56.5	7.418	2365.4	2337.6	0.01	39.80	3.00	122.2
7	699.8	706.2	3.754	3.703	34.356	27.299	54.5	34.355	55.8	7.416	2354.6	2328.2	0.02	39.35	2.98	115.9
8	600.1	605.5	4.152	4.108	34.309	27.221	58.6	34.309	60.2	7.423	2350.8	2314.0	0.02	38.50	2.91	107.6
9	499.8	504.2	4.549	4.511	34.229	27.115	64.4	34.228	66.4	7.425	2332.7	2304.6	0.02	37.35	2.84	97.24
10	399.8	403.2	5.033	5.001	34.136	26.986	84.9	34.134	86.4	7.455	2316.8	2272.3	0.02	34.96	2.68	83.37
11	300.4	302.8	6.366	6.339	34.153	26.837	116.7	34.150	119.5	7.551	2302.2	2228.0	0.03	29.78	2.31	63.94
12	249.7	251.7	6.766	6.743	34.084	26.729	142.4	34.081	147.0	7.605	2292.2	2200.4	0.00	26.73	2.08	53.67
13	200.0	201.6	7.503	7.484	34.041	26.593	167.5	34.032	170.9	7.655	2279.4	2173.4	0.00	23.54	1.84	43.74
14	148.4	149.5	10.250	10.233	34.263	26.334	161.2	34.265	166.6	7.741	2280.5	2144.6	0.00	18.98	1.43	31.90
15	124.6	125.6	11.776	11.760	34.314	26.099	172.5	34.315	178.0	7.800	2277.6	2113.5	0.00	15.28	1.13	23.63
16	99.8	100.5	12.809	12.796	34.228	25.832	200.9	34.227	208.4	7.878	2269.0	2077.9	0.00	10.04	0.71	15.00
17	80.7	81.3	13.901	13.889	34.269	25.643	229.5	34.264	238.5	7.954	2267.4	2030.8	0.20	5.39	0.32	8.22
18	60.4	60.9	14.215	14.206	34.316	25.613	237.9	34.316	246.2	7.977	2268.0	2013.7	0.28	4.00	0.39	6.28
19	49.0	49.3	14.244	14.237	34.323	25.613	238.3	34.322	246.1	7.977	2266.5	2018.9	0.35	3.95	0.22	6.31
20	40.4	40.7	14.272	14.266	34.331	25.613	237.1	34.329	245.7	7.977	2266.4	2018.4	0.35	3.97	0.22	6.34
21	30.1	30.3	14.336	14.332	34.350	25.614	236.6	34.351	245.0	7.977	2266.6	2020.3	0.34	4.03	0.22	6.44
22	20.3	20.5	14.332	14.329	34.349	25.614	236.6	34.349	244.9	7.977	2265.6	2017.3	0.34	4.04	0.22	6.44
23	11.8	11.9	14.326	14.324	34.353	25.618	236.9	34.353	244.8	7.977	2267.3	2020.9	0.33	4.02	0.22	6.41
24	5.0	5.0	14.339	14.339	34.359	25.620	234.2	34.360	245.4	7.977	2266.6	2015.0	0.32	4.03	0.22	6.47
								1/22/00	Jan.30'00		2/4/00	2/16/00	1.20.00	Jan.25'00	Jan.25'00	Jan.25'00

Station: Stn.16

	Start	Bottom	End
Date/Time:	1/19/00, 15:22	1/19/00, 17:00	1/19/00, 18:38
Lat.:	37°30.99'N	37°31.70'N	37°32.29'N
Long.:	147°32.78'E	147°32.39'E	147°32.07'E
Depth (m):	5674	5675	5663

(GMT)

Remarks:
Water samples for trace elements (JAMSTEC Nakabayashi)

CTD file #: 0016S02.DAT

Bottle #	CTD data						
	Depth [m]	Pressure [db]	Temp. [deg C]	Pot-Temp [deg C]	Salinity [PSU]	Sigma-t [kg/m^3]	DO [μmol/kg]
1	5399.8	5510.2	1.563	1.063	34.685	27.753	
2	5001.1	5098.7	1.523	1.076	34.684	27.755	
3	4500.4	4582.9	1.482	1.098	34.682	27.756	
4	4000.4	4069.0	1.469	1.144	34.678	27.754	
5	3500.7	3556.6	1.483	1.212	34.672	27.748	
6	3000.3	3044.6	1.538	1.316	34.660	27.735	
7	2500.7	2534.6	1.642	1.465	34.641	27.712	
8	1999.3	2024.1	1.845	1.709	34.606	27.668	
9	1499.9	1516.6	2.174	2.075	34.545	27.593	
10	999.2	1009.2	2.836	2.768	34.441	27.454	
11	801.4	808.9	3.400	3.344	34.393	27.363	
12	599.5	604.9	4.121	4.076	34.297	27.215	

Station: Stn.17

	Start	Bottom	End	
Date/Time:	1/20/00, 06:28	1/20/00, 07:36	1/20/00, 08:35	(GMT)
Lat.:	35°00.04'N	35°00.45'N	35°00.64'N	
Long.:	147°30.02'E	147°30.00'E	147°30.28'E	
Depth (m):	5834	5819	5822	

Remarks:
Water samples for routine and etc.

CTD file #: 0017S01.DAT

Bottle #	CTD data														
	Depth [m]	Pressure [db]	Temp. [deg C]	Pot-Temp [deg C]	Salinity [PSU]	Sigma-t [kg/m^3]	DO µmol/kg	Salinity [psu]	DO [µmol/kg]	pH (T) 25C	TA [µmol/kg]	TDIC [µmol/kg]	NO2 [µmol/kg]	NO3 [µmol/kg]	PO4 [µmol/kg]	SiO4 [µmol/kg]
1	2998.0	3041.6	1.602	1.379	34.652	27.724		34.658	122.9	7.563	2416.7	2334.8	0.00	40.04	2.74	151.00
2	1999.1	2023.4	2.060	1.921	34.572	27.624		34.576	65.2	7.440	2407.7	2368.6	0.00	43.80	3.01	155.66
3	1500.7	1517.1	2.694	2.589	34.462	27.483		34.466	42.5	7.394	2384.7	2362.2	0.01	44.78	3.13	142.70
4	999.4	1009.1	4.076	3.999	34.235	27.170		34.240	53.5	7.396	2338.9	2314.5	0.01	42.10	2.96	105.73
5	800.5	807.9	5.407	5.338	34.100	26.914		34.101	102.7	7.492	2307.7	2253.0	0.01	35.74	2.53	74.87
6	600.4	605.6	9.147	9.080	34.151	26.430		34.150	179.9	7.724	2276.7	2140.0	0.01	21.22	1.49	32.89
7	399.6	402.9	15.404	15.342	34.645	25.609		34.654	188.6	7.913	2280.4	2055.9	0.02	9.60	0.61	9.89
8	298.6	301.0	17.626	17.575	34.769	25.186		34.683	194.5	7.974	2284.8	2028.1	0.01	5.76	0.34	5.06
9	199.4	201.0	18.841	18.806	34.680	24.817		34.696	215.3	8.037	2275.7	1993.8	0.05	2.14	0.11	2.58
10	100.1	100.9	19.142	19.124	34.653	24.720		34.662	224.7	8.060	2276.6	1976.4	0.25	0.78	0.05	2.07
11	49.5	49.9	19.150	19.141	34.655	24.719		34.662	224.7	8.060	2276.8	1975.4	0.24	0.80	0.05	2.13
12	10.1	10.2	19.145	19.143	34.656	24.721		[redacted]	227.5	8.059	2276.7	1973.6	0.24	0.81	0.05	2.13
								1/22/00	Jan.30'00		2/4/00	2/16/00	1.20.00	Jan.25'00	Jan.25'00	Jan.25'00

Station: Stn.14

	Start	Bottom	End
Date/Time:	1/23/00, 00:59	1/23/00, 02:08	1/23/00, 03:16
Lat.:	39°59.94'N	39°59.18'N	39°58.52'N
Long.:	154°59.71'E	154°59.53'E	154°59.37'E
Depth (m):	5599	5632	5672

(GMT)

Remarks:
Water samples for trace elements (JAMSTEC Nakabayashi)

CTD file #: 0014S01.DAT

Bottle #	CTD data						
	Depth [m]	Pressure [db]	Temp. [deg C]	Pot-Temp [deg C]	Salinity [PSU]	Sigma-t [kg/m^3]	DO [μmol/kg]
1	3000.2	3045.2	1.566	1.344	34.656	27.729	
2	1999.6	2024.8	1.938	1.800	34.589	27.647	
3	1497.9	1514.9	2.292	2.191	34.503	27.550	
4	1251.3	1264.8	2.626	2.541	34.461	27.488	
5	1001.1	1011.3	3.064	2.995	34.380	27.385	
6	800.1	807.9	3.512	3.455	34.295	27.274	
7	698.1	704.7	3.886	3.835	34.231	27.186	
8	600.3	605.8	4.209	4.165	34.182	27.113	
9	499.4	503.9	4.684	4.645	34.095	26.993	
10	400.0	403.5	5.057	5.026	33.990	26.868	
11	301.3	303.8	5.928	5.902	33.921	26.709	
12	249.7	251.8	5.841	5.820	33.758	26.591	

Station: Stn.14

	Start	Bottom	End
Date/Time:	1/23/00, 04:04	1/23/00, 04:10	1/23/00, 04:24
Lat.:	39°58.38'N	39°58.42'N	39°58.50'N
Long.:	155°00.05'E	155°00.10'E	155°00.23'E
Depth (m):	5675	5670	5671

(GMT)

Remarks:
Water samples for trace elements (JAMSTEC Nakabayashi)

CTD file #: 0014S02.DAT

Bottle #	CTD data Depth [m]	Pressure [db]	Temp. [°C]	Pot-Temp [°C]	Salinity [PSU]	Sigma-t [kg/m^3]	DO [µmol/kg]
1	203.3	205.0	6.726	6.708	33.827	26.532	
2	148.4	149.6	9.283	9.266	34.137	26.397	
3	124.3	125.3	10.214	10.199	34.158	26.258	
4	99.3	100.1	11.938	11.925	34.207	25.985	
5	79.7	80.3	11.953	11.943	34.211	25.985	
6	59.0	59.5	11.976	11.968	34.216	25.984	
7	51.3	51.7	11.975	11.968	34.216	25.985	
8	40.2	40.5	11.974	11.968	34.216	25.985	
9	28.4	28.6	11.972	11.969	34.216	25.985	
10	18.9	19.0	11.969	11.967	34.216	25.986	
11	10.7	10.7	11.964	11.963	34.217	25.987	
12	4.9	5.0	11.963	11.962	34.217	25.988	

Station: Stn.14

	Start	Bottom	End	
Date/Time:	1/23/00, 05:14	1/23/00, 05:54	1/23/00, 06:25	(GMT)
Lat.:	39°58.77'N	39°58.87'N	39°58.91'N	
Long.:	155°00.59'E	155°00.79'E	155°00.85'E	
Depth (m):	5659	5647	5649	

Remarks:
Water samples for reference material (NIES Nojiri)

CTD file #: 0014S03.DAT

Bottle #	CTD data						
	Depth [m]	Pressure [db]	Temp. [。C]	Pot-Temp [。C]	Salinity [PSU]	Sigma-t [kg/m^3]	DO [μmol/kg]
1	2001.0	2026.2	1.952	1.814	34.585	27.643	
2	1999.3	2024.5	1.953	1.815	34.585	27.643	
3	2000.5	2025.7	1.953	1.815	34.585	27.643	
4	2001.5	2026.8	1.952	1.814	34.585	27.643	
5	2001.1	2026.3	1.951	1.814	34.585	27.643	
6	2001.2	2026.4	1.952	1.814	34.585	27.643	
7	2000.7	2025.9	1.952	1.814	34.585	27.643	
8	1999.6	2024.8	1.952	1.815	34.585	27.643	
9	1999.2	2024.4	1.952	1.815	34.585	27.643	
10	2001.9	2027.1	1.952	1.814	34.585	27.643	
11	1999.8	2025.0	1.952	1.814	34.585	27.643	
12	2000.5	2025.7	1.952	1.814	34.585	27.643	

Station: **Stn.14**

	Start	Bottom	End
Date/Time:	1/23/00, 06:46	1/23/00, 07:50	1/23/00, 08:51
Lat.:	39°58.94'N	39°59.14'N	39°59.40'N
Long.:	155°00.90'E	155°00.93'E	155°01.03'E
Depth (m):	5652	5632	5626

(GMT)

Remarks:
Water samples for routine and etc.

CTD file #: 0014S04.DAT

Bottle #	CTD data														
	Depth [m]	Pressure [db]	Temp. [°C]	Pot-Temp [°C]	Salinity [PSU]	Sigma-t [kg/m^3]	DO [µmol/kg]	Salinity [psu]	DO [µmol/kg]	pH (T) 25C	TA [µmol/kg]	TDIC [µmol/kg]	NO2 [µmol/kg]	NO3 [µmol/kg]	PO4 [µmol/kg]	SiO4 [µmol/kg]
1	2999.1	3044.1	1.574	1.351	34.655	27.728		34.587								
2	1999.7	2024.9	1.940	1.802	34.588	27.646		34.590	72.4		2409.7	2363.9	0.01	41.27	2.90	161.1
3	1500.4	1517.5	2.277	2.176	34.511	27.558		34.514	46.8	7.396	2397.5	2372.0	0.01	42.74	3.04	158.0
4	1249.4	1262.8	2.633	2.549	34.458	27.485		34.462	40.1	7.372	2388.0	2370.8	0.01	42.96	3.05	147.5
5	999.8	1010.0	3.089	3.020	34.378	27.380		34.382	40.4	7.367	2370.7	2350.7	0.01	42.48	3.06	134.1
6	800.4	808.2	3.561	3.504	34.290	27.266					-					
7	702.5	709.1	3.846	3.795	34.240	27.197		34.238	50.4	7.377	2340.5	2315.8	0.01	40.79	2.92	110.9
8	600.5	606.0	4.246	4.201	34.178	27.107		34.167	65.5	7.401	2327.3	2298.1	0.01	39.10	2.81	98.15
9	499.8	504.2	4.612	4.574	34.108	27.011		34.112	78.4	7.425	2315.3	2283.0	0.01	37.40	2.73	88.92
10	399.9	403.4	4.956	4.925	33.986	26.876					-					
11	300.3	302.8	5.792	5.767	33.897	26.707		33.903	167.9	7.597	2279.3	2188.9	0.02	26.92	2.02	51.55
12	250.0	252.1	5.674	5.654	33.785	26.633		33.788	205.3	7.644	2268.5	2164.3	0.02	23.84	1.81	42.79
								2/2/00	Jan.30'00		2/4/00	2.16.00	Feb.3'00	Feb.3'00	Feb.3'00	Feb.3'00

Station: Stn.14

	Start	Bottom	End
Date/Time:	1/23/00, 10:00	1/23/00, 10:12	1/23/00, 10:34
Lat.:	39°59.94'N	40°00.02'N	40°00.05'N
Long.:	155°01.00'E	155°01.00'E	155°01.13'E
Depth (m):	5620	5619	5617

(GMT)

Remarks:
Water samples for routine and etc.

CTD file #: 0014S05.DAT

Bottle #	CTD data															
	Depth [m]	Pressure [db]	Temp. [°C]	Pot-Temp [°C]	Salinity [PSU]	Sigma-t [kg/m^3]	DO [µmol/kg]	Salinity [psu]	DO [µmol/kg]	pH (T) 25C	TA [µmol/kg]	TDIC [umol/kg]	NO2 [µmol/kg]	NO3 [µmol/kg]	PO4 [µmol/kg]	SiO4 [µmol/kg]
1	400.8	404.3	4.986	4.954	33.978	26.867		33.981	117.1	7.492	2297.2	2244.1	0.01	33.57	2.47	71.59
2	200.0	201.6	6.580	6.562	33.797	26.528		33.818	227.9	7.705	2266.4	2139.6	0.02	20.32	1.56	33.27
3	148.8	150.0	9.188	9.172	34.064	26.355		34.049	209.2	7.761	2269.3	2119.2	0.03	17.58	1.32	26.20
4	124.5	125.5	11.958	11.941	34.216	25.988		34.210	235.5	7.884	2264.9	2061.9	0.17	9.89	0.77	14.59
5	99.9	100.7	12.046	12.033	34.224	25.978		34.231	252.4	7.922	2265.4	2051.8	0.23	7.33	0.60	10.92
6	79.4	80.0	12.043	12.033	34.225	25.979		34.231	254.6	7.922	2265.4	2048.3	0.23	7.30	0.60	10.92
7	60.1	60.5	12.041	12.033	34.225	25.980		34.231	252.4	7.922	2266.3	2048.0	0.23	7.33	0.60	11.00
8	50.9	51.3	12.043	12.036	34.226	25.980		34.231	251.9	7.923	2265.6	2046.8	0.22	7.35	0.60	11.00
9	39.8	40.1	12.039	12.034	34.226	25.980		34.232	252.0	7.922	2263.0	2046.5	0.23	7.32	0.60	11.00
10	30.1	30.3	12.038	12.034	34.226	25.981		34.231	252.2	7.922	2266.9	2049.4	0.23	7.30	0.60	11.00
11	20.3	20.4	12.026	12.023	34.226	25.983		34.231	252.2	7.922	2268.9	2042.9	0.23	7.29	0.59	10.92
12	9.9	10.0	12.025	12.024	34.226	25.983		34.231	252.9	7.92	2266.7	2042.7	0.23	7.28	0.60	10.97
								2/2/00	Jan.30'00		2/4/00	2.16.00	Feb.3'00	Feb.3'00	Feb.3'00	Feb.3'00

Station: Stn.14

	Start	Bottom	End
Date/Time:	1/23/00, 11:06	1/23/00, 11:13	1/23/00, 11:33
Lat.:	39°59.92'N	39°59.90'N	39°59.83'N
Long.:	155°00.95'E	155°00.84'E	155°00.67'E
Depth (m):	5619	5616	5609

(GMT)

Remarks:
Water samples for radionuclide (JAMSTEC Kawakami)

CTD file #: 0014L01.DAT

Bottle #	CTD data						
	Depth [m]	Pressure [db]	Temp. [deg C]	Pot-Temp [deg C]	Salinity [PSU]	Sigma-t [kg/m^3]	DO [μmol/kg]
1	298.4	300.9	5.673	5.648	33.851	26.685	181.4
2	300.9	303.4	5.698	5.673	33.857	26.687	181.9
3	249.6	251.7	6.766	6.743	33.923	26.602	190.4
4	250.5	252.6	6.826	6.803	33.931	26.600	190.1
5	199.2	200.8	6.804	6.785	33.805	26.504	234.1
6	201.1	202.8	6.793	6.775	33.804	26.505	234.8
7	149.1	150.3	9.102	9.086	34.054	26.361	206.6
8	150.4	151.6	9.176	9.159	34.066	26.359	204.8
9	101.8	102.6	12.041	12.027	34.233	25.985	244.9
10	100.9	101.8	12.041	12.028	34.233	25.985	245.3
11	75.9	76.5	12.043	12.033	34.234	25.986	244.6
12	74.3	74.9	12.043	12.033	34.234	25.986	245.1
13	58.7	59.2	12.043	12.036	34.234	25.986	245.2
14	58.3	58.8	12.045	12.037	34.234	25.986	244.8
15	47.9	48.2	12.045	12.038	34.234	25.986	243.4
16	48.5	48.8	12.045	12.039	34.234	25.986	244.1
17	39.2	39.5	12.042	12.037	34.234	25.986	244.1
18	39.7	40.0	12.042	12.037	34.234	25.986	243.3
19	30.9	31.1	12.041	12.037	34.234	25.986	244.4
20	30.6	30.8	12.041	12.037	34.234	25.986	244.7
21	20.8	21.0	12.040	12.037	34.234	25.987	243.8
22	21.4	21.5	12.041	12.038	34.234	25.986	243.9
23	13.0	13.1	12.033	12.032	34.234	25.988	244.6
24	8.7	8.8	12.040	12.038	34.234	25.987	244.8

Station: Stn.14

	Start	Bottom	End	
Date/Time:	1/23/00, 12:20	1/23/00, 12:35	1/23/00, 12:59	(GMT)
Lat.:	39°59.80'N	39°59.73'N	39°59.65'N	
Long.:	155°00.25'E	155°00.13'E	154°59.89'E	
Depth (m):	5610	5607	5611	

Remarks:
Water samples #1 - 20 for radionuclide (Narita)
Water samples #21-24 for NAON (W.U. R.Hamme)

CTD file #: 0014L02.DAT

Bottle #	CTD data Depth [m]	Pressure [db]	Temp. [°C]	Pot-Temp [°C]	Salinity [PSU]	Sigma-t [kg/m^3]	DO [µmol/kg]
1	499.2	503.6	4.684	4.646	34.106	27.002	78.5
2	499.9	504.4	4.684	4.645	34.106	27.002	78.5
3	500.9	505.4	4.680	4.641	34.106	27.003	78.8
4	501.0	505.5	4.683	4.644	34.106	27.002	78.9
5	499.7	504.2	4.685	4.647	34.106	27.002	78.7
6	498.9	503.4	4.685	4.647	34.106	27.002	78.9
7	497.9	502.3	4.686	4.648	34.106	27.001	78.8
8	498.7	503.1	4.686	4.648	34.105	27.001	78.9
9	497.7	502.1	4.686	4.648	34.106	27.002	78.8
10	499.1	503.6	4.687	4.648	34.106	27.002	78.8
11	182.0	183.5	7.390	7.373	33.869	26.474	228.2
12	151.1	152.3	8.775	8.759	34.032	26.395	208.9
13	129.3	130.4	10.294	10.279	34.195	26.273	180.4
14	115.5	116.4	11.950	11.935	34.233	26.003	234.6
15	90.2	90.9	12.053	12.041	34.237	25.987	242.2
16	59.9	60.4	12.048	12.040	34.237	25.987	242.6
17	40.9	41.2	12.051	12.045	34.237	25.987	242.0
18	19.8	20.0	12.049	12.047	34.238	25.988	243.2
19	9.5	9.5	12.052	12.051	34.237	25.987	242.2
20	500.3	504.8	4.681	4.642	34.106	27.003	78.6
21	149.7	150.9	8.831	8.815	34.038	26.392	208.5
22	99.4	100.2	12.054	12.041	34.237	25.986	243.4
23	15.5	15.6	12.048	12.046	34.237	25.988	243.4
24	4.3	4.3	12.050	12.050	34.238	25.987	243.3

Station: **Stn.6**

	Start	Bottom	End
Date/Time:	1/25/00, 22:32	1/25/00, 22:49	1/25/00, 23:14
Lat.:	50°00.54'N	50°00.77'N	50°01.07'N
Long.:	164°59.83'E	165°00.19'E	165°00.31'E
Depth (m):	5527	5533	5535

(GMT)

Remarks:
Water samples for radionuclide (Kawakami)

CTD file #: 0006L01.DAT

Bottle #	CTD data						
	Depth [m]	Pressure [db]	Temp. [。C]	Pot-Temp [。C]	Salinity [PSU]	Sigma-t [kg/m^3]	DO [μmol/kg]
1	299.2	302.0	3.486	3.467	34.035	27.069	11.9
2	300.3	303.2	3.487	3.467	34.035	27.069	12.0
3	249.8	252.1	3.503	3.486	33.976	27.020	13.6
4	251.7	254.0	3.503	3.486	33.974	27.019	13.9
5	200.2	202.1	3.552	3.539	33.900	26.956	27.9
6	199.0	200.8	3.555	3.542	33.900	26.955	28.1
7	148.9	150.2	3.261	3.252	33.698	26.822	83.7
8	149.2	150.6	3.243	3.233	33.690	26.818	87.8
9	100.8	101.7	2.580	2.574	32.964	26.296	322.6
10	100.3	101.2	2.580	2.575	32.964	26.295	323.1
11	74.0	74.6	2.600	2.596	32.957	26.288	321.7
12	74.8	75.5	2.600	2.596	32.956	26.288	322.4
13	62.3	62.9	2.619	2.615	32.947	26.279	320.9
14	60.7	61.2	2.618	2.614	32.947	26.279	320.5
15	50.4	50.8	2.618	2.615	32.947	26.279	320.9
16	49.9	50.3	2.622	2.619	32.947	26.278	320.5
17	39.2	39.5	2.628	2.625	32.946	26.277	319.6
18	38.8	39.2	2.626	2.624	32.947	26.278	319.4
19	30.2	30.5	2.623	2.621	32.947	26.278	319.2
20	30.5	30.8	2.623	2.621	32.947	26.278	319.5
21	21.7	21.9	2.621	2.620	32.946	26.278	319.2
22	20.9	21.1	2.618	2.617	32.946	26.278	319.0
23	9.8	9.9	2.621	2.621	32.947	26.278	318.9
24	9.9	10.0	2.621	2.621	32.947	26.278	319.2

Station: **Stn.6**

	Start	Bottom	End	
Date/Time:	1/25/00, 23:33	1/25/00, 23:46	1/26/00, 00:09	(GMT)
Lat.:	50°01.01'N	50°00.99'N	50°00.93'N	
Long.:	165°00.32'E	165°00.19'E	164°59.96'E	
Depth (m):	5534	5540	5533	

Remarks:
Water samples for trace elements (JAMSTEC Nakabayashi)

CTD file #: 0006S01.DAT

Bottle #	CTD data						
	Depth [m]	Pressure [db]	Temp. [deg C]	Pot-Temp [deg C]	Salinity [PSU]	Sigma-t [kg/m^3]	DO [µmol/kg]
1	500.2	505.1	3.235	3.202	34.220	27.241	
2	400.2	404.1	3.387	3.361	34.143	27.165	
3	299.6	302.4	3.486	3.466	34.038	27.072	
4	250.5	252.8	3.506	3.490	33.981	27.024	
5	199.5	201.3	3.507	3.494	33.896	26.957	
6	149.8	151.1	3.276	3.266	33.700	26.822	
7	100.7	101.6	2.598	2.593	32.961	26.292	
8	70.7	71.3	2.595	2.591	32.949	26.282	
9	50.5	50.9	2.658	2.655	32.943	26.272	
10	28.5	28.8	2.659	2.658	32.943	26.272	
11	9.9	10.0	2.658	2.658	32.943	26.272	
12	5.2	5.2	2.655	2.655	32.943	26.272	

Station: **Stn.6**

	Start	Bottom	End
Date/Time:	1/26/00, 00:24	1/26/00, 01:57	1/26/00, 03:40
Lat.:	50°01.06'N	50°01.65'N	50°02.02'N
Long.:	165°00.08'E	165°00.01'E	164°59.91'E
Depth (m):	5531	5543	5542

(GMT)

Remarks:
Water samples for routine and etc.

CTD file #: 0006L02.DAT

Bottle #	CTD data															
	Depth [m]	Pressure [db]	Temp. [deg.C]	Pot-Temp [deg.C]	Salinity [PSU]	Sigma-t [kg/m^3]	DO [µmol/kg]	Salinity [psu]	DO [µmol/kg]	pH (T) 25C	TA [µmol/kg]	TDIC [µmol/kg]	NO2 [µmol/kg]	NO3 [µmol/kg]	PO4 [µmol/kg]	SiO4 [µmol/kg]
1	5301.4	5414.7	1.565	1.077	34.692	27.759	166.9	34.692	159.1	7.604	2410.6	2314.9	0.01	36.47	2.49	147.9
2	4999.9	5103.3	1.530	1.082	34.692	27.761	164.1	34.690	158.2	7.597	2410.0	2313.0	0.00	36.52	2.50	147.4
3	3999.2	4072.5	1.476	1.150	34.685	27.759	149.6	34.683	149.2	7.583	2410.3	2316.6	0.00	37.05	2.54	148.7
4	2999.8	3047.6	1.529	1.307	34.667	27.741	124.0	34.664	127.4	7.542	2413.3	2334.3	0.01	38.53	2.66	154.8
5	2000.2	2027.3	1.792	1.657	34.613	27.678	73.5	34.612	79.3	7.450	2410.8	2364.6	0.01	41.64	2.91	165.0
6	1499.6	1518.1	2.087	1.988	34.547	27.602	41.5	34.544	47.8	7.384	2401.1	2375.9	0.01	43.55	3.05	163.6
7	999.9	1011.0	2.564	2.499	34.433	27.471	17.9	34.434	24.1	7.329	2382.2	2374.1	0.01	45.02	3.16	151.0
8	750.1	757.9	2.910	2.860	34.340	27.367	12.8	34.343	18.3	7.305	2366.9	2368.0	0.01	45.17	3.19	139.0
9	500.5	505.5	3.270	3.237	34.211	27.231	11.3	34.209	16.5	7.280	2344.4	2349.5	0.01	45.45	3.21	125.8
10	400.2	404.0	3.400	3.374	34.140	27.161	12.0	34.137	16.9	7.267	2333.5	2341.6	0.02	45.52	3.22	118.6
11	300.0	302.8	3.489	3.469	34.028	27.064	12.0	34.026	14.9	7.242	2315.4	2331.3	0.01	46.34	3.25	108.0
12	250.1	252.4	3.494	3.478	33.942	26.995	17.0	33.946	20.6	7.227	2303.8	2324.1	0.01	46.86	3.30	101.5
13	200.3	202.2	3.469	3.456	33.848	26.922	38.6	33.845	40.9	7.248	2292.7	2305.9	0.01	45.38	3.21	93.10
14	150.6	152.0	3.030	3.020	33.581	26.750	121.8	33.577	132.1	7.375	2268.7	2251.7	0.02	38.92	2.79	73.91
15	125.6	126.7	2.571	2.564	33.015	26.337	298.4	33.015	308.7	7.670	2228.2	2115.4	0.11	25.50	1.98	42.79
16	101.0	101.9	2.578	2.572	32.971	26.302	319.1	32.972	321.1	7.697	2226.0	2105.0	0.12	24.39	1.91	40.40
17	80.7	81.4	2.585	2.581	32.965	26.296	318.7	32.964	321.8	7.699	2226.0	2101.6	0.13	24.27	1.91	40.20
18	58.6	59.1	2.610	2.607	32.954	26.285	317.7	32.952	321.5	7.701	2225.4	2100.8	0.13	23.98	1.89	39.53
19	50.4	50.9	2.655	2.652	32.949	26.277	317.1	32.953	321.4	7.703	2224.4	2097.6	0.14	23.90	1.89	39.30
20	39.2	39.5	2.663	2.660	32.948	26.276	316.8	32.948	321.2	7.705	2225.2	2099.1	0.14	23.85	1.88	39.10
21	28.1	28.4	2.664	2.663	32.949	26.276	316.5	32.948	321.3	7.704	2225.2	2099.0	0.14	23.88	1.88	39.19
22	19.8	20.0	2.662	2.661	32.949	26.276	316.5	32.948	321.3	7.706	2224.3	2094.9	0.16	23.81	1.87	39.19
23	9.0	9.1	2.662	2.662	32.949	26.277	316.2	32.949	321.4	7.705	2223.0	2098.1	0.14	23.79	1.87	39.16
24	4.2	4.2	2.662	2.662	32.949	26.277	316.4	32.950	320.4	7.707	2224.7	2093.9	0.14	23.75	1.85	39.30
								2/2/00	Jan.30'00		2/4/00	2/16/00	Feb.3'00	Feb.4'00	Feb.3'00	Feb.3'00

Station: **Stn.6**

	Start	Bottom	End
Date/Time:	1/26/00, 04:40	1/26/00, 04:46	1/26/00, 04:58
Lat.:	50° 02.05'N	50° 02.07'N	50° 02.08'N
Long.:	165° 00.69'E	165° 00.60'E	165° 00.54'E
Depth (m):	5555	5558	5555

(GMT)

Remarks:
Water samples for pigments (Sasaoka and Minami)

CTD file #: 0006S02.DAT

Bottle #	CTD data						
	Depth [m]	Pressure [db]	Temp. [。C]	Pot-Temp [。C]	Salinity [PSU]	Sigma-t [kg/m^3]	DO [μmol/kg]
1	200.1	202.0	3.514	3.501	33.884	26.946	
2	149.8	151.2	3.240	3.231	33.676	26.806	
3	124.6	125.7	2.499	2.492	33.264	26.542	
4	100.5	101.4	2.592	2.586	32.961	26.292	
5	80.7	81.5	2.599	2.595	32.953	26.285	
6	60.2	60.7	2.670	2.667	32.943	26.271	
7	49.7	50.1	2.671	2.668	32.943	26.271	
8	40.5	40.9	2.673	2.671	32.943	26.271	
9	30.0	30.3	2.665	2.663	32.943	26.271	
10	20.1	20.2	2.663	2.661	32.943	26.272	
11	9.6	9.7	2.660	2.659	32.943	26.272	
12	5.6	5.7	2.654	2.653	32.943	26.273	

Station: **Stn.6**

	Start	Bottom	End	
Date/Time:	1/26/00, 05:44	1/26/00, 07:21	1/26/00, 09:01	(GMT)
Lat.:	50°02.29'N	50°01.80'N	50°01.14'N	
Long.:	165°00.26'E	165°00.48'E	165°00.25'E	
Depth (m):	5545	5559	5530	

Remarks:
Water samples for trace elements (JAMSTEC Nakabayashi)

CTD file #: 0006S03.DAT

Bottle #	CTD data						
	Depth [m]	Pressure [db]	Temp. [° C]	Pot-Temp [° C]	Salinity [PSU]	Sigma-t [kg/m^3]	DO [µmol/kg]
1	5299.4	5412.7	1.567	1.080	34.682	27.750	
2	4999.2	5102.6	1.532	1.085	34.682	27.753	
3	4499.7	4587.5	1.494	1.110	34.680	27.754	
4	3997.2	4070.4	1.480	1.154	34.676	27.752	
5	3499.7	3559.7	1.487	1.216	34.670	27.746	
6	2999.9	3047.8	1.534	1.312	34.659	27.734	
7	2500.4	2537.3	1.634	1.458	34.639	27.711	
8	1999.5	2026.6	1.803	1.668	34.604	27.670	
9	1500.4	1518.9	2.093	1.994	34.539	27.595	
10	1000.1	1011.2	2.601	2.535	34.418	27.456	
11	799.5	808.0	2.864	2.811	34.348	27.377	
12	599.3	605.4	3.132	3.093	34.259	27.282	

Station: **Stn.6**

	Start	Bottom	End
Date/Time:	1/26/00, 10:27	1/26/00, 10:31	1/26/00, 10:35
Lat.:	50°01.34'N	50°01.35'N	50°01.35'N
Long.:	164°59.94'E	164°59.91'E	164°59.87'E
Depth (m):	5533	5536	5532

(GMT)

Remarks:
Water samples for filtered water for iron (JAMSTEC Nakabayashi)

CTD file #: 0006S04.DAT

Bottle #	CTD data						
	Depth [m]	Pressure [db]	Temp. [°C]	Pot-Temp [°C]	Salinity [PSU]	Sigma-t [kg/m^3]	DO [µmol/kg]
1	51.2	51.7	2.556	2.553	32.962	26.296	
2	50.1	50.5	2.557	2.555	32.962	26.295	
3	49.8	50.3	2.557	2.555	32.962	26.295	
4	50.2	50.6	2.556	2.553	32.962	26.296	
5	50.7	51.1	2.554	2.552	32.963	26.296	
6	51.1	51.5	2.555	2.552	32.962	26.296	
7	49.6	50.0	2.555	2.552	32.962	26.296	
8	50.1	50.6	2.555	2.552	32.963	26.296	
9	50.5	50.9	2.554	2.552	32.963	26.297	
10	50.3	50.7	2.554	2.551	32.963	26.297	
11	50.5	51.0	2.553	2.550	32.963	26.297	
12	50.6	51.0	2.553	2.550	32.963	26.297	

Station: **Stn.6**

	Start	Bottom	End
Date/Time:	1/26/00, 11:00	1/26/00, 11:09	1/26/00, 11:36
Lat.:	50° 01.49'N	50° 01.50'N	50° 01.54'N
Long.:	164° 59.69'E	164° 59.60'E	164° 59.44'E
Depth (m):	5559	5543	5572

(GMT)

Remarks:
Water samples for radionuclide (Narita and harada)

CTD file #: 0006L03.DAT

Bottle #	CTD data Depth [m]	Pressure [db]	Temp. [。C]	Pot-Temp [。C]	Salinity [PSU]	Sigma-t [kg/m^3]	DO [μmol/kg]
1	148.9	150.2	3.288	3.279	33.704	26.824	644.7
2	100.6	101.5	2.548	2.543	32.974	26.306	802.9
3	14.6	14.7	2.540	2.539	32.969	26.303	799.1
4	5.2	5.2	2.535	2.535	32.967	26.301	798.4
5	179.9	181.5	3.563	3.552	33.843	26.909	327.1
6	140.5	141.8	2.783	2.774	33.509	26.714	790.0
7	124.8	125.9	2.558	2.551	33.042	26.360	800.3
8	100.3	101.2	2.547	2.542	32.974	26.306	803.7
9	77.1	77.8	2.543	2.539	32.973	26.306	803.8
10	49.7	50.1	2.540	2.537	32.972	26.305	802.1
11	30.6	30.8	2.539	2.537	32.970	26.304	800.7
12	19.6	19.8	2.540	2.539	32.970	26.303	799.6
13	8.1	8.2	2.537	2.537	32.967	26.301	798.5
14	302.2	305.1	3.490	3.470	34.029	27.064	102.8
15	200.9	202.8	3.555	3.542	33.889	26.946	253.4
16	150.8	152.2	3.214	3.204	33.671	26.805	673.1
17	124.0	125.1	2.553	2.546	32.994	26.322	802.0
18	79.1	79.8	2.544	2.540	32.974	26.306	803.0
19	60.0	60.6	2.542	2.539	32.973	26.306	802.7
20	50.5	50.9	2.539	2.537	32.971	26.305	802.4
21	39.4	39.8	2.539	2.537	32.971	26.305	801.5
22	30.6	30.9	2.539	2.537	32.970	26.304	800.8
23	19.5	19.6	2.540	2.539	32.970	26.303	799.6
24	9.7	9.8	2.538	2.537	32.967	26.301	798.7

Station: **Stn.6**

	Start	Bottom	End
Date/Time:	1/26/00, 12:27	1/26/00, 12:37	1/26/00, 12:48
Lat.:	50°01.52'N	50°01.48'N	50°01.43'N
Long.:	164°59.53'E	164°59.53'E	164°59.53'E
Depth (m):	5540	5539	5537

(GMT)

Remarks:

Water samples for filterd water for iron (JAMSTEC Nakabayashi)
#8-12 taken for coccolith (JAMSTEC Harada)
Because of file damage, CTD data not available

CTD file #: 0006S05.DAT

Bottle #	CTD data Depth [m]	Pressure [db]	Temp. [, C]	Pot-Temp [, C]	Salinity [PSU]	Sigma-t [kg/m^3]	DO [µmol/kg]
1	50.0						
2	50.0						
3	50.0						
4	50.0						
5	50.0						
6	50.0						
7	50.0						
8	200.0						
9	150.0						
10	100.0						
11	50.0						
12	10.0						

No data!

Station: **Stn.6**

	Start	Bottom	End
Date/Time:	1/26/00, 17:57	1/26/00, 18:02	1/26/00, 18:17
Lat.:	50°00.00'N	50°00.00'N	50°00.00'N
Long.:	165°00.00'E	164°59.89'E	164°59.70'E
Depth (m):	5510	5509	5506

(GMT)

Remarks:
Water samples for primary productivity (NIES Egashira)

CTD file #: 0006S06.DAT

Bottle #	CTD data						
	Depth [m]	Pressure [db]	Temp. [deg C]	Pot-Temp [deg C]	Salinity [PSU]	Sigma-t [kg/m^3]	DO [µmol/kg]
1	59.1	59.6	2.671	2.667	32.948	26.275	
2	29.8	30.1	2.664	2.663	32.947	26.275	
3	22.9	23.1	2.662	2.661	32.947	26.275	
4	14.3	14.4	2.656	2.656	32.947	26.275	
5	9.4	9.5	2.658	2.658	32.947	26.275	
6	3.7	3.7	2.659	2.659	32.947	26.275	
7	59.4	60.0	2.675	2.672	32.949	26.275	
8	29.6	29.9	2.667	2.665	32.947	26.275	
9	23.2	23.4	2.664	2.663	32.947	26.275	
10	13.7	13.8	2.655	2.654	32.947	26.276	
11	9.4	9.5	2.659	2.658	32.947	26.275	
12	4.6	4.6	2.658	2.658	32.947	26.275	

Station: **Stn.7**

	Start	Bottom	End
Date/Time:	1/27/00, 23:00	1/27/00, 23:07	1/27/00, 23:18
Lat.:	45°00.08'N	45°00.02'N	45°00.04'N
Long.:	165°00.06'E	164°59.94'E	164°59.83'E
Depth (m):	5972	5975	5978

(GMT)

Remarks:
Water samples #1-5 for coccolith (JAMSTEC Harada)

CTD file #: 0007S01.DAT

Bottle #	CTD data						
	Depth [m]	Pressure [db]	Temp. [deg C]	Pot-Temp [deg C]	Salinity [PSU]	Sigma-t [kg/m^3]	DO [µmol/kg]
1	201.2	203.0	3.097	3.084	33.636	26.788	
2	150.9	152.2	2.823	2.814	33.425	26.644	
3	99.3	100.1	4.038	4.031	32.955	26.156	
4	50.0	50.4	4.047	4.043	32.950	26.151	
5	9.5	9.5	4.042	4.041	32.951	26.152	
6	201.9	203.7	3.099	3.086	33.639	26.790	
7	201.7	203.5	3.097	3.085	33.638	26.789	
8	202.4	204.2	3.099	3.087	33.641	26.791	
9	202.0	203.8	3.097	3.085	33.638	26.789	
10	202.9	204.6	3.100	3.088	33.642	26.792	
11	201.4	203.2	3.097	3.085	33.637	26.788	
12	202.8	204.6	3.105	3.092	33.643	26.792	

Station: **Stn.7**

	Start	Bottom	End
Date/Time:	1/27/00, 23:50	1/27/00, 23:55	1/28/00, 00:07
Lat.:	44°59.83'N	44°59.89'N	44°59.93'N
Long.:	164°59.77'E	164°59.73'E	164°59.64'E
Depth (m):	5975	5974	5975

(GMT)

Remarks:
Water samples for trace elements (JAMSTEC Nakabayashi)

CTD file #: 0007S02.DAT

Bottle #	CTD data						
	Depth [m]	Pressure [db]	Temp. [deg C]	Pot-Temp [deg C]	Salinity [PSU]	Sigma-t [kg/m^3]	DO [µmol/kg]
1	199.7	201.4	3.017	3.005	33.594	26.761	
2	149.7	150.9	2.794	2.786	33.407	26.631	
3	124.7	125.8	3.305	3.298	33.172	26.399	
4	99.1	99.9	4.027	4.020	32.954	26.156	
5	79.7	80.4	4.026	4.021	32.954	26.156	
6	60.0	60.5	4.027	4.023	32.953	26.155	
7	50.3	50.8	4.027	4.024	32.952	26.154	
8	39.4	39.7	4.026	4.023	32.952	26.155	
9	29.4	29.6	4.026	4.024	32.952	26.155	
10	19.5	19.6	4.027	4.026	32.952	26.155	
11	10.0	10.1	4.026	4.025	32.952	26.155	
12	4.4	4.5	4.029	4.028	32.952	26.155	

Station: **Stn.7**

	Start	Bottom	End
Date/Time:	1/28/00, 00:56	1/28/00, 01:52	1/28/00, 02:50
Lat.:	45°00.25'N	45°00.41'N	45°00.37'N
Long.:	165°00.49'E	165°00.32'E	165°00.60'E
Depth (m):	5966	5977	5974

(GMT)

Remarks:
Water samples for trace elements (JAMSTEC Nakabayashi)

CTD file #: 0007S03.DAT

Bottle #	CTD data						
	Depth [m]	Pressure [db]	Temp. [, C]	Pot-Temp [, C]	Salinity [PSU]	Sigma-t [kg/m^3]	DO [µmol/kg]
1	3003.0	3049.4	1.537	1.315	34.657	27.732	
2	2000.4	2026.5	1.866	1.730	34.594	27.657	
3	1499.5	1517.2	2.192	2.092	34.520	27.571	
4	1249.6	1263.6	2.417	2.335	34.464	27.508	
5	998.9	1009.5	2.704	2.638	34.394	27.428	
6	799.5	807.6	2.998	2.944	34.319	27.342	
7	700.4	707.4	3.143	3.096	34.270	27.289	
8	599.7	605.5	3.280	3.240	34.206	27.225	
9	500.0	504.7	3.443	3.410	34.130	27.149	
10	400.2	403.8	3.520	3.493	34.024	27.057	
11	299.0	301.7	3.446	3.427	33.856	26.930	
12	248.0	250.2	3.357	3.341	33.761	26.864	

Station: **Stn.7**

	Start	Bottom	End
Date/Time:	1/28/00, 03:07	1/28/00, 04:06	1/28/00, 05:16
Lat.:	45°00.51'N	45°00.75'N	45°00.89'N
Long.:	165°00.72'E	165°00.92'E	165°01.24'E
Depth (m):	5984	5965	5957

(GMT)

Remarks:
Water samples for routine and etc.

CTD file #: 0007L01.DAT

Bottle #	CTD data															
	Depth [m]	Pressure [db]	Temp. [°C]	Pot-Temp [°C]	Salinity [PSU]	Sigma-t [kg/m^3]	DO [µmol/kg]	Salinity [psu]	DO [µmol/kg]	pH (T) 25C	TA [µmol/kg]	TDIC [µmol/kg]	NO2 [µmol/kg]	NOx [µmol/kg]	PO4 [µmol/kg]	SiO4 [µmol/kg]
1	2999.6	3046.0	1.543	1.321	34.666	27.739		34.663	125.8	7.546	2414.1	2336.4	0.02	38.76	2.71	154.15
2	2001.1	2027.2	1.863	1.726	34.603	27.664		34.600	73.6	7.439	2408.5	2375.5	0.02	42.13	2.97	164.11
3	1500.2	1518.0	2.173	2.073	34.532	27.583		34.530	46.5	7.380	2399.3	2379.1	0.02	43.70	3.09	160.33
4	1250.1	1264.1	2.383	2.301	34.479	27.524		34.477	35.0	7.355	2392.1	2377.8	0.02	44.29	3.14	155.68
5	999.6	1010.2	2.674	2.608	34.409	27.443		34.406	27.4	7.334	2377.9	2374.8	0.02	44.67	3.17	146.55
6	800.0	808.1	2.966	2.913	34.332	27.355		34.327	26.3	7.322	2364.8	2367.2	0.03	44.76	3.16	136.02
7	701.0	707.9	3.152	3.105	34.278	27.295		34.276	25.4	7.313	2357.0	2357.4	0.03	44.67	3.15	129.59
8	600.3	606.1	3.302	3.262	34.204	27.222		34.203	24.9	7.298	2342.2	2352.3	0.03	44.79	3.16	122.20
9	499.6	504.3	3.447	3.414	34.139	27.156		34.133	30.7	7.299	2332.7	2340.4	0.03	44.28	3.13	113.62
10	401.2	404.9	3.522	3.495	34.023	27.057		34.021	40.5	7.292	2314.2	2326.6	0.03	43.75	3.13	103.24
11	299.9	302.6	3.529	3.509	33.882	26.943		33.878	68.6	7.316	2295.7	2296.1	0.03	41.63	3.01	89.71
12	249.9	252.1	3.405	3.389	33.792	26.883		33.791	92.1	7.351	2284.9	2279.2	0.03	39.85	2.88	82.93
13	200.9	202.7	3.136	3.124	33.655	26.799		33.654	131.2	7.402	2276.3	2254.4	0.03	36.78	2.72	73.54
14	150.4	151.7	2.907	2.898	33.483	26.682		33.473	204.7	7.514	2256.7	2203.2	0.03	30.86	2.35	56.45
15	127.2	128.3	2.618	2.611	33.345	26.597		33.338	265.0	7.601	2245.6	2162.9	0.03	26.65	2.07	45.17
16	98.0	98.9	3.873	3.867	33.031	26.232		33.036	306.1	7.730	2225.8	2095.4	0.19	19.71	1.67	31.66
17	78.7	79.4	4.001	3.996	32.967	26.169		32.970	313.5	7.757	2225.0	2087.1	0.23	18.35	1.59	29.38
18	61.9	62.4	4.004	4.000	32.964	26.166		32.963	314.2	7.761	2223.3	2083.8	0.23	18.18	1.58	29.12
19	49.8	50.2	4.004	4.001	32.964	26.166		32.963	314.4	7.762	2222.7	2081.7	0.23	18.18	1.59	29.12
20	40.8	41.1	4.004	4.001	32.963	26.166		32.962	314.4	7.760	2222.1	2081.8	0.23	18.18	1.59	29.18
21	30.4	30.7	4.002	4.000	32.963	26.166		32.961	314.7	7.763	2222.9	2081.1	0.23	18.19	1.59	29.07
22	21.0	21.2	3.998	3.996	32.962	26.166		32.961	314.8	7.763	2223.0	2081.8	0.23	18.15	1.58	29.01
23	8.6	8.7	4.002	4.002	32.963	26.165		32.961	315.2	7.763	2221.9	2081.1	0.23	18.12	1.57	28.87
24	5.5	5.5	4.005	4.005	32.962	26.165		32.962	315.3	7.763	2222.3	2080.2	0.23	18.12	1.57	28.98
								2/2/00	Jan.30'00		2/4/00	2/16/00	Feb.4'00	Feb.4'00	Feb.4'00	Feb.4'00

Station: **Stn.7**

	Start	Bottom	End	
Date/Time:	1/28/00, 07:36	1/28/00, 07:45	1/28/00, 08:04	(GMT)
Lat.:	44°59.74'N	44°59.66'N	44°59.63'N	
Long.:	165°00.13'E	165°00.16'E	165°00.23'E	
Depth (m):	5938	5940	5942	

Remarks:
Water samples for radionuclide (JAMSTEC Kawakami)
some CTD data missing

CTD file #: 0007L02.DAT
CTD file #: 07L02_3.DAT

Bottle #	CTD data						
	Depth [m]	Pressure [db]	Temp. [。C]	Pot-Temp [。C]	Salinity [PSU]	Sigma-t [kg/m^3]	DO [μmol/kg]
1	298.4	301.0	3.533	3.513	33.932	26.983	
2	298.8	301.5	3.533	3.514	33.931	26.982	
3	251.7	253.9	3.446	3.430	33.851	26.927	
4	248.7	250.9	3.450	3.434	33.849	26.925	
5	198.5	200.2	3.365	3.352	33.735	26.842	
6	199.1	200.9	3.297	3.285	33.721	26.837	
7	148.9	150.2	3.029	3.020	33.559	26.732	
8	148.2	149.5	3.028	3.019	33.558	26.731	
9	100.2	101.0	3.500	3.494	33.122	26.341	
10	101.0	101.9	3.494	3.488	33.128	26.346	
11	75.3	76.0	3.974	3.969	32.982	26.184	
12	72.9	73.5	4.002	3.997	32.968	26.170	
13	60.0	NO DATA	-	-	-		
14	57.7	58.2	4.019	4.015	NO DATA	26.162	
15	46.5	46.9	4.019	4.016	32.960	26.162	
16	44.2	44.6	4.014	4.011	32.960	26.162	
17	40.0	NO DATA	-	-	-		
18	37.7	38.0	4.017	4.015	NO DATA	26.162	
19	28.2	28.5	4.017	4.015	32.960	26.162	
20	23.5	23.7	4.018	4.016	32.960	26.162	
21	22.6	22.8	4.016	4.014	32.960	26.162	
22	19.8	20.0	4.011	4.010	32.960	26.163	
23	6.9	7.0	4.011	4.010	32.960	26.163	
24	7.8	7.8	4.011	4.010	32.960	26.162	

Station: **Stn.7**

	Start	Bottom	End	
Date/Time:	1/28/00, 08:53	1/28/00, 08:57	1/28/00, 09:15	(GMT)
Lat.:	44°59.69'N	44°59.69'N	44°59.74'N	
Long.:	165°00.51'E	165°00.47'E	165°00.28'E	
Depth (m):	5945	5942	5941	

Remarks:
Water samples for radionuclide (Narita and Harada)
Bottle file data #3 and 4 missing

CTD file #: 0007L03.DAT

Bottle #	CTD data Depth [m]	Pressure [db]	Temp. [°C]	Pot-Temp [°C]	Salinity [PSU]	Sigma-t [kg/m^3]	DO [µmol/kg]
1	107.2	108.1	3.140	3.134	33.208	26.442	
2	70.4	71.0	4.041	4.036	32.960	26.160	
3	15.0	NO DATA	-	-	-		
4	5.0	NO DATA	-	-	-		
5	201.6	203.3	3.173	3.160	33.689	26.823	
6	200.2	201.9	3.160	3.148	33.686	26.822	
7	198.9	200.6	3.155	3.143	33.683	26.820	
8	199.7	201.4	3.157	3.144	33.684	26.821	
9	199.2	200.9	3.152	3.140	33.683	26.820	
10	200.0	201.8	3.151	3.138	33.683	26.820	
11	200.0	201.7	3.148	3.136	33.682	26.819	
12	200.0	201.7	3.151	3.138	33.683	26.820	
13	151.0	152.3	2.962	2.953	33.521	26.708	
14	124.2	125.3	2.629	2.622	33.361	26.608	
15	102.0	102.8	3.597	3.590	33.105	26.318	
16	98.6	99.5	3.647	3.641	33.092	26.303	
17	79.7	80.4	4.010	4.004	32.972	26.172	
18	48.8	49.2	4.043	4.039	32.960	26.159	
19	31.8	32.1	4.044	4.042	32.960	26.159	
20	19.9	20.1	4.044	4.042	32.960	26.159	
21	8.6	8.7	4.036	4.035	32.960	26.160	
22	198.5	200.3	3.143	3.130	33.680	26.819	
23	198.4	200.1	3.143	3.131	33.680	26.819	
24	201.3	203.1	3.158	3.145	33.685	26.821	

Station: **Stn.8**

	Start	Bottom	End
Date/Time:	1/29/00, 06:11	1/29/00, 07:33	1/29/00, 09:15
Lat.:	40°00.90'N	40. 01.26'N	40. 02.07'N
Long.:	165°00.27'E	165°00.22'E	165°00.47'E
Depth (m):	5508	5508	5502

(GMT)

Remarks:
Water samples for routine and etc.

CTD file #: 0008L01.DAT

Bottle #	CTD data															
	Depth [m]	Pressure [db]	Temp. [. C]	Pot-Temp [. C]	Salinity [PSU]	Sigma-t [kg/m^3]	DO [µmol/kg]	Salinity [psu]	DO [µmol/kg]	pH (T) 25C	TA [µmol/kg]	TDIC [µmol/kg]	NO2 [µmol/kg]	NO3 [µmol/kg]	PO4 [µmol/kg]	SiO4 [µmol/kg]
1	5299.9	5408.2	1.564	1.077	34.693	27.759		34.689		7.600	2413.2	2313.1	0.02	36.09	2.52	146.89
2	4999.1	5097.8	1.529	1.082	34.693	27.761		34.689		7.596	2413.0	2315.7	0.02	36.11	2.53	145.89
3	3999.5	4069.0	1.474	1.148	34.686	27.760		34.681		7.578	2410.3	2322.8	0.02	36.74	2.57	147.21
4	2998.8	3043.8	1.566	1.344	34.663	27.735		34.660		7.532	2410.6	2333.2	0.02	38.44	2.71	154.00
5	1999.6	2024.7	1.930	1.793	34.593	27.651		34.589		7.430	2405.8	2362.1	0.02	41.90	2.97	160.72
6	1500.2	1517.2	2.342	2.241	34.509	27.550		34.505		7.368	2393.4	2375.5	0.02	43.63	3.10	154.39
7	999.9	1010.0	3.131	3.061	34.362	27.364		34.359		7.349	2364.9	2349.2	0.02	43.14	3.09	130.68
8	750.1	757.2	3.726	3.672	34.240	27.209		34.237		7.355	2339.6	2324.1	0.02	41.96	3.01	112.19
9	500.0	504.5	4.642	4.603	34.028	26.945		34.032		7.423	2301.8	2268.6	0.02	36.88	2.69	80.92
10	400.4	403.9	5.139	5.107	33.921	26.804		33.925		7.503	2284.5	2232.3	0.03	31.95	2.37	63.35
11	300.3	302.8	6.022	5.996	33.836	26.630		33.840		7.632	2269.7	2168.6	0.03	24.65	1.89	43.09
12	249.9	252.0	6.455	6.433	33.813	26.556		33.811		7.690	2263.0	2138.0	0.03	21.17	1.63	34.53
13	199.7	201.4	7.263	7.244	33.864	26.488		33.861		7.744	2260.0	2119.1	0.03	17.99	1.40	26.88
14	149.7	150.9	8.493	8.477	33.968	26.389		33.963		7.770	2260.0	2108.7	0.03	16.57	1.29	23.33
15	125.5	126.5	10.532	10.517	33.934	26.028		33.939		7.902	2250.6	2038.1	0.32	7.03	0.67	10.85
16	100.4	101.2	10.544	10.532	33.940	26.031		33.938		7.904	2251.4	2037.8	0.32	7.03	0.66	10.83
17	79.6	80.3	10.524	10.515	33.933	26.029		33.931		7.905	2252.2	2038.5	0.33	7.04	0.67	10.86
18	60.7	61.2	10.510	10.503	33.930	26.029		33.930		7.905	2250.1	2036.3	0.33	7.03	0.67	10.92
19	50.1	50.5	10.487	10.482	33.924	26.028		33.923		7.906	2250.1	2036.1	0.33	7.05	0.67	10.83
20	40.0	40.3	10.496	10.491	33.925	26.028		33.925		7.906	2250.6	2040.9	0.33	7.05	0.68	10.95
21	31.5	31.7	10.515	10.511	33.932	26.030		33.935		7.906	2251.3	2035.5	0.33	7.01	0.67	10.83
22	20.3	20.5	10.517	10.515	33.933	26.030		33.932		7.906	2252.5	2037.8	0.33	7.00	0.67	10.86
23	10.5	10.5	10.493	10.492	33.928	26.030		33.928		7.906	2252.1	2036.2	0.33	7.02	0.66	10.92
24	6.2	6.2	10.490	10.489	33.926	26.029		33.924		7.906	2251.2	2039.8	0.33	7.05	0.69	10.71
								2/2/00			2/4/00	2/16/00	Feb.4'00	Feb.4'00	Feb.4'00	Feb.4'00

Station: Stn.8

	Start	Bottom	End
Date/Time:	1/29/00, 05:37	1/29/00, 05:42	1/29/00, 05:56
Lat.:	40° 00.68'N	40. 00.75'N	40. 00.82'N
Long.:	165° 00.24'E	165° 00.23'E	165° 00.20'E
Depth (m):	5499	5500	5501

(GMT)

Remarks:
Water samples for trace element (JAMSTEC Nakabayashi)

CTD file #: 0008S01.DAT

Bottle #	CTD data						
	Depth [m]	Pressure [db]	Temp. [. C]	Pot-Temp [. C]	Salinity [PSU]	Sigma-t [kg/m^3]	DO [µmol/kg]
1	200.4	202.0	6.967	6.948	33.838	26.508	
2	149.4	150.6	8.150	8.135	33.918	26.402	
3	124.9	125.9	9.169	9.155	34.028	26.330	
4	100.0	100.8	10.540	10.528	33.927	26.021	
5	80.2	80.8	10.557	10.547	33.933	26.023	
6	60.1	60.6	10.555	10.548	33.933	26.023	
7	50.2	50.6	10.551	10.546	33.933	26.024	
8	40.4	40.8	10.556	10.551	33.933	26.023	
9	30.3	30.6	10.548	10.545	33.933	26.024	
10	20.0	20.2	10.544	10.542	33.933	26.025	
11	9.9	10.0	10.540	10.539	33.933	26.026	
12	5.4	5.5	10.529	10.528	33.933	26.028	

Station: Stn.8

	Start	Bottom	End
Date/Time:	1/29/00, 09:51	1/29/00, 10:37	1/29/00, 11:32
Lat.:	40°00.89'N	40. 00.82'N	40. 00.89'N
Long.:	165°01.59'E	165. 01.52'E	165. 01.18'E
Depth (m):	6522	5506	5505

(GMT)

Remarks:
Water samples for trace elements (JAMSTEC Nakabayashi)

CTD file #: 0008S02.DAT

Bottle #	CTD data						
	Depth [m]	Pressure [db]	Temp. [. C]	Pot-Temp [. C]	Salinity [PSU]	Sigma-t [kg/m^3]	DO [µmol/kg]
1	3000.3	3045.3	1.570	1.347	34.652	27.726	
2	1999.6	2024.8	1.955	1.818	34.580	27.638	
3	1499.7	1516.8	2.334	2.233	34.502	27.546	
4	1250.2	1263.7	2.647	2.563	34.440	27.469	
5	1000.5	1010.7	3.115	3.046	34.355	27.359	
6	800.0	807.7	3.592	3.535	34.267	27.244	
7	700.3	706.9	3.801	3.751	34.195	27.166	
8	599.8	605.3	4.124	4.080	34.107	27.063	
9	500.0	504.5	4.588	4.550	34.050	26.968	
10	400.2	403.7	5.100	5.069	33.943	26.826	
11	299.9	302.5	5.931	5.906	33.853	26.655	
12	250.0	252.1	6.402	6.380	33.811	26.562	

Station: Stn.8

	Start	Bottom	End
Date/Time:	1/30/00, 02:33	1/30/00, 02:38	1/30/00, 02:52
Lat.:	40° 00.39'N	40. 00.36'N	40. 00.27'N
Long.:	165° 00.63'E	165. 00.55'E	165. 00.39'E
Depth (m):	5468	5471	5460

(GMT)

Remarks:
Water samples for pigment
and primary productivity (Sasaoka and Minami)

CTD file #: 0008S03.DAT

Bottle #	CTD data Depth [m]	Pressure [db]	Temp. [. C]	Pot-Temp [. C]	Salinity [PSU]	Sigma-t [kg/m^3]	DO [µmol/kg]
1	200.0	201.7	7.071	7.052	33.814	26.474	
2	150.4	151.7	8.504	8.488	33.957	26.379	
3	125.3	126.3	9.966	9.952	33.970	26.153	
4	100.4	101.2	10.165	10.153	33.847	26.024	
5	80.8	81.4	10.066	10.057	33.824	26.023	
6	60.9	61.4	10.043	10.036	33.818	26.022	
7	50.8	51.2	9.968	9.962	33.801	26.021	
8	40.1	40.4	9.938	9.934	33.792	26.019	
9	29.8	30.0	9.938	9.935	33.793	26.020	
10	19.4	19.5	9.920	9.918	33.790	26.020	
11	10.0	10.0	9.935	9.934	33.793	26.020	
12	5.7	5.7	9.926	9.925	33.789	26.019	

Station: **Stn.8 (40N)**

	Start	Bottom	End	
Date/Time:	1/30/00, 02:33	1/30/00, 02:38	1/30/00, 02:52	(GMT)
Lat.:	40° 00.39'N	40, 00.36'N	40, 00.27'N	
Long.:	165° 00.63'E	165, 00.55'E	165, 00.39'E	
Depth (m):	5468	5471	5460	

Remarks:
Water samples for pigment
and primary productivity (Sasaoka and Minami)

CTD file #: 0008S03.DAT

Bottle #	CTD data						
	Depth [m]	Pressure [db]	Temp. [, C]	Pot-Temp [, C]	Salinity [PSU]	Sigma-t [kg/m^3]	DO [μmol/kg]
1	200.0	201.7	7.071	7.052	33.814	26.474	
2	150.4	151.7	8.504	8.488	33.957	26.379	
3	125.3	126.3	9.966	9.952	33.970	26.153	
4	100.4	101.2	10.165	10.153	33.847	26.024	
5	80.8	81.4	10.066	10.057	33.824	26.023	
6	60.9	61.4	10.043	10.036	33.818	26.022	
7	50.8	51.2	9.968	9.962	33.801	26.021	
8	40.1	40.4	9.938	9.934	33.792	26.019	
9	29.8	30.0	9.938	9.935	33.793	26.020	
10	19.4	19.5	9.920	9.918	33.790	26.020	
11	10.0	10.0	9.935	9.934	33.793	26.020	
12	5.7	5.7	9.926	9.925	33.789	26.019	

Station: Stn.8 (40N)

	Start	Bottom	End
Date/Time:	1/30/00, 03:08	1/30/00, 03:15	1/30/00, 03:38
Lat.:	40° 00.22'N	40. 00.24'N	40. 00.38'N
Long.:	165° 00.32'E	165. 00.31'E	165. 00.22'E
Depth (m):	5462	5462	5462

(GMT)

Remarks:
Water samples for radionuclide (JAMSTEC Kawakami)

CTD file #: 0008L02.DAT

Bottle #	CTD data						
	Depth [m]	Pressure [db]	Temp. [. C]	Pot-Temp [. C]	Salinity [PSU]	Sigma-t [kg/m^3]	DO [µmol/kg]
1	300.7	303.3	5.922	5.897	33.837	26.643	
2	299.0	301.5	5.925	5.900	33.837	26.643	
3	250.0	252.1	6.324	6.302	33.785	26.552	
4	250.9	252.9	6.333	6.311	33.785	26.551	
5	199.3	201.0	7.182	7.163	33.829	26.472	
6	200.3	202.0	7.174	7.155	33.829	26.472	
7	150.6	151.8	8.782	8.766	34.000	26.369	
8	150.3	151.5	8.793	8.777	34.002	26.369	
9	100.6	101.4	10.028	10.017	33.824	26.029	
10	100.4	101.2	10.026	10.015	33.824	26.029	
11	75.4	76.0	9.893	9.884	33.792	26.027	
12	76.3	76.9	9.896	9.888	33.793	26.027	
13	61.0	61.5	9.903	9.896	33.793	26.026	
14	60.8	61.3	9.898	9.891	33.792	26.026	
15	50.3	50.7	9.904	9.899	33.794	26.026	
16	50.9	51.3	9.932	9.926	33.799	26.026	
17	37.3	37.6	9.910	9.906	33.795	26.026	
18	39.1	39.4	9.937	9.932	33.801	26.026	
19	29.5	29.7	9.921	9.918	33.798	26.026	
20	28.7	28.9	9.916	9.913	33.796	26.026	
21	19.8	19.9	9.932	9.930	33.802	26.028	
22	17.1	17.2	9.932	9.930	33.801	26.028	
23	10.2	10.3	9.933	9.932	33.801	26.027	
24	6.8	6.9	9.936	9.935	33.801	26.027	

Station: **Stn.8**

	Start	Bottom	End
Date/Time:	1/30/00, 03:57	1/30/00, 04:02	1/30/00, 04:14
Lat.:	40° 00.36'N	40. 00.33'N	40. 00.21'N
Long.:	164° 59.98'E	164. 59.96'E	164. 59.90'E
Depth (m):	5464	5459	5466

(GMT)

Remarks:
Water samples #1-5 for coccolith (JAMSTEC Harada)

CTD file #: 0008S04.DAT

Bottle #	CTD data						
	Depth [m]	Pressure [db]	Temp. [. C]	Pot-Temp [. C]	Salinity [PSU]	Sigma-t [kg/m^3]	DO [µmol/kg]
1	200.3	202.0	7.347	7.328	33.836	26.454	
2	149.6	150.8	8.957	8.941	34.018	26.356	
3	100.2	101.0	9.963	9.952	33.799	26.020	
4	50.2	50.5	9.886	9.880	33.782	26.020	
5	10.2	10.3	9.912	9.911	33.789	26.021	
6	200.9	202.6	7.340	7.321	33.835	26.454	
7	201.3	202.9	7.330	7.311	33.837	26.457	
8	199.7	201.3	7.363	7.344	33.837	26.452	
9	200.4	202.1	7.360	7.341	33.836	26.452	
10	200.9	202.5	7.335	7.316	33.836	26.455	
11	199.7	201.4	7.378	7.359	33.837	26.450	
12	201.3	202.9	7.334	7.315	33.835	26.455	

Station: **Stn.8**

	Start	Bottom	End	
Date/Time:	1/30/00, 04:29	1/30/00, 04:53	1/30/00, 05:29	(GMT)
Lat.:	40° 00.22'N	40. 00.29'N	40. 00.59'N	
Long.:	164° 59.83'E	164. 59.72'E	164. 59.49'E	
Depth (m):	5459	5467	5470	

Remarks:
Water samples for radionuclides (Narita, Harada and Kawakami)

CTD file #: 0008L03.DAT

Bottle #	CTD data						
	Depth [m]	Pressure [db]	Temp. [. C]	Pot-Temp [. C]	Salinity [PSU]	Sigma-t [kg/m^3]	DO [µmol/kg]
1	999.4	1009.5	3.099	3.029	34.365	27.370	
2	1000.0	1010.2	3.098	3.028	34.365	27.370	
3	999.7	1009.9	3.098	3.029	34.365	27.369	
4	999.8	1010.0	3.098	3.029	34.365	27.369	
5	999.9	1010.1	3.098	3.029	34.365	27.369	
6	999.6	1009.8	3.098	3.029	34.365	27.369	
7	1000.1	1010.3	3.097	3.027	34.366	27.370	
8	999.8	1010.0	3.096	3.027	34.366	27.370	
9	999.7	1009.9	3.096	3.027	34.366	27.370	
10	999.5	1009.7	3.097	3.028	34.366	27.370	
11	999.1	1009.3	3.096	3.027	34.366	27.370	
12	999.0	1009.2	3.097	3.028	34.366	27.370	
13	300.2	302.8	5.906	5.880	33.827	26.638	
14	199.9	201.6	7.212	7.193	33.837	26.474	
15	150.8	152.0	8.891	8.874	34.017	26.365	
16	125.9	126.9	10.108	10.094	33.847	26.033	
17	99.3	100.1	10.158	10.146	33.853	26.030	
18	81.0	81.7	10.058	10.049	33.831	26.029	
19	62.8	63.3	10.050	10.043	33.829	26.029	
20	51.2	51.6	10.037	10.031	33.826	26.029	
21	40.6	40.9	10.129	10.124	33.847	26.029	
22	31.7	31.9	10.135	10.132	33.848	26.029	
23	20.2	20.3	10.153	10.151	33.853	26.030	
24	11.9	12.0	10.155	10.153	33.853	26.030	

Station: **Stn.8**

	Start	Bottom	End
Date/Time:	1/30/00, 17:57	1/30/00, 18:03	1/30/00, 18:14
Lat.:	39° 59.86'N	39, 59.80'N	39, 59.66'N
Long.:	164° 59.99'E	164, 59.97'E	164, 59.93'E
Depth (m):	5455	5460	5468

(GMT)

Remarks:
Water samples #1-5 for primary productivity

CTD file #: 0008S05.DAT

Bottle #	CTD data						
	Depth [m]	Pressure [db]	Temp. [, C]	Pot-Temp [, C]	Salinity [PSU]	Sigma-t [kg/m^3]	DO [µmol/kg]
1	53.9	54.3	10.017	10.011	33.823	26.030	
2	27.5	27.7	10.103	10.100	33.846	26.033	
3	20.8	20.9	10.104	10.101	33.846	26.034	
4	9.9	10.0	10.068	10.067	33.838	26.033	
5	6.1	6.2	10.086	10.086	33.839	26.030	
6	2.6	2.6	10.096	10.096	33.844	26.033	
7	54.4	54.9	10.028	10.022	33.825	26.030	
8	26.8	27.0	10.105	10.102	33.846	26.033	
9	20.2	20.3	10.089	10.087	33.843	26.033	
10	10.7	10.7	10.062	10.061	33.835	26.032	
11	6.0	6.1	10.098	10.097	33.840	26.029	
12	3.4	3.4	10.095	10.094	33.844	26.033	

Station: **Stn.5**

	Start	Bottom	End
Date/Time:	2/3/00, 17:25	2/3/00, 18:03	2/3/00, 18:49
Lat.:	44°30.04'N	44, 30.05'N	44, 30.00'N
Long.:	155°00.02'E	154°59.84'E	154°59.68'E
Depth (m):	5179	5175	5170

(GMT)

Remarks:
Water samples for CREST routine (CREST Nojiri)

CTD file #: 0005S01.DAT

Bottle #	CTD data Depth [m]	Pressure [db]	Temp. [°C]	Pot-Temp [°C]	Salinity [PSU]	Sigma-t [kg/m^3]	DO [µmol/kg]	Salinity [µmol/kg]	NO2 [µmol/kg]	NO3 [µmol/kg]	PO4 [µmol/kg]	SiO4 [µmol/kg]
1	1999.2	2025.2	1.747	1.613	34.617	27.685		34.624	0.01	40.82	2.88	158.2
2	1500.0	1517.7	2.046	1.948	34.556	27.612		34.562	0.00	42.88	3.06	159.6
3	1000.3	1010.9	2.424	2.360	34.455	27.500		34.460	0.01	44.03	3.13	152.6
4	800.2	808.3	2.714	2.663	34.383	27.418		34.389	0.01	44.32	3.15	143.8
5	500.0	504.7	3.196	3.163	34.232	27.254		34.239	0.01	45.41	3.22	128.4
6	301.0	303.6	3.382	3.362	34.032	27.077		34.041	0.01	45.23	3.22	109.5
7	199.3	201.0	3.356	3.344	33.860	26.942		33.873	0.01	44.35	3.16	95.95
8	148.0	149.3	2.819	2.811	33.624	26.802		33.637	0.02	39.62	2.89	80.16
9	125.3	126.4	2.400	2.394	33.452	26.700		33.467	0.02	36.57	2.70	68.65
10	99.8	100.7	1.699	1.695	32.921	26.328		32.929	0.12	23.57	1.92	39.42
11	60.1	60.6	1.634	1.631	32.885	26.303		32.889	0.14	22.55	1.85	37.17
12	20.3	20.5	1.627	1.627	32.884	26.303		32.888	0.14	22.52	1.85	37.02
								2/6/00	Feb.24'00	Feb.24'00	Feb.24'00	Feb.24'00

Station: Stn.15

	Start	Bottom	End
Date/Time:	2/3/00, 21:20	2/3/00,21:34	2/3/00,21:53
Lat.:	43° 59.99'N	43° 59.93'N	43° 59.88'N
Long.:	154° 59.92'E	154, 59.79'E	155, 00.00'E
Depth (m):	5309	5305	5307

(GMT)

Remarks:
Water samples for trace element (JAMSTEC Nakabayashi and NIES Nijiri)

CTD file #: 0015S01.DAT

Bottle #	CTD data Depth [m]	Pressure [db]	Temp. [° C]	Pot-Temp [° C]	Salinity [PSU]	Sigma-t [kg/m^3]	DO [µmol/kg]
1	498.2	502.8	3.216	3.183	34.219	27.242	
2	400.3	403.9	3.361	3.335	34.148	27.172	
3	300.5	303.2	3.477	3.457	34.044	27.078	
4	250.0	252.1	3.519	3.503	33.982	27.024	
5	200.1	201.8	3.494	3.481	33.894	26.956	
6	149.5	150.7	3.063	3.054	33.678	26.824	
7	99.8	100.6	1.796	1.791	33.179	26.528	
8	70.5	71.1	2.057	2.054	32.850	26.245	
9	50.6	51.0	2.057	2.055	32.850	26.245	
10	29.8	30.0	2.053	2.052	32.850	26.245	
11	9.8	9.9	2.046	2.045	32.850	26.246	
12	5.3	5.3	2.047	2.047	32.850	26.246	

Station: Stn.15

	Start	Bottom	End
Date/Time:	2/3/00, 23:13	2/3/00,23:20	2/3/00,23:43
Lat.:	43° 59.75'N	43° 59.76'N	43° 59.88'N
Long.:	154° 59.15'E	154. 59.11'E	154. 59.01'E
Depth (m):	5312	5307	5307

(GMT)

Remarks:
Water samples for radionuclide (MAG Narita and NIRE Harada)

CTD file #: 0015L01.DAT

Bottle #	CTD data Depth [m]	Pressure [db]	Temp. [. C]	Pot-Temp [. C]	Salinity [PSU]	Sigma-t [kg/m^3]	DO [µmol/kg]
1	301.3	304.0	3.482	3.462	34.046	27.078	
2	299.3	301.9	3.484	3.464	34.044	27.077	
3	297.2	299.8	3.484	3.465	34.044	27.077	
4	152.1	153.3	3.101	3.092	33.692	26.832	
5	126.1	127.2	2.383	2.376	33.468	26.714	
6	108.5	109.4	1.946	1.941	33.252	26.576	
7	99.8	100.6	2.042	2.037	32.909	26.293	
8	79.9	80.6	2.040	2.036	32.857	26.252	
9	49.0	49.4	2.044	2.041	32.857	26.252	
10	30.8	31.1	2.040	2.039	32.857	26.252	
11	20.6	20.8	2.043	2.042	32.857	26.252	
12	9.3	9.3	2.042	2.042	32.857	26.252	
13	299.5	302.1	3.483	3.463	34.044	27.077	
14	203.5	205.3	3.490	3.477	33.873	26.940	
15	150.2	151.5	3.023	3.014	33.669	26.820	
16	124.1	125.2	2.271	2.265	33.438	26.699	
17	102.0	102.8	2.018	2.013	32.992	26.362	
18	80.0	80.7	2.040	2.036	32.857	26.252	
19	59.5	60.0	2.039	2.037	32.857	26.252	
20	49.6	50.0	2.043	2.040	32.857	26.252	
21	39.2	39.5	2.039	2.037	32.857	26.252	
22	28.6	28.9	2.040	2.039	32.857	26.252	
23	18.4	18.6	2.044	2.043	32.857	26.252	
24	7.8	7.8	2.043	2.043	32.857	26.252	

Station: Stn.15

	Start	Bottom	End
Date/Time:	2/4/00, 00:35	2/4/00, 00:40	2/4/00, 00:55
Lat.:	43° 59.81'N	43. 59.78'N	43. 59.74'N
Long.:	154° 58.38'E	154. 58.32'E	154. 58.13'E
Depth (m):	5323	5321	5323

(GMT)

Remarks:
Water samples for pigments and PP(Sasaoka and Minami)

CTD file #: 0015S02.DAT

Bottle #	CTD data						
	Depth [m]	Pressure [db]	Temp. [。C]	Pot-Temp [。C]	Salinity [PSU]	Sigma-t [kg/m^3]	DO [μmol/kg]
1	201.4	203.1	3.422	3.409	33.868	26.942	
2	150.8	152.1	3.197	3.187	33.704	26.833	
3	126.5	127.5	2.395	2.389	33.464	26.710	
4	99.6	100.4	1.971	1.966	33.161	26.501	
5	80.4	81.1	2.032	2.028	32.852	26.249	
6	59.6	60.1	2.031	2.028	32.851	26.248	
7	50.5	50.9	2.033	2.031	32.852	26.248	
8	39.8	40.2	2.034	2.032	32.851	26.248	
9	30.6	30.9	2.032	2.031	32.851	26.248	
10	20.6	20.7	2.032	2.031	32.851	26.248	
11	10.7	10.7	2.030	2.030	32.851	26.248	
12	6.2	6.2	2.031	2.030	32.851	26.248	

Station: Stn.15

	Start	Bottom	End
Date/Time:	2/4/00, 01:10	2/4/00, 01:30	2/4/00, 02:08
Lat.:	43°59.91'N	44. 00.07'N	44. 00.50'N
Long.:	154°58.18'E	154. 58.10'E	154. 57.98'E
Depth (m):	5325	5324	5323

(GMT)

Remarks:
Water samples for routine and etc.
#24 bucket sampling data

CTD file #: 0015L02.DAT

Bottle #	CTD data														
	Depth [m]	Pressure [db]	Temp. [. C]	Pot-Temp [. C]	Salinity [PSU]	Sigma-t [kg/m^3]	DO [µmol/kg]	Salinity [psu]	DO [µmol/kg]	pH (T) 25C	TA [µmol/kg]	TDIC [µmol/kg]	NO2 [µmol/kg]	NO3 [µmol/kg]	PO4 [µmol/kg]	SiO4 [µmol/kg]
1	801.9	809.9	2.782	2.729	34.377	27.408		34.373	15.9	7.318	2374.4	2378.9	0.00	45.32	3.10	145.57
2	699.7	706.5	2.914	2.868	34.338	27.365		34.334	15.3	7.301	2366.1	2380.1	0.00	45.38	3.10	140.53
3	600.1	605.8	3.073	3.033	34.288	27.310		34.284	14.2	7.291	2356.5	2370.3	0.00	45.47	3.10	134.64
4	499.9	504.6	3.226	3.193	34.223	27.244		34.218	15.3	7.279	2347.3	2365.9	0.00	45.41	3.10	126.90
5	400.4	404.0	3.378	3.351	34.147	27.169		34.143	14.3	7.264	2332.9	2356.2	0.00	45.78	3.12	119.39
6	297.8	300.4	3.488	3.469	34.034	27.069		34.030	14.9	7.239	2317.9	2345.1	0.00	46.36	3.17	108.56
7	250.4	252.6	3.506	3.489	33.973	27.018		33.970	16.3	7.229	2312.2	2339.0	0.00	46.64	3.20	103.32
8	225.8	227.7	3.490	3.475	33.927	26.983		33.926	21.8	7.225	2305.8	2332.1	0.00	46.48	3.19	99.50
9	201.4	203.1	3.407	3.394	33.871	26.946		33.867	38.1	7.242	2297.0	2317.9	0.00	45.55	3.10	95.18
10	176.0	177.5	3.376	3.365	33.799	26.892		33.787	60.2	7.271	2283.6	2301.8	0.00	43.77	2.98	88.67
11	149.6	150.9	3.007	2.998	33.651	26.808		33.647	105.7	7.330	2277.3	2266.2	0.00	40.81	2.80	79.85
12	123.6	124.7	2.242	2.236	33.416	26.684			190.3	7.445	2259.3	2214.2	0.00	34.67	2.48	65.58
13	101.7	102.5	2.006	2.001	33.083	26.436			208.9	7.584	2240.5	2155.0	0.04	28.23	2.09	48.69
14	88.2	89.0	2.040	2.035	32.860	26.255		32.858	328.5	7.717	2223.9	2095.7	0.16	20.07	1.60	32.79
15	82.5	83.2	2.040	2.035	32.860	26.254		32.857	328.9	7.722	2221.4	2096.2	0.16	20.03	1.60	32.76
16	72.2	72.8	2.039	2.036	32.860	26.254			328.9	7.724	2220.7	2093.1	0.17	20.04	1.60	32.65
17	59.9	60.4	2.040	2.037	32.860	26.254		32.858	332.2	7.726	2223.2	2096.3	0.16	20.04	1.60	32.70
18	50.6	51.0	2.041	2.039	32.860	26.254		32.857	332.4	7.726	2223.2	2092.7	0.17	20.08	1.60	32.73
19	39.7	40.1	2.039	2.037	32.860	26.255		32.860	332.6	7.724	2221.9	2096.7	0.17	20.03	1.59	32.76
20	30.6	30.8	2.039	2.037	32.860	26.255		32.858	332.5	7.722	2221.8	2094.5	0.16	20.01	1.59	32.60
21	23.0	23.2	2.036	2.035	32.860	26.255		32.857	329.2	7.724	2223.9	2093.2	0.16	20.02	1.59	32.57
22	5.9	5.9	2.037	2.037	32.860	26.255		32.858	329.1	7.724	2223.5	2097.1	0.17	19.99	1.59	32.42
23	4.7	4.8	2.038	2.037	32.860	26.255		32.858	329.2	7.724	2223.0	2097.6	0.17	20.00	1.60	32.51
24	802.0	810.0	2.783	2.731	34.377	27.407		-		-		-	0.12	19.97	1.68	32.77
								2/6/00				2/16/00	Feb.24'00	Feb.24'00	Feb.24'00	Feb.24'00

Station: Stn.15

	Start	Bottom	End
Date/Time:	2/4/00, 05:16	2/4/00, 06:43	2/4/00, 08:20
Lat.:	44° 00.11'N	44. 00.60'N	44. 01.00'N
Long.:	155° 00.01'E	154. 59.68'E	154. 59.62'E
Depth (m):	5308	5308	5321

(GMT)

Remarks:
Water samples for routine and etc.

CTD file #: 0015L03.DAT

Bottle #	CTD data														
	Depth [m]	Pressure [db]	Temp. [deg. C]	Pot-Temp [deg. C]	Salinity [PSU]	Sigma-t [kg/m^3]	DO [µmol/kg]	Salinity [psu]	DO [µmol/kg]	pH (SWS) 25C	TA [µmol/kg]	TDIC [µmol/kg]	NO2 [µmol/kg]	NOx [µmol/kg]	PO4 [µmol/kg]	SiO4 [µmol/kg]
1	5102.0	5205.8	1.535	1.075	34.696	27.763		34.691	159.291	7.597	2415.6	2315.6	0.00	36.24	2.42	146.5
2	4999.8	5100.3	1.523	1.076	34.696	27.764		34.691	159.593	7.597	2417.0	2315.4	0.00	36.25	2.42	146.0
3	4500.3	4585.5	1.472	1.088	34.694	27.767		34.689	157.683	7.594	2415.3	2319.8	0.00	36.40	2.42	145.9
4	3999.6	4070.6	1.448	1.123	34.691	27.766		34.686	153.121	7.587	2416.8	2319.3	0.00	36.71	2.44	146.4
5	3498.9	3556.8	1.459	1.188	34.684	27.760		34.679	144.606	7.572	2414.3	2328.9	0.00	37.32	2.49	149.1
6	2999.1	3045.2	1.511	1.289	34.673	27.747		34.668	131.051	7.549	2417.5	2334.6	0.00	38.13	2.55	152.2
7	2500.0	2535.4	1.610	1.433	34.654	27.725		34.649	112.153	7.517	2416.3	2346.3	0.00	39.65	2.65	156.6
8	2249.9	2280.4	1.687	1.532	34.641	27.708		34.636	102.942	7.497	2418.8	2355.8	0.00	40.00	2.70	157.5
9	2000.0	2025.9	1.798	1.663	34.620	27.683		34.615	85.606	7.463	2412.5	2361.3	0.00	41.15	2.78	160.8
10	1749.2	1770.9	1.933	1.817	34.594	27.651		34.589	71.572	7.435	2411.1	2370.8	0.00	42.04	2.84	159.9
11	1499.8	1517.5	2.066	1.968	34.561	27.615		34.556	57.755	7.405	2408.6	2373.4	0.00	42.85	2.91	160.6
12	1250.6	1264.5	2.221	2.141	34.516	27.566		34.511	47.327	7.379	2402.1	2378.5	0.00	43.41	2.95	158.1
13	1000.1	1010.6	2.461	2.397	34.458	27.499		34.453	25.208	7.332	2389.5	2378.7	0.00	44.80	3.03	155.6
14	898.5	907.8	2.601	2.543	34.423	27.460		34.418	21.819	7.321	2383.3	2382.0	0.00	44.80	3.03	151.1
15	798.8	806.8	2.728	2.676	34.391	27.423		34.386	19.168	7.311	2377.0	2381.8	0.00	44.91	3.10	147.1
16	149.8	151.1	2.756	2.747	33.619	26.804		[redacted]	-	-		-	-	-	-	-
17	118.0	119.0	1.813	1.807	33.334	26.651		33.329	-	-		-	-	-	-	-
18	82.1	82.8	2.121	2.117	32.859	26.247		32.857	-	-		-	-	-	-	-
19	50.8	51.3	2.116	2.114	32.854	26.244		32.851	-	-		-	-	-	-	-
20	14.8	14.9	2.100	2.100	32.854	26.245		32.852	-	-		-	-	-	-	-
21	4.7	4.7	2.097	2.096	32.853	26.245		32.851	-	-		-	-	-	-	-
22	799.1	807.2	2.734	2.682	34.390	27.422		-	-	-		-	-	-	-	-
23	799.0	807.0	2.735	2.684	34.389	27.421		-	-	-		-	-	-	-	-
24	799.6	807.6	2.738	2.686	34.389	27.420		-	-	-		-	-	-	-	-
								2/6/00				2/16/00	Feb.24'00	Feb.24'00	Feb.24'00	Feb.24'00

Station: Stn.15

	Start	Bottom	End
Date/Time:	2/4/00, 08:49	2/4/00, 08:56	2/4/00, 09:08
Lat.:	43° 59.85'N	43. 59.83'N	43. 59.84'N
Long.:	155° 00.08'E	154. 59.99'E	154. 59.84'E
Depth (m):	4747	5311	5309

(GMT)

Remarks:
Water samples for primary production (Egashira)

CTD file #: 0015S03.DAT

Bottle #	CTD data Depth [m]	Pressure [db]	Temp. [. C]	Pot-Temp [. C]	Salinity [PSU]	Sigma-t [kg/m^3]	DO [µmol/kg]
1	53.8	54.2	2.124	2.122	32.853	26.242	
2	25.9	26.1	2.111	2.110	32.852	26.243	
3	19.9	20.0	2.123	2.122	32.852	26.242	
4	9.9	10.0	2.118	2.118	32.852	26.242	
5	5.5	5.5	2.109	2.109	32.852	26.243	
6	2.0	2.0	2.109	2.109	32.852	26.243	
7	51.9	52.4	2.122	2.120	32.852	26.242	
8	26.4	26.6	2.123	2.121	32.852	26.242	
9	19.8	20.0	2.117	2.116	32.852	26.242	
10	10.0	10.1	2.122	2.122	32.852	26.242	
11	4.8	4.8	2.111	2.110	32.852	26.242	
12	1.1	1.1	2.112	2.112	32.851	26.242	

Station: **Stn.3**

	Start	Bottom	End
Date/Time:	2/4/00, 11:23	2/4/00, 12:00	2/4/00, 12:41
Lat.:	43°30.11'N	43°30.35'N	43。30.39'N
Long.:	155°00.10'E	155°00.24'E	155°00.50'E
Depth (m):	5482	5479	5475

(GMT)

Remarks:
Water samples for CREST routine (CREST Nojiri)

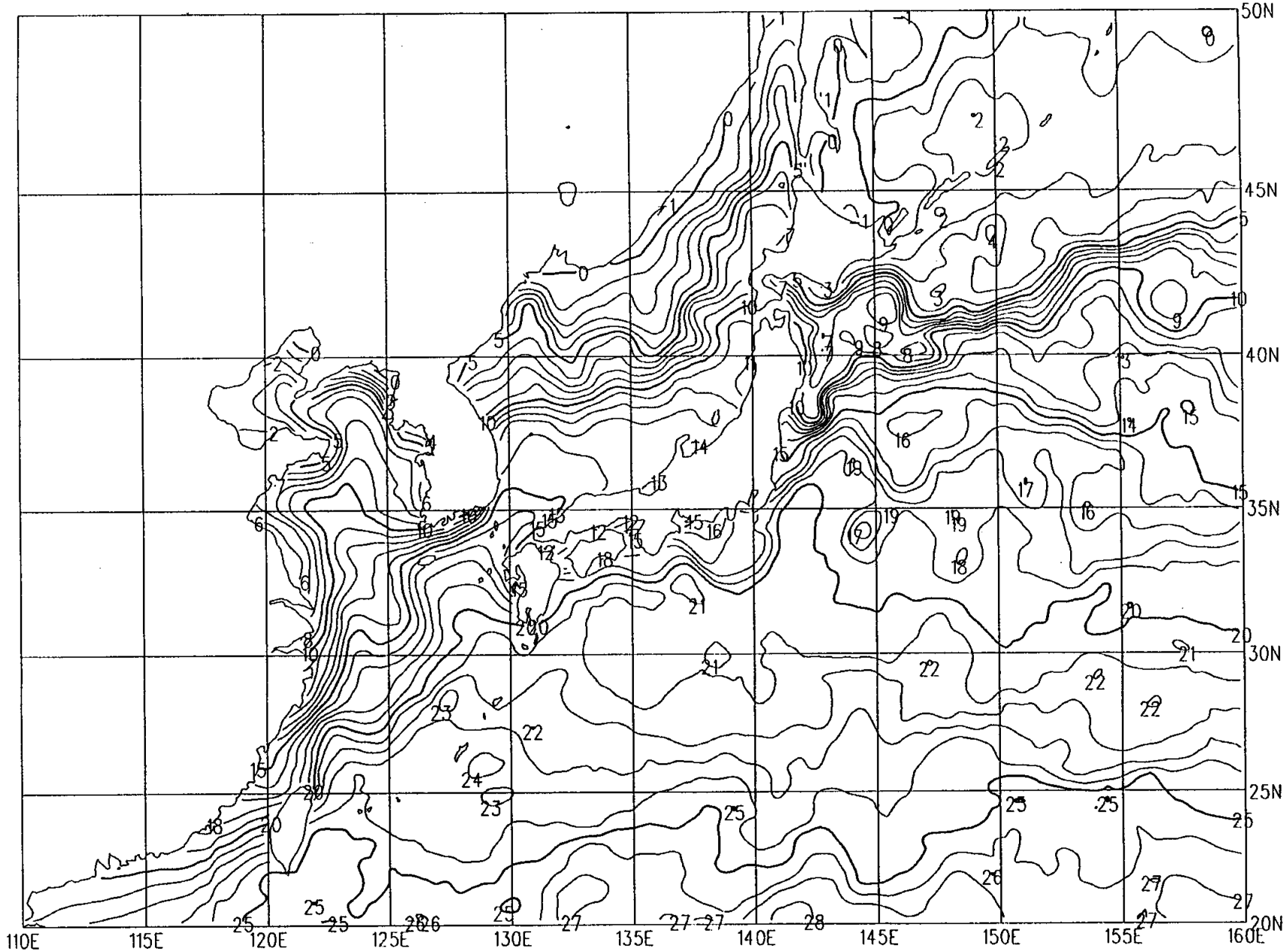
CTD file #: 0003S01.DAT

Bottle #	CTD data Depth [m]	Pressure [db]	Temp. [。C]	Pot-Temp [。C]	Salinity [PSU]	Sigma-t [kg/m^3]	DO [µmol/kg]	Salinity [psu]	NO2 [µmol/kg]	NO3 [µmol/kg]	PO4 [µmol/kg]	SiO4 [µmol/kg]
1	2000.6	2026.5	1.858	1.721	34.599	27.662		34.606	0.02	41.55	2.91	160.6
2	1500.9	1518.5	2.165	2.066	34.528	27.580		34.534	0.02	43.33	3.06	159.8
3	1000.8	1011.3	2.649	2.583	34.405	27.441		34.412	0.02	44.07	3.12	146.4
4	799.9	807.9	2.962	2.909	34.340	27.362		34.344	0.02	43.85	3.12	136.9
5	501.2	505.9	3.650	3.616	34.179	27.169		34.186	0.03	42.74	3.03	112.0
6	301.1	303.8	3.288	3.268	33.865	26.953		33.871	0.03	41.26	2.97	92.98
7	200.8	202.5	2.816	2.804	33.624	26.803		33.637	0.03	37.75	2.76	77.81
8	150.1	151.4	2.385	2.376	33.419	26.675		33.427	0.03	32.04	2.40	60.09
9	124.6	125.6	2.123	2.116	33.320	26.617		33.327	0.04	29.74	2.26	53.31
10	100.5	101.4	2.383	2.377	33.191	26.493		33.183	0.05	25.81	2.01	43.54
11	60.1	60.6	2.527	2.524	33.016	26.342		33.022	0.18	18.99	1.59	31.44
12	20.9	21.1	2.532	2.531	33.016	26.341		33.022	0.18	18.92	1.59	31.47
								2/6/00	Feb.24'00	Feb.24'00	Feb.24'00	Feb.24'00

2. SST

(presented by Nakano, Climate and Marine Department,

Japan Meteorological Agency)



日本近海日別海面水温解析

2000-01-12

3. Nojiri's library (photographs)

(courtesy of Nojiri, NIES)