Preliminary Report
of
The Hakuho Maru Cruises

KH-00-4

5 September ~ 19 October 2000

Tokyo – Naha – Tokyo

and

KH-01-1 leg 1

18 June ~ 9 July 2001

Tokyo – Kagoshima

Ocean Research Institute
The University of Tokyo
2004

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by

The Scientific Members of the Cruises

Edited by

Keisuke TAIRA and Masaki KAWABE

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1. Cruise Narrative

The cruise KH-00-4 of R.V. *Hakuho Maru* was carried out for 45 days from September 5 to October 19 in 2000, composed of two legs with port calls at Naha in Okinawa Island (23-29 September). The title of the research of this cruise is "Observational study on variations of oceanic conditions in the East China Sea and deep circulation east of Honshu, Japan". Study subjects are

(1) to measure volume transport and density structure of the Kuroshio off Izu and Shikoku and in the East China Sea (leg 1),
(2) to measure deep currents east of the Izu Ridge (leg 1),
(3) to study distribution and biology of sea birds in the Kuroshio area (leg 1),
(4) to study the variations and monitoring of oceanic conditions in the East China Sea (leg 2),
(5) to study on the primary production process in the marginal seas (leg 2).

The cruise KH-01-1 leg 1 was carried out for 22 days from June 18 to July 9 in 2001. Study subjects are

(1) to observe current velocity and water properties in deep layer in the Mariana Trench,
(2) to experiment for verification of upwelling due to the perpetual salt fountain in the Mariana region,
(3) to study the subtropical front and countercurrent in the North Pacific,
(4) to observe the deep current velocities in the western region of Okinawa,
(5) to observe tidal current velocities in the Tokara Strait.

These cruises are related to the Research Project, Grant-in-aid for Scientific Research on Priority Areas "Physical, Chemical and Biological Studies on Monitoring of Marginal Seas for Ocean Forecasting" (FY1999-2002). This project is a Japanese contribution to the international program North East Asian Regional–Global Ocean Observing System (NEAR–GOOS), which is steered by WESTPAC, the Intergovernmental Oceanographic Commission (IOC) sub-commission for the Western Pacific Region.

Throughout the cruises, we measured current velocity in a surface layer with shipboard ADCP (acoustic Doppler current profiler) of the Furuno Electric Co., Ltd. and the RD Instruments. At all the stations of CTD (conductivity, temperature, depth profiler), we sampled sea surface water with a bucket to measure temperature, salinity, and dissolved oxygen, and intake water to correct salinity data of the thermo-salinograph. Temperature data of CTD, XBT (expendable bathythermograph), and XCTD (expendable CTD) were sent to the Japan Meteorological Agency just after the cast using the BATHY telegram.

KH-00-4 leg 1 (Tokyo – Naha)

Full-depth casts of $CTDO_2$ with water sampling were made at 44 stations. $CTDO_2$ casts without water sampling were made at five stations because of lack of time due to refuge from Typhoon No. 14. Velocity was measured by LADCP at all the casts except for C06. Casts of XBT were made at 153 points.

As part of the Scientific Research on Priority Areas, volume transport of the Kuroshio was measured over the Izu Ridge and between Okinawa and Taiwan using shipboard ADCP and XBT, for obtaining the equations to convert voltage data of submarine cables to volume transport. For this purpose, three moorings of current meters were deployed at YAE1~YAE3 north of Ishigaki-jima. To measure volume and heat transport of the Kuroshio, three moorings of multi-paths IES (inverted echo sounder) and one mooring of pop-up XBT were deployed at EC1~EC4 east of Miyake-jima. A drop-sonde for transport measurement was tested around there.

The Kuroshio south of Shikoku was observed on the line of ASUKA (affiliated surveys of the Kuroshio off Cape Ashizuri), using $CTDO_2$, LADCP, and XBT and deploying four moorings of IESs and current meters at ES05, ES06, CM06, and CM07. The ASUKA works were made in the project "Kuroshio Fluctuation Prediction Experiment" of the Core Research for Evolutional Science and Technology (CREST) of Japan Science and Technology Corporation (JST).

Deep water and current in the Izu-Ogasawara Trench were observed using $CTDO_2$ and LADCP, and four moorings of current meters were deployed at ER1~ER4 (these were recovered in the Tansei Maru cruise KT-01-16). Moreover, sea birds in the Kuroshio area and bottom topography around Yonaguni-jima were surveyed.

KH-00-4 leg 2 (Naha – Tokyo)

We made physical, biological, and chemical observations in the East China Sea under excellent weather fortunately. Next day of leaving Naha, we deployed two moorings of ADCP at TK1 and TK2 in the Tokara Strait for observations of tidal currents to remove them from velocity data and construct a monitoring system of velocity and transport of the Kuroshio. In the last stage of the cruise (October 16), we recovered four moorings of multi-paths IES and pop-up XBT deployed in leg 1. In the rest of leg 2, we made $CTDO_2$ and bio-optical observations in the East China Sea, to clarify oceanographic conditions in the continental shelf and Kuroshio regions, current structure east of the Ryukyu Islands and in the Tokara Strait, east-west water exchange over the Nansei Shoto Ridge, and to make an estimation method of primary production.

Casts of $CTDO_2$ with and without water sampling were made at 136 and 18 stations, respectively. The nutrients were analyzed for all the water-sampling

stations. Particulate organic carbon (POC) and nitrogen (PON) were measured at 56 selected water-sampling stations. Velocity was measured by LADCP at almost all the $CTDO_2$ casts, and fluorescent intensity was measured by fluorometer at several casts. Casts of spectral radiometer were made at 32 stations, at 10 out of which casts of an instrument for natural fluorescence were made. Moreover, XBT and XCTD casts were made at 20 and 6 points, respectively.

KH-01-1 leg 1 (Tokyo – Kagoshima)

47 casts of XBT were made while we sailed from Tokyo to the Mariana region. In the Mariana Trench, we deployed three moorings of current meters at MM1~MM3 (these were recovered in KH-02-2), made 13 (2) casts of $CTDO_2$ with (without) water sampling, and sampled waters for measuring nutrients, dissolved inorganic carbon (DIC)–^{14}C, DIC–^{13}C, total carbon, alkalinity, and dissolved organic carbon (DOC)–^{14}C. Moreover, we made experiments for upwelling due to the perpetual salt fountain, but they were not successful, because the pipe (50-cm diameter, 300-m length) and ropes were not enough strong.

In the East China Sea, we recovered the three moorings of current meters at YAE1~YAE3 and two moorings of ADCP at TK1 and TK2, which were deployed in the cruise KH-00-4. We made four casts of $CTDO_2$ with water sampling around the mooring stations of YAE and 14 $CTDO_2$ casts without water sampling in the Tokara and Osumi Straits.

We obtained quite valuable oceanographic data for physical, chemical, and biological studies in the regions of the Izu-Ogasawara and Mariana Trenches, the Kuroshio, and the East China Sea.

Acknowledgements

We really express our gratitude to the captain and crew of R.V. *Hakuho Maru* and the scientists joining the cruises of KH-00-4 and KH-01-1 leg 1 for their cooperation throughout the cruises. Success in the observations is obviously due to their devoted and complete works.

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2. Summary of measurement and correction

A. Water Sample

A1. Instrument

Seawater was sampled from 12-liter Niskin bottles mounted at 24 places on a Sea-Bird Electronics Carousel water sampler (SBE 32).

A2. Conductivity

Conductivity of water samples was measured with a salinometer Guildline Portasal Model 8410 which was standardized by IAPSO Standard Seawater (Ocean Scientific International Ltd.) of Batch P137 (K_{15}=0.99995) in KH-00-4 and P130 (K_{15}=0.99997) at CM10~CM04, P137 (K_{15}=0.99995) at CM03~CM08 and YAE1~YAE3 in KH-01-1. The measurement was done in a laboratory in which air temperature was controlled and was a little lower than water temperature in the salinometer water bath.

A3. Dissolved Oxygen

Dissolved oxygen of water samples was measured with an automatic recording titrator Hirama Laboratories ART-3. We used 0.05 mol l^{-1} Sodium Thiosulfate Solution (Wako Pure Chemical Industries Ltd.) (factor = 1.007 in KH-00-4, 1.0121 in KH-01-1) for the titration.

A4. Nutrients

Phosphate phosphorus, nitrate plus nitrite nitrogen, ammonia nitrogen, and silicate silicon were measured with an auto analyzer Bran Luebbe Traacs 2000. Analyses of these nutrients were done on board immediately after sampling.

A5. Particulate organic carbon (POC) and nitrogen (PON)

Sampled seawater was filtered through 47 mm Whatman GF/F glass fiber filter immediately after sampling. All filters used were combusted in advance at 450°C for three hours in a muffle furnace to eliminate organic contamination. After the filtration, the filter was stored in a deep freezer until later analyses at the shore laboratory. POC and PON were analyzed with a Perkin Elmer 2400CHNS/O Elemental Analyzer.

B. $CTDO_2$

B1. Instrument

The $CTDO_2$ was a Sea-Bird Electronics instrument for 6500 db (SBE9plus). The sensor of conductivity was manufactured by the Sea-Bird Electronics, Inc. (SBE4) who claimed a resolution of 0.0004 mmho cm^{-1} and an accuracy of

±0.003 mmho cm^{-1}. The sensor of water temperature was manufactured by the Sea-Bird Electronics, Inc. (SBE3plus) who claimed a resolution of 0.0002°C and an initial accuracy of ±0.002°C. The sensor of pressure was manufactured by the Paroscientific Digiquartz (Model 4xK) with a resolution of 0.001% of full scale and an accuracy of ±0.015% of full scale (6000-db range). The sensor of dissolved oxygen was manufactured by the Sea-Bird Electronics, Inc. (SBE13).

In the cruise KH-00-4, two sets of the $CTDO_2$ system were used. One was CTD SBE9plus (Serial Number 23797-0608) equipped with conductivity sensor SBE4 (SN 2496), temperature sensor SBE3plus (SN 2905), and oxygen sensor SBE13 (SN 0550). Another set was CTD SBE9plus (SN 12545-0400), SBE4 (SN 1578), SBE3plus (SN 2017), and SBE13 (SN 0401 at QW06~KD08, SN 0550 at KD09~EC4). The former set of $CTDO_2$ was used in leg 1 and at the first several stations (TK14~QW05) in leg 2. This was the first operation of this underwater unit. The latter unit was used at the other stations in leg 2. Salinity data from the former unit tended to decrease as depth increases. We thought it was due to unsuccessful sensor calibration or an abrupt change of sensor characteristics, and we changed the underwater unit to the latter one. However, the awful sensor values were due to wrong input of a coefficient for water pressure data in SEASOFT. We found it during our next cruise KH-01-1, and reprocessed the $CTDO_2$ data of the former unit.

In KH-00-4 leg 2, the CTD underwater unit was equipped with a fluorometer manufactured by Chelsea Instrument Ltd. (Mk III Aquatracka Fluorometer). The fluorometer (SN 8218) was used at the first several stations (TK14~QW02), and was replaced with that (SN 8192) for the later stations (QW03~EC4).

In KH-01-1 leg 1, we used three sets of the $CTDO_2$ system. The first set was CTD SBE9 (SN 91894) equipped with conductivity sensor SBE4 (SN 518), temperature sensor SBE3plus (SN 893), and oxygen sensor SBE13 (SN 0474), and pressure sensor SBE12 (SN 1894). This system is for very deep oceans with a depth of 10500 m, and was used at CM10 and CM05A in the Mariana Trench. The second set was CTD SBE9plus (SN 23797-0608), SBE4 (SN 2496), SBE3plus (SN 2905), SBE13 (SN 0401), and was used at CM01~CM09, CM10A, CM11, CM12, and YAE1. The third set was CTD SBE9plus (SN 12545-0400), SBE4 (SN 2496), SBE3plus (SN 2017), SBE13 (SN 0550), and was used at YAE1A, YAE2, YAE3, and TK14~TK01.

B2. Data Collection

Full signals of frequency, which are digitized 24 times per second and sent from the underwater CTD unit SBE9plus, were received with the onboard unit SBE11plus and converted to output sequences of RS232C. The data were collected with the Sea-Bird Electronics CTD operating software SEASOFT, using an IBM-compatible personal computer EPSON Endeavor Pro. The full signals of

frequency were stored in the hard disc during the lowering stage of CTD cast and then were copied in magnetic optical discs at the deepest point of the cast.

B3. Calibration

The sensors of conductivity, temperature, and dissolved oxygen were calibrated by the Sea-Bird Electronics, Inc. prior to the cruise. The obtained new coefficients were used in the CTD operating software SEASOFT.

a. Pressure

Pressure data were corrected by subtracting the pressure-sensor value in the air of 0.6 db for CTD SBE9plus (SN 23797-0608), -1.2 db for CTD SBE9plus (SN 12545-0400) in KH-00-4 and of 1.0 db for the pressure sensor SBE12 (SN 1894), 0.3 db for CTD SBE9plus (SN 23797-0608), and 1.3 db for CTD SBE9plus (SN 12545-0400) in KH-01-1 leg 1.

b. Conductivity

Conductivity data were moreover calibrated using water-sample data. The ratio of conductivity from water sample to that from CTD (*CF*) was calculated. Vertical change of *CF* was expressed with polynomials of pressure *P* (db) such as

$$CF = a + bP + cP^2 + dP^3 + eP^4 + fP^5.$$

The calibration was made with *CF* computed from the above equation. The following coefficients *a*~*f* were used for the station groups.

KH-00-4 leg 1
1) C01~C12
a~*f* = 1.00036, -.323352E-6, .200720E-9, -.620299E-13, .925592E-17, -.525533E-21
2) C13~C25
a~*f* = 1.00043, -.299159E-6, .196773E-9, -.662320E-13, .104225E-16, -.605201E-21
3) C01~C25, YC01~YC19 (used for AS06~AS10)
a~*f* = 1.00044, -.325456E-6, .205211E-9, -.691930E-13, .110888E-16, -.659158E-21
4) YC01~YC19
a~*f* = 1.00052, -.555212E-6, .623645E-9, -.369177E-12, .104536E-15, -.109411E-19

KH-00-4 leg 2
1) TK13~QW05 (used for TK14~QW05A)
a~*f* = 1.000780, -.1410724E-5, .1092608E-8, 0.0, 0.0, 0.0
2) QW06~KD08
a~*f* = 1.000463, -.2323252E-5, .2160338E-8, 0.0, 0.0, 0.0
3) KD09~KD13
a~*f* = 1.001001, -.9676958E-6, .2460805E-9, 0.0, 0.0, 0.0
4) KD14~SM05
a~*f* = 1.000641, -.2919488E-5, .3840912E-8, -.1391112E-11, 0.0, 0.0
5) SM06~SM07
a~*f* = 1.001043, -.7121917E-6, .1712506E-9, -.1312402E-13, 0.0, 0.0

6) KG01~C2
a~f = 1.000768, -.3110784E-5, .4487335E-8, -.1891388E-11, 0.0, 0.0
7) KB01~ST01
a~f = 1.000720, -.1296355E-5, .9399269E-9, 0.0, 0.0, 0.0

KH-01-1 leg 1
1) CM01~CM09, CM10A, CM11, CM12 (for deeper than 1500 db)
a~f = 1.000046, -.8078458E-7, .9374744E-11, 0.0, 0.0, 0.0
2) No correction for YAE1, YAE1A, YAE2, YAE3, TK14~TK01

c. Dissolved Oxygen

Oxygen data were obtained with the method in the World Ocean Circulation Experiment (WOCE) Operations Manual, WOCE Hydrographic Programme Office Report WHPO 91-1, WOCE Report No. 68/91. Dissolved oxygen was calculated from the polarographic oxygen sensor electric current and probe temperature with the algorithm

$$O_x = \left[A(O_c + B\frac{dO_c}{dt}) + C \right] O_x^*(T,S) \exp\left[D\{T + E(T_o - T)\} + FP\right]$$

where O_x is the concentration of dissolved oxygen (ml l^{-1}), O_c the oxygen electric current (mA), T_o the oxygen sensor temperature (°C), T, S, and P are water temperature (°C), salinity (psu), and pressure (db) measured with CTD, $O_x^*(T,S)$ the saturated oxygen for T and S, and t is time (sec). Initially, the oxygen electric current Oc was smoothed by a running mean of 15 data (taking 24 data s^{-1}), and six parameters A~F were determined with a nonlinear least squares fitting to the oxygen of water samples. The result of the coefficients is shown below.

KH-00-4 leg 1
1) C01~C12
A~F = 2.5414, 7.5048, 0.00902, -0.028601, 1.11335, 1.3653E-4
2) C13~C25
A~F = 2.6505, 8.1994, 0.00373, -0.029502, 1.13226, 1.3398E-04
3) C01~C25, YC01~YC19 (used for AS06~AS10)
A~F = 2.5778, 8.6120, 0.00654, -0.028882, 1.01691, 1.3668E-04
4) YC01~YC19
A~F = 2.3425, 8.0911, 0.02177, -0.025569, 0.77996, 1.3363E-04

KH-00-4 leg 2
1) TK13~TK01, QW01, QW03, QW05 (used for TK13~QW05)
A~F = 2.2736, 6.7380, 0.02089, -0.024190, 0.86154, 1.5562E-04

2) QW08~QW10, KA01A, ST01A, KC02A, F, KD01 (used for QW06~KD01)

A~F = 2.2813, 3.2731, 0.10772, -0.026940, 0.95017, 2.3940E-04

3) KD09~KD14, SM01~SM07 (used for KD09~SM07)

A~F = 1.9409, 9.4964, 0.03361, -0.020035, 0.64750, 2.1594E-04

4) KG01, KG03, KG05, KG07, KC15, KC13, KC11, KC08, KC05, KC02, KB01, KB03, KB05, KB08, KB11, KB13, TK01A, KA14, KA12, KA10, KA08, KA06, KA04, KA02, A2, ST02A, ST04A, ST06A, ST08A, ST15, ST12, ST10 (used for KG01~ST01A)

A~F = 2.3637, 6.2113, 0.02785, -0.026079, 0.78912, 0.9926E-04

KH-01-1 leg 1

1) CM05A

A~F = 2.3788, -3.9796, -0.028700, -0.030294, 1.5267, 1.4821E-4

2) CM01~CM09, CM10A, CM11, CM12

A~F = 2.6797, 0.0904, -0.058157, -0.034101, 1.3702, 1.5686E-4

3) YAE1

A~F = 1.2791, 47.212, 0.085934, -0.013094, -0.2313, 1.1837E-4

4) YAE1A, YAE2, YAE3 (used also for TK01~TK14)

A~F = 2.3639, 4.7491, 0.016767, -0.025356, 0.9720, 1.3748E-4

C. XBT

Probes of TSK T-5, TSK T-6 (BATHY Code 212), TSK T-7 (Code 222), and Sparton XBT-7 (Code 461) were used. The depth of a falling XBT probe, z (m), was computed with the equation of the elapse time, t (sec), after falling from the sea surface that

$$z = 6.828 \cdot t - 0.00182 \cdot t^2 \quad \text{(TSK T-5)},$$

$$z = 6.691 \cdot t - 0.00225 \cdot t^2 \quad \text{(TSK T-6, T-7)},$$

$$z = 6.472 \cdot t - 0.00216 \cdot t^2 \quad \text{(Sparton XBT-7)}.$$

The data were recorded with Murayama Denki Z-60-16III.

D. XCTD

We used probes of TSK XCTD-1. The depth of a falling probe was computed with the equation that

$$z = 3.42543 \cdot t - 0.00047026 \cdot t^2.$$

The data were recorded with TSK MK-130 (Tsurumi Seiki Co., Ltd).

E. Shipboard ADCP

E1. ADCP (Furuno Electric Co., Ltd.)

Current velocities at three depths of 20, 50, 100 m (KH-00-4 leg 1), 15, 50, 100 m (KH-00-4 leg 2), and 20, 50, 100 m (KH-01-1 leg 1) were measured in an interval of 15 seconds. The data were averaged for every minute and recorded

with Doppler Sonar Current Profiler System CI-20H.

E2. ADCP (RD Instruments)

Current velocities at 64 levels in an interval of 16 m from 32–m depth (KH-00 -4 leg 1), 128 levels in an interval of 8 m from 24-m depth (KH-00-4 leg 2), and 64 levels in an interval of 16 m from 32-m depth (KH-01-1 leg 1) down to about 1000 m were measured with Broadband 38 kHz ADCP and recorded every two minutes.

Uncertainty of the ship heading direction decreases accuracies of the measured flow direction relative to the ship head and the measured velocity components. The ship heading direction data by the gyrocompass was manually input with a resolution of one degree when the system was switched on. Inaccuracy of this input is a source of measurement error. Another error source is a deviation in direction of the shipboard transducer from the original design.

According to Joyce (1989; *Journal of Atmospheric and Oceanic Technology*, **6**, 169-172), the correct velocity (u_w, v_w) is given from a ship speed (u_s, v_s) and a measured ADCP velocity (u_d, v_d) as

$$u_w = u_s + (1+\beta)(u'_d \cos\alpha - v'_d \sin\alpha)$$

$$v_w = v_s + (1+\beta)(u'_d \sin\alpha + v'_d \cos\alpha),$$

where α is the error in orientation of transducer, and $1+\beta$ is the scale factor. The coefficients computed with all the data of the cruise are

$$\alpha \text{ (rad)} = 0.0091, \quad \beta = -0.0479.$$

The current velocity data from the RDI ADCP should be corrected with the above equations and coefficients.

F. Lowered ADCP

Workhorse 300 kHz ADCP manufactured by RD Instruments was attached to the CTD-water sampler frame and used as a lowered ADCP in order to obtain vertical profiles of horizontal velocity. The transducer was set downward, and a buttery package was mounted on the frame. We selected 4-meter bins, 1 ping per ensemble, and 1 ping per 0.5 second. Data were stored in the underwater ADCP unit and recovered on the deck after the cast.

Noises and an influence of vertical move and rotation of the ADCP unit must be removed from the original data. Further processes of data should be made after the cruise to obtain correct data of current velocity.

G. Bio-optical Observations

G1. Water Leaving Radiances

Underwater downward irradiances and upward radiances were measured by an underwater spectral radiometer, MER-2040, Biospherical Instruments, 1-3 times per day during daytime. Downward irradiances were simultaneously measured on-board. Water leaving radiances were estimated from those data. Water leaving radiances were also directly measured by an on-board radiometer developed by Dr. Kishino in Physical Chemical Laboratory. Chlorophyll *a* concentration, an indicator of phytoplankton biomass, can also be estimated from water leaving radiances estimated from ocean color remote sensing.

G2. Chlorophyll *a*, Suspended matter, Colored-dissolved organic matter

Concentrations of chlorophyll *a* were measured by fluorometry with a Turner Designs fluorometer after filtration on Whatman GF/F filters and extraction by dimethyl formamid. Weights of the suspended matter (SS) were measured after filtration on 0.2μm Nuclepore filters. Absorption spectra of colored-dissolved organic matter (CDOM) were measured by a Shimadzu spectral photometer, MPS-2000, after filtration of water samples with 0.2μm Nuclepore filters.

Most of the present ocean color remote sensing algorithms are based on the empirical relationship between chlorophyll *a* and water leaving radiance assuming chlorophyll *a* is the dominant factor controlling optical properties. However, in the coastal waters, it is known that suspended matter and colored dissolved organic matter largely affect the optical properties and induce error to the algorithm. In order to develop a method to accurately estimate chlorophyll *a*, suspended matter, and colored dissolved organic matter, those water constituents were measured during the cruise.

G3. Phytoplankton Absorption Spectra

Absorption spectra of particulate matter and phytoplankton were measured by spectral photometer MPS-2400 by a 10-cm cell. Water samples were filtered by Whatman GF/F filters, and absorption of the filter was directly measured before and after extraction of phytoplankton pigments by methanol and hot water. Particulate matter affects the spectral characteristics, and specifically phytoplankton absorption is an important parameter for primary production.

G4. Light-Photosynthesis Curve

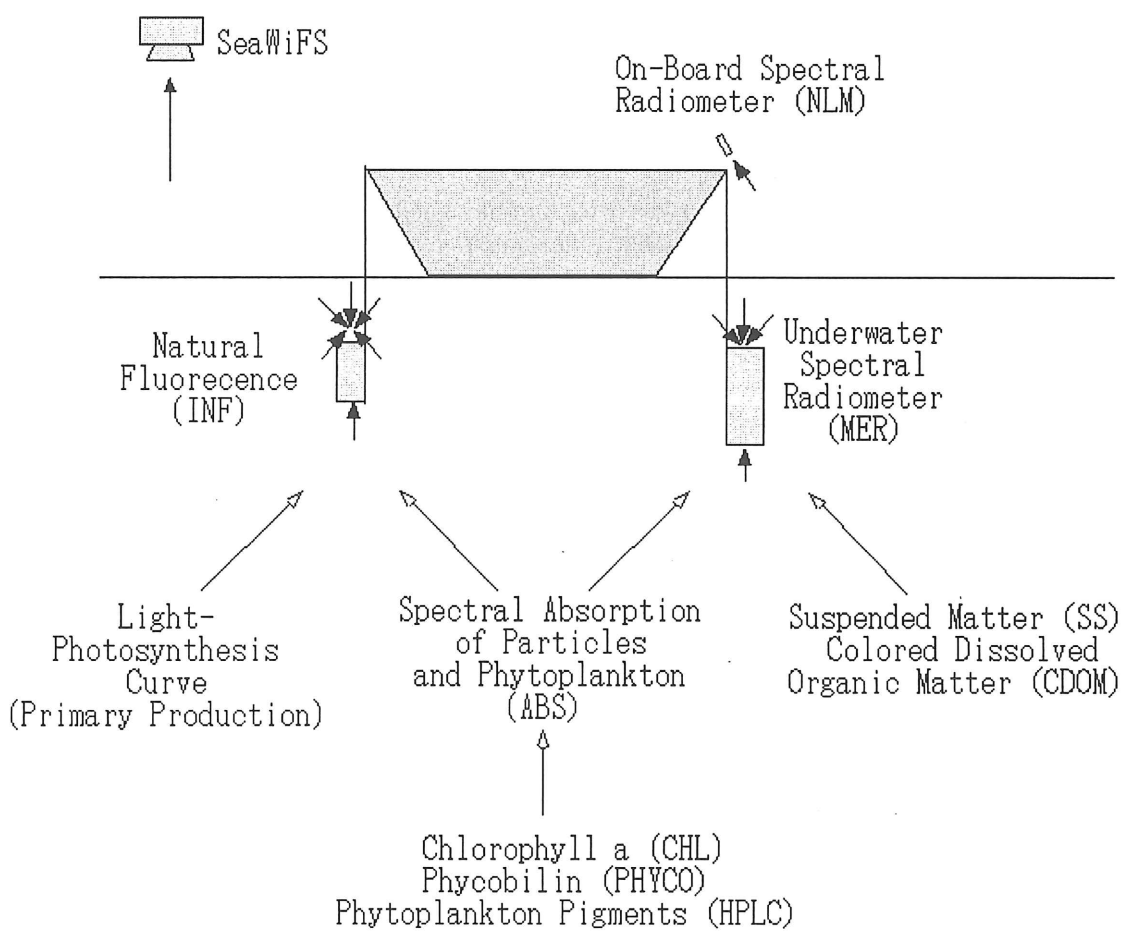
Light dependency of primary production was measured with ^{13}C labeled bicarbonate, in order to estimate water column primary production. Water samples taken from two to three layers within euphotic zone were incubated with 9 different light levels. ^{13}C of particulate organic matter on filters were measured.

G5. Natural Fluorescence

In vivo (living cells in natural environment) natural fluorescence was measured by an INF300, Biospherical Instrument, at daytime stations when light-photosynthesis curve was measured. It is suggested that phytoplankton *in vivo* natural fluorescence excited by sunlight can be used as an indicator of biomass and primary production.

G6. Phytoplankton Pigments

Phytoplankton pigment concentrations were measured by HPLC after extraction from filtered samples. To develop the measurement method of phycobili-pigments, samples were extracted by glycerin after filtration and analyzed by fluorometers, since Cyanobacteria such as Trichodesmium and Synechococcus are important primary producers in oligotrophic environment and have phycobili-pigments, which HPLC cannot measure. Phytoplankton has variety of pigments, and the pigments can be used as an indicator of taxonomic groups. The light absorption spectra correspond to combination of the pigments.



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KH-00-4

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[1] Participating leg 1 only, [2] Participating leg 2 only

KH-01-1 leg 1

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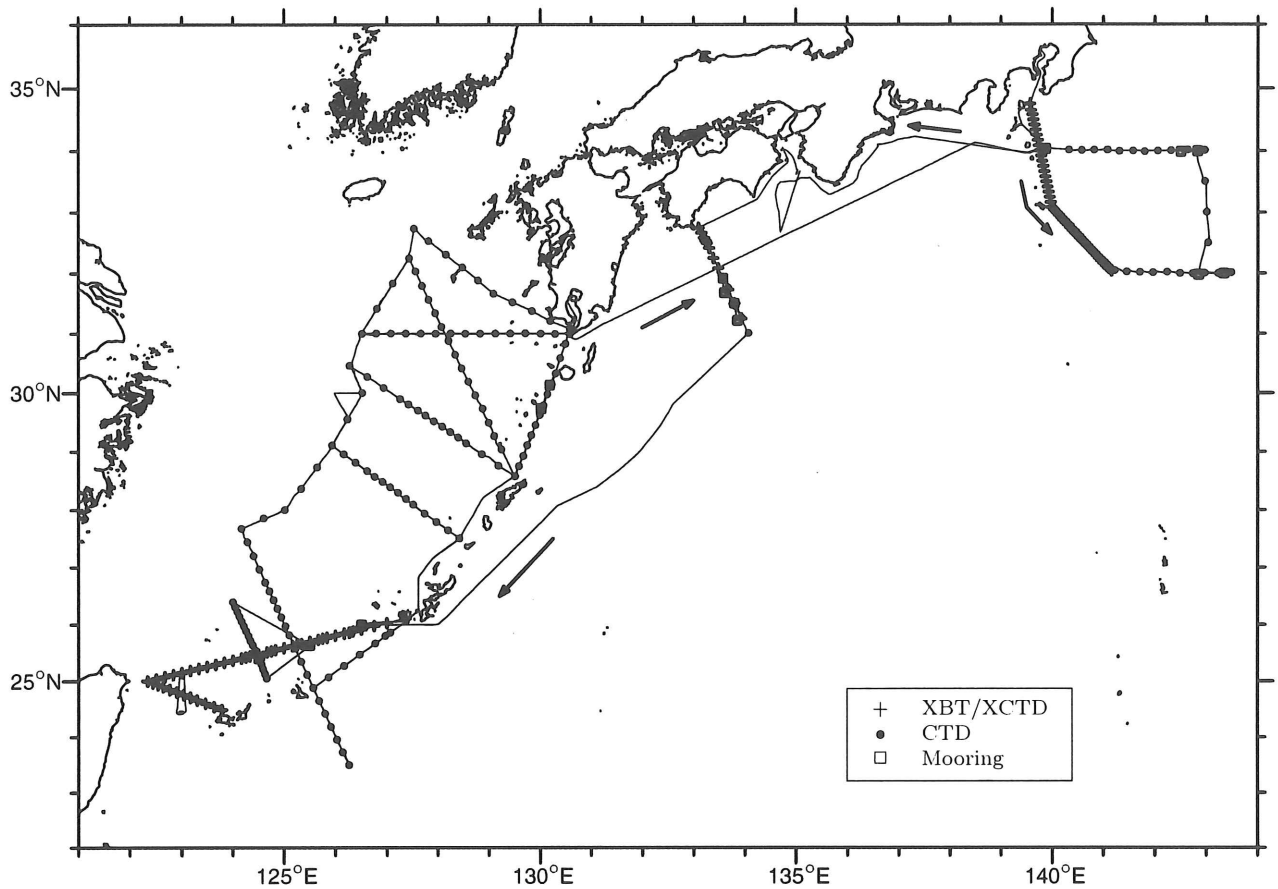
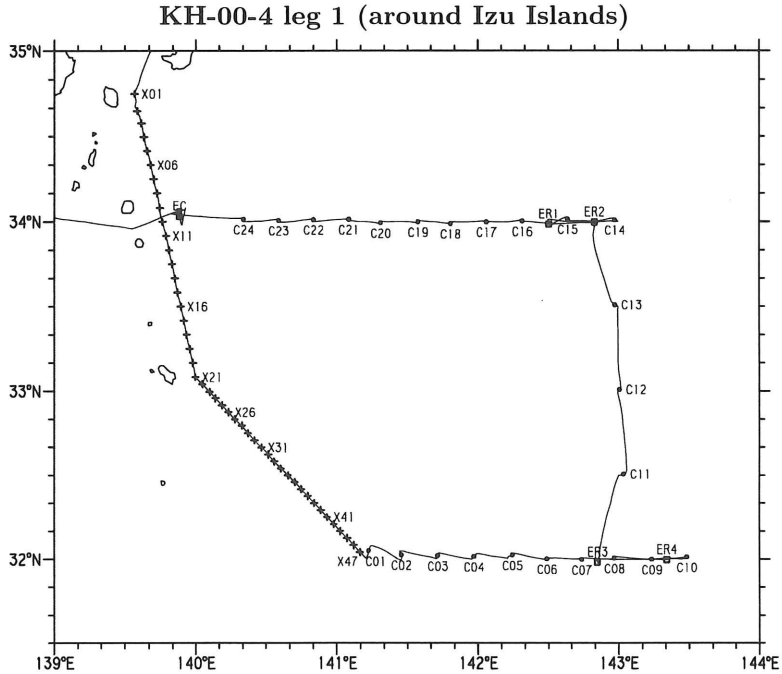
4. Track Chart

KH-00-4

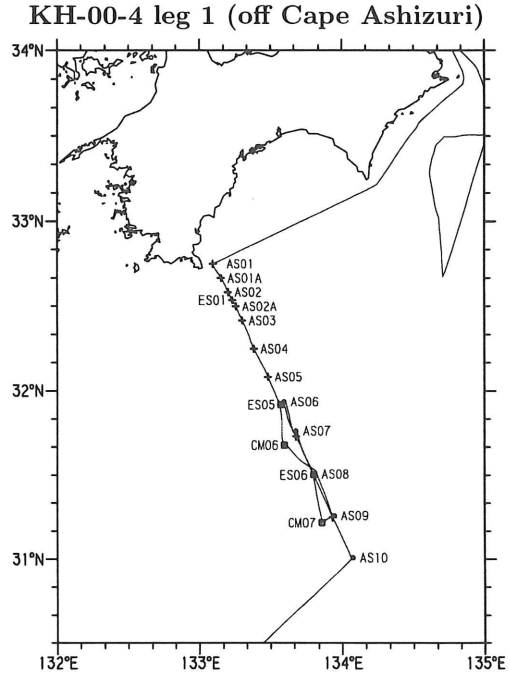


Area maps

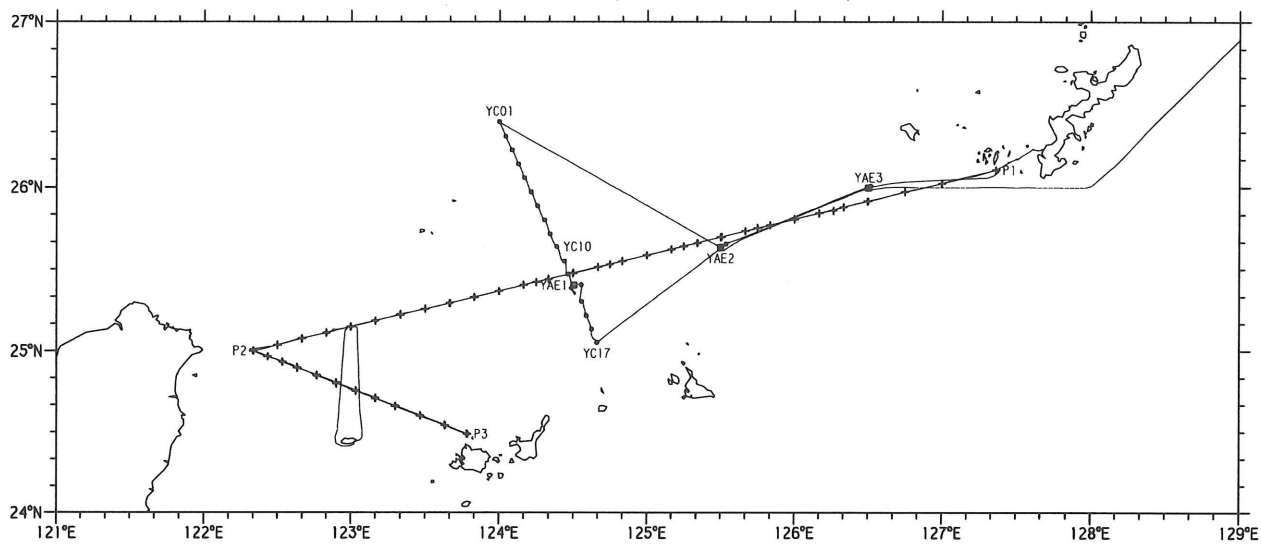
KH-00-4 leg 1 (around Izu Islands)



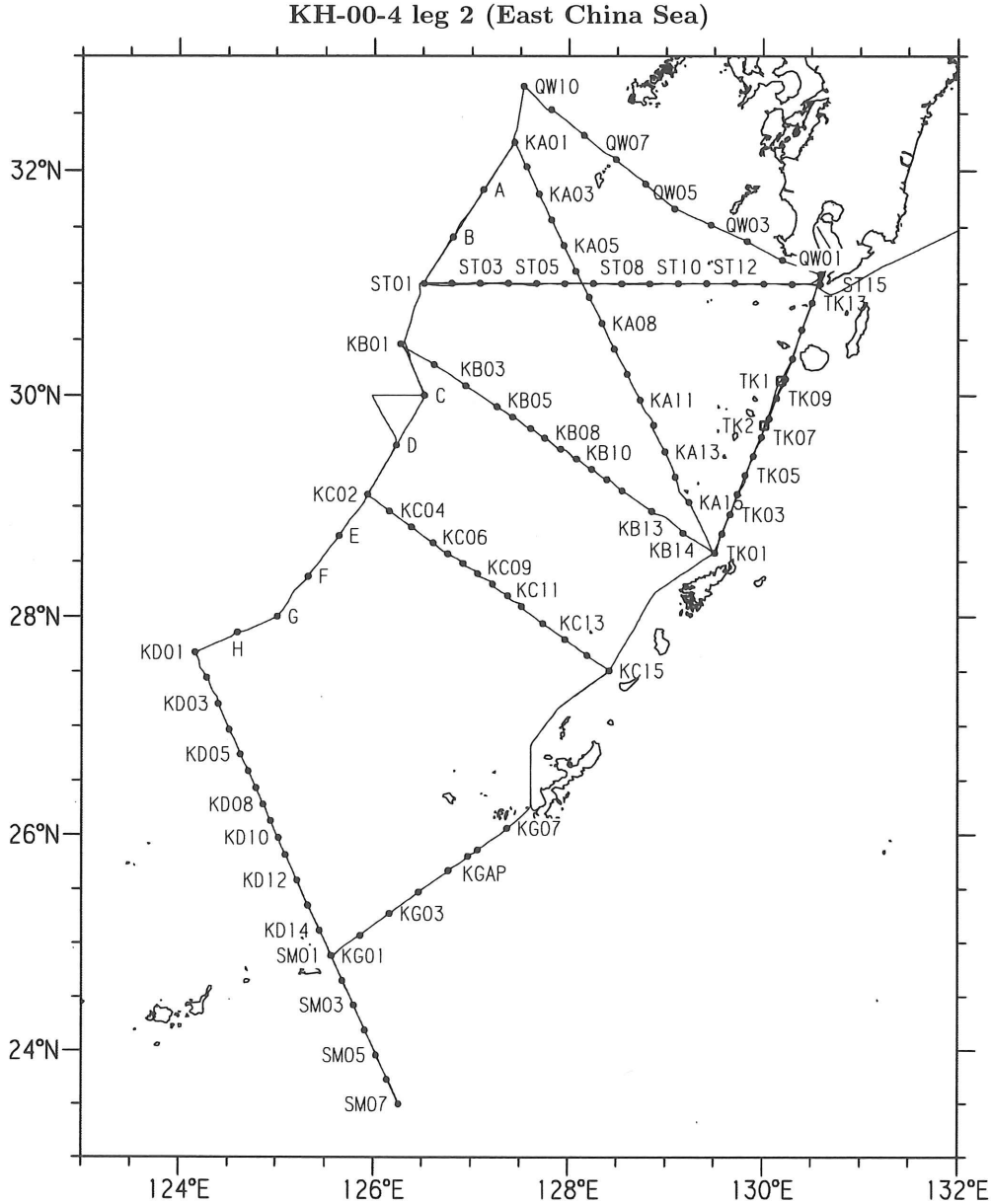
KH-00-4 leg 1 (off Cape Ashizuri)



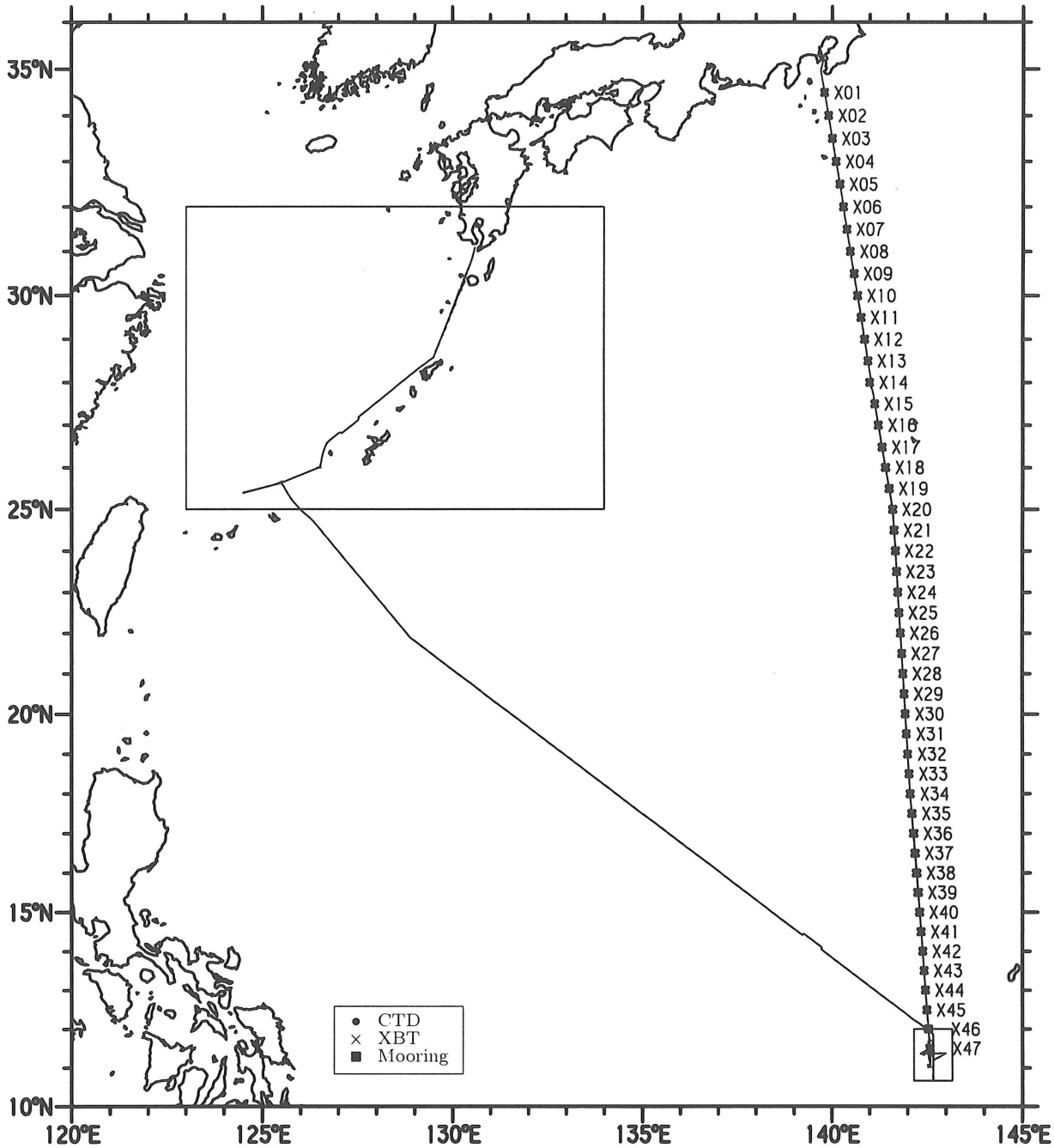
KH-00-4 leg 1 (Okinawa–Taiwan)



KH-00-4 leg 2 (East China Sea)

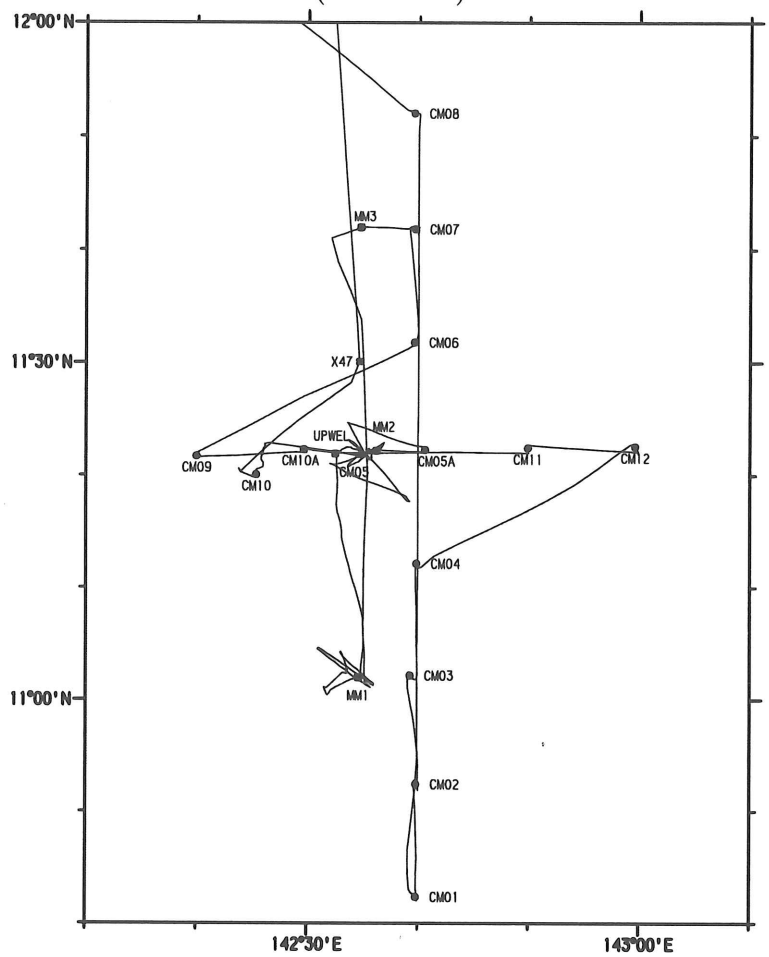


KH-01-1 leg 1

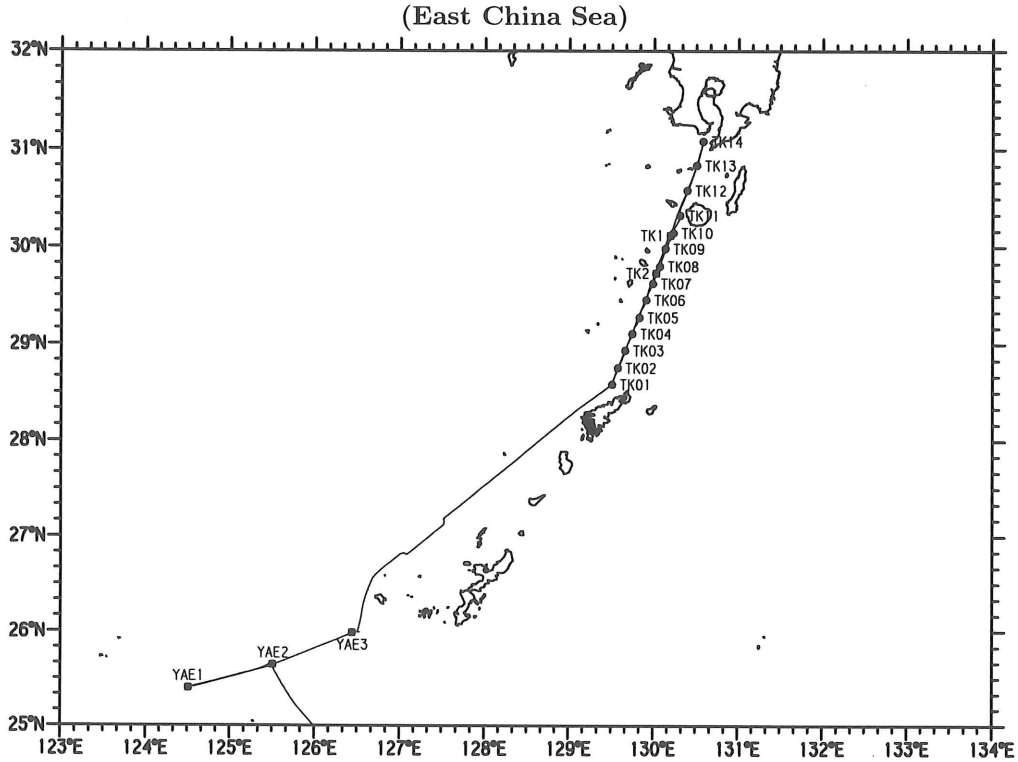

35°N
30°N
25°N
20°N
15°N
10°N
120°E
125°E
130°E
135°E
140°E
145°E
X01
X02
X03
X04
X05
X06
X07
X08
X09
X10
X11
X12
X13
X14
X15
X16
X17
X18
X19
X20
X21
X22
X23
X24
X25
X26
X27
X28
X29
X30
X31
X32
X33
X34
X35
X36
X37
X38
X39
X40
X41
X42
X43
X44
X45
X46
X47
CTD
XBT
Mooring

Area maps

(Marinana)

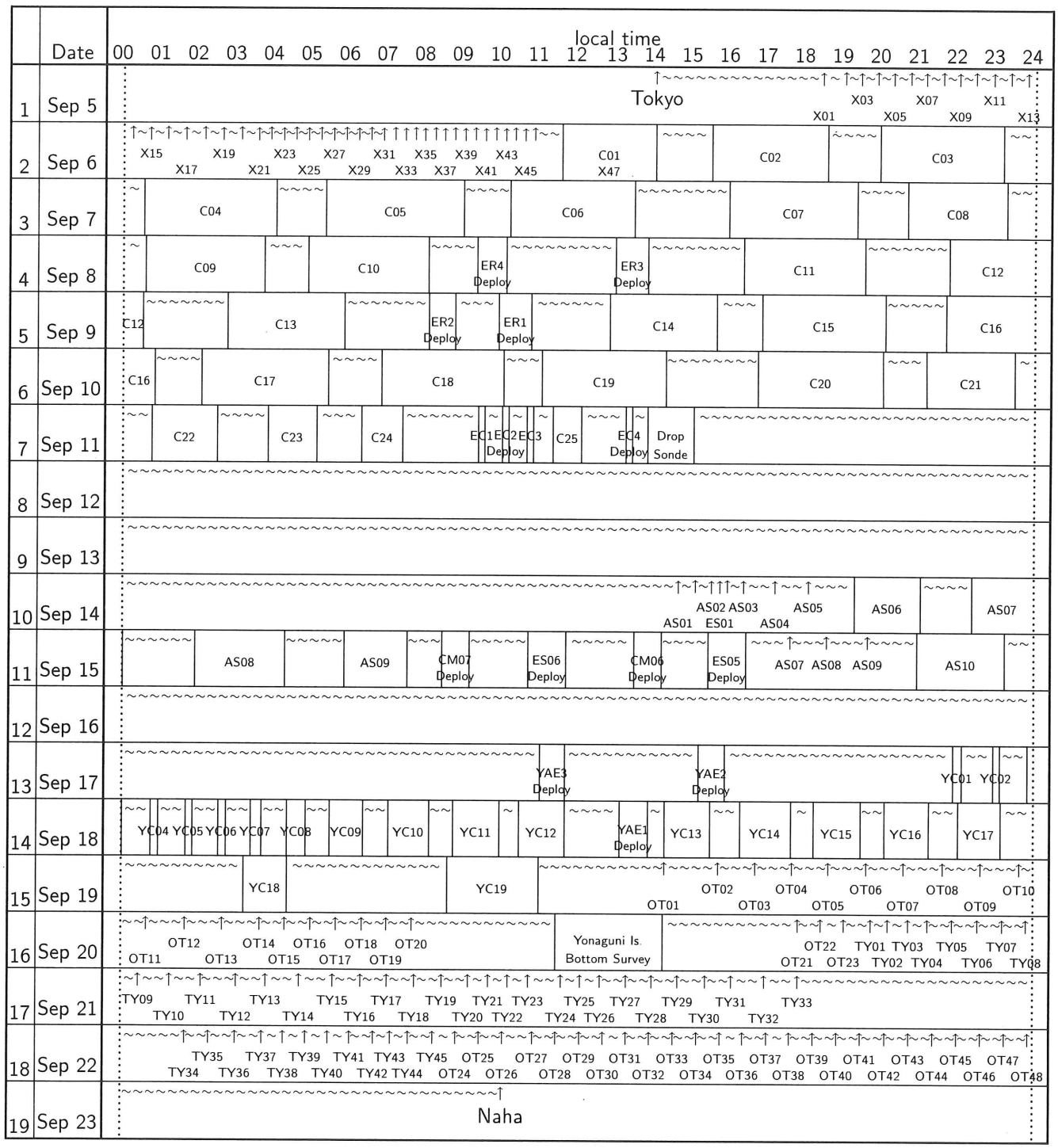


(East China Sea)

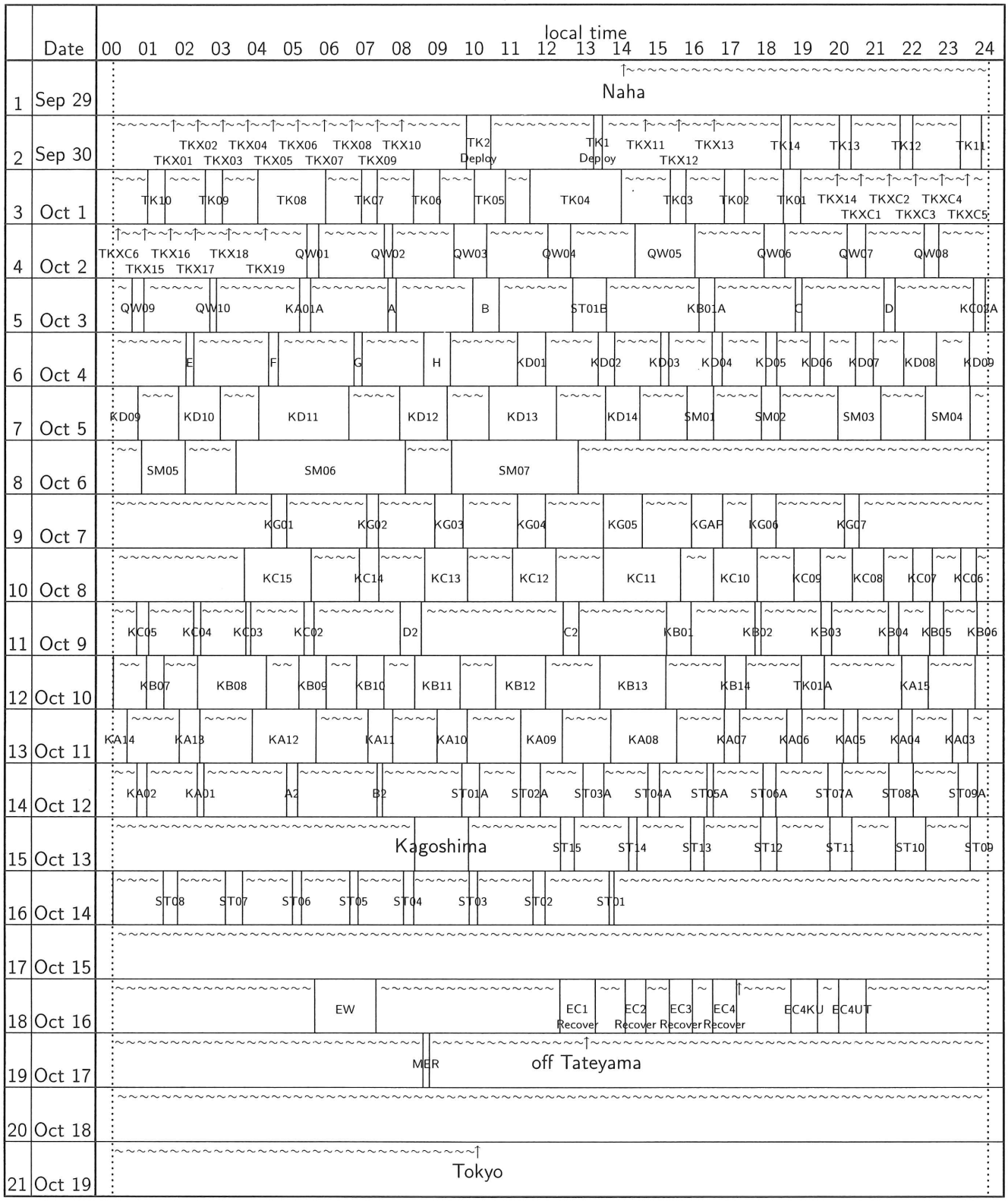


5. Time Table

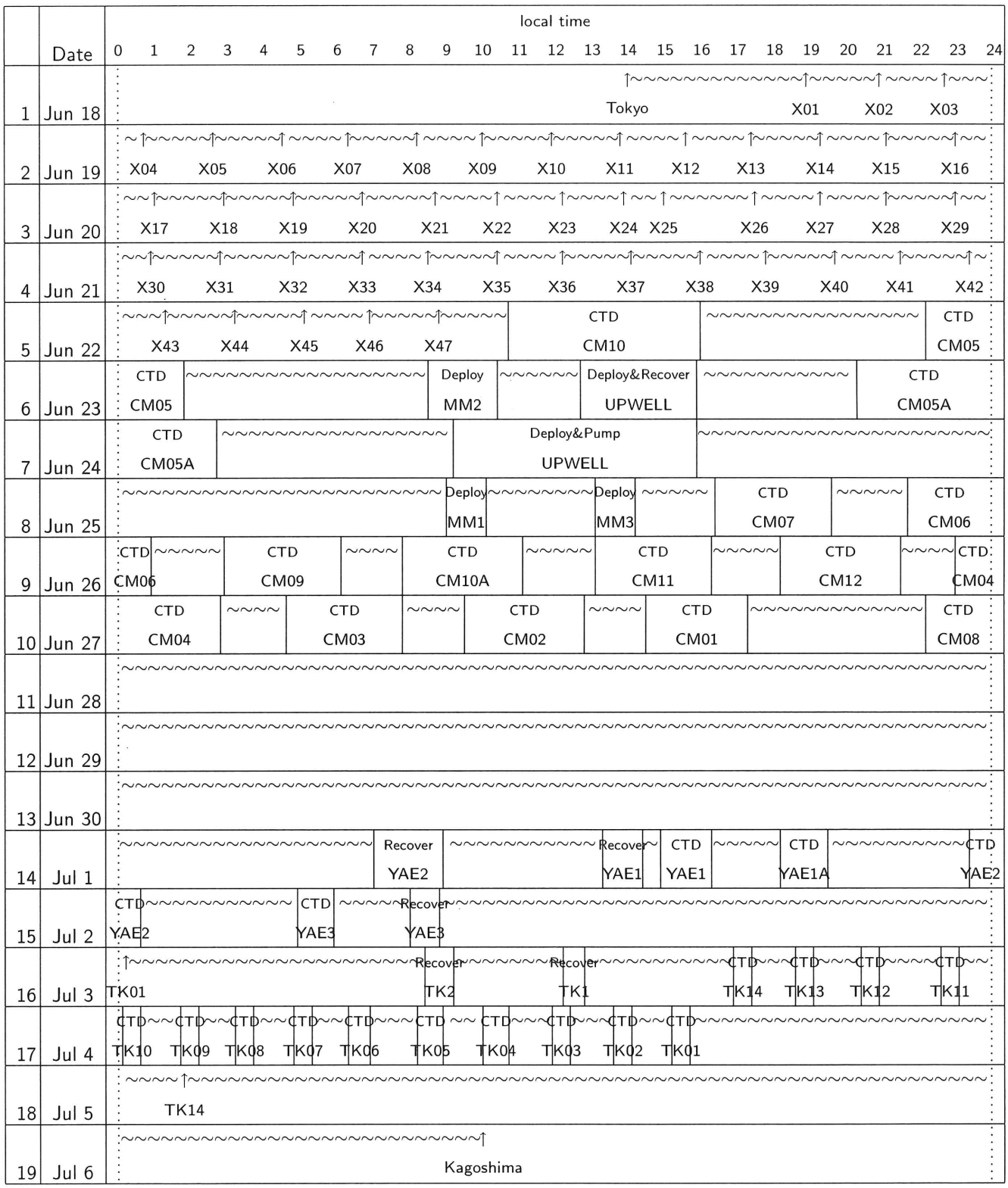
KH-00-4 leg 1



KH-00-4 leg 2


local time
00 01 02 03 04 05 06 07 08 09 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24
1 Sep 29
Naha
2 Sep 30
TKX02 TKX04 TKX06 TKX08 TKX10
TKX01 TKX03 TKX05 TKX07 TKX09
TK2 Deploy
TK1 Deploy
TKX11 TKX13 TK14 TK13 TK12 TK11
TKX12
3 Oct 1
TK10 TK09 TK08 TK07 TK06 TK05 TK04 TK03 TK02 TK01 TKX14 TKXC2 TKXC4
TKXC1 TKXC3 TKXC5
4 Oct 2
TKXC6 TKX16 TKX18 QW01 QW02 QW03 QW04 QW05 QW06 QW07 QW08
TKX15 TKX17 TKX19
5 Oct 3
QW09 QW10 KA01A A B ST01B KB01A C D KC01A
6 Oct 4
E F G H KD01 KD02 KD03 KD04 KD05 KD06 KD07 KD08 KD09
7 Oct 5
KD09 KD10 KD11 KD12 KD13 KD14 SM01 SM02 SM03 SM04
8 Oct 6
SM05 SM06 SM07
9 Oct 7
KG01 KG02 KG03 KG04 KG05 KGAP KG06 KG07
10 Oct 8
KC15 KC14 KC13 KC12 KC11 KC10 KC09 KC08 KC07 KC06
11 Oct 9
KC05 KC04 KC03 KC02 D2 C2 KB01 KB02 KB03 KB04 KB05 KB06
12 Oct 10
KB07 KB08 KB09 KB10 KB11 KB12 KB13 KB14 TK01A KA15
13 Oct 11
KA14 KA13 KA12 KA11 KA10 KA09 KA08 KA07 KA06 KA05 KA04 KA03
14 Oct 12
KA02 KA01 A2 B2 ST01A ST02A ST03A ST04A ST05A ST06A ST07A ST08A ST09A
15 Oct 13
Kagoshima ST15 ST14 ST13 ST12 ST11 ST10 ST09
16 Oct 14
ST08 ST07 ST06 ST05 ST04 ST03 ST02 ST01
17 Oct 15
18 Oct 16
EW EC1 Recover EC2 Recover EC3 Recover EC4 Recover EC4KU EC4UT
19 Oct 17
MER off Tateyama
20 Oct 18
21 Oct 19
Tokyo

KH-01-1 leg 1


local time
0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24
Date
1 Jun 18
Tokyo
X01
X02
X03
2 Jun 19
X04 X05 X06 X07 X08 X09 X10 X11 X12 X13 X14 X15 X16
3 Jun 20
X17 X18 X19 X20 X21 X22 X23 X24 X25 X26 X27 X28 X29
4 Jun 21
X30 X31 X32 X33 X34 X35 X36 X37 X38 X39 X40 X41 X42
5 Jun 22
X43 X44 X45 X46 X47
CTD
CM10
CTD
CM05
6 Jun 23
CTD
CM05
Deploy
MM2
Deploy&Recover
UPWELL
CTD
CM05A
7 Jun 24
CTD
CM05A
Deploy&Pump
UPWELL
8 Jun 25
Deploy
MM1
Deploy
MM3
CTD
CM07
CTD
CM06
9 Jun 26
CTD
CM06
CTD
CM09
CTD
CM10A
CTD
CM11
CTD
CM12
CTD
CM04
10 Jun 27
CTD
CM04
CTD
CM03
CTD
CM02
CTD
CM01
CTD
CM08
11 Jun 28
12 Jun 29
13 Jun 30
14 Jul 1
Recover
YAE2
Recover
YAE1
CTD
YAE1
CTD
YAE1A
CTD
YAE2
15 Jul 2
CTD
YAE2
CTD
YAE3
Recover
YAE3
16 Jul 3
TK01
Recover
TK2
Recover
TK1
CTD
TK14
CTD
TK13
CTD
TK12
CTD
TK11
17 Jul 4
CTD
TK10
CTD
TK09
CTD
TK08
CTD
TK07
CTD
TK06
CTD
TK05
CTD
TK04
CTD
TK03
CTD
TK02
CTD
TK01
18 Jul 5
TK14
19 Jul 6
Kagoshima

6. Summary of Observation Stations

KH-00-4

STN: Station number
TYPE: CTD=CTDO only, ROS=CTDO plus Rosette water sampler, MOR=Mooring, XBT=XBT, XCTD=XCTD, DROP=Drop Sonde, TOPO=Topographic survey, MER&INF=Underwater spectral radiometer
CODE: BE=Beginning of cast or work, DE=Deployment of mooring or XBT/XCTD, RE=Recovery of mooring
DEPTH: Water depth in meters
MAXP: Maximum pressure in decibars
PARAM: Sampling parameters
1=Salinity, 2=Dissolved Oxygen, 3=Nutrient, 4=POC, 5=Chlorophyl, 6=bio-opt1, 7=bio-opt2, 8=production
LADCP=Lowered ADCP, TP=Transponder
COMMENTS are included in the columns of MAXP/PARAM

KH-00-4 leg 1

STN	TYPE	DATE	GMT	CODE	LATITUDE	LONGITUDE	DEPTH	MAXP	PARAM
X01	XBT	090500	0925	DE	34°45.00′N	139°34.09′E	1844		*TSK T-6*
X02	XBT	090500	1000	DE	34°38.98′N	139°35.19′E	1287		*TSK T-6*
X03	XBT	090500	1025	DE	34°34.70′N	139°36.90′E	1120		*TSK T-6*
X04	XBT	090500	1051	DE	34°29.82′N	139°37.91′E	1010		*TSK T-6*
X05	XBT	090500	1117	DE	34°24.91′N	139°39.23′E	978		*TSK T-6*
X06	XBT	090500	1143	DE	34°20.01′N	139°40.67′E	1018		*TSK T-6*
X07	XBT	090500	1207	DE	34°15.02′N	139°41.90′E	871		*TSK T-6*
X08	XBT	090500	1234	DE	34°10.00′N	139°43.30′E	851		*TSK T-6*
X09	XBT	090500	1300	DE	34°04.86′N	139°44.52′E	915		*TSK T-6*
X10	XBT	090500	1326	DE	34°00.00′N	139°45.66′E	1093		*TSK T-6*
X11	XBT	090500	1354	DE	33°54.98′N	139°47.20′E	1209		*TSK T-6*
X12	XBT	090500	1421	DE	33°50.00′N	139°48.46′E	1213		*TSK T-6*
X13	XBT	090500	1448	DE	33°44.99′N	139°49.75′E	944		*TSK T-6*
X14	XBT	090500	1514	DE	33°39.94′N	139°50.97′E	608		*TSK T-6*
X15	XBT	090500	1542	DE	33°34.98′N	139°52.12′E	200		*TSK T-6*
X16	XBT	090500	1609	DE	33°30.00′N	139°53.53′E	445		*TSK T-6*
X17	XBT	090500	1638	DE	33°24.98′N	139°54.79′E	520		*TSK T-6*
X18	XBT	090500	1708	DE	33°19.99′N	139°56.05′E	533		*TSK T-6*
X19	XBT	090500	1737	DE	33°14.96′N	139°57.35′E	528		*TSK T-6*
X20	XBT	090500	1806	DE	33°09.99′N	139°58.72′E	467		*TSK T-6*
X21	XBT	090500	1833	DE	33°04.96′N	139°59.88′E	448		*TSK T-6*
X22	XBT	090500	1852	DE	33°02.49′N	140°02.78′E	504		*TSK T-6*
X23	XBT	090500	1913	DE	32°59.71′N	140°05.98′E	572		*TSK T-6*
X24	XBT	090500	1932	DE	32°57.44′N	140°08.49′E	646		*TSK T-7*
X25	XBT	090500	1951	DE	32°54.94′N	140°11.22′E	787		*TSK T-7*
X26	XBT	090500	2011	DE	32°52.47′N	140°13.96′E	891		*TSK T-7*
X27	XBT	090500	2031	DE	32°49.94′N	140°16.70′E	1056		*TSK T-7*
X28	XBT	090500	2051	DE	32°47.75′N	140°19.69′E	1256		*TSK T-7*
X29	XBT	090500	2110	DE	32°44.96′N	140°22.29′E	1419		*TSK T-7*
X30	XBT	090500	2130	DE	32°42.46′N	140°25.08′E	1555		*TSK T-7*
X31	XBT	090500	2150	DE	32°39.94′N	140°28.07′E	1796		*TSK T-7*
X32	XBT	090500	2208	DE	32°37.41′N	140°30.97′E	1806		*TSK T-7*
X33	XBT	090500	2224	DE	32°34.92′N	140°33.49′E	2005		*TSK T-7*
X34	XBT	090500	2240	DE	32°32.40′N	140°36.35′E	2216		*TSK T-7*
X35	XBT	090500	2255	DE	32°29.96′N	140°39.33′E	2308		*TSK T-7*
X36	XBT	090500	2311	DE	32°27.55′N	140°42.22′E	2641		*TSK T-7*
X37	XBT	090500	2326	DE	32°25.01′N	140°44.87′E	2825		*TSK T-7*
X38	XBT	090500	2342	DE	32°22.51′N	140°47.77′E	3465		*TSK T-7*
X39	XBT	090500	2358	DE	32°20.01′N	140°50.49′E	2982		*TSK T-7*
X40	XBT	090600	0014	DE	32°17.51′N	140°53.26′E	2998		*TSK T-7*
X41	XBT	090600	0030	DE	32°15.01′N	140°55.96′E	3164		*TSK T-7*
X42	XBT	090600	0046	DE	32°12.49′N	140°58.80′E	3556		*TSK T-7*

STN	TYPE	DATE	GMT	CODE	LATITUDE	LONGITUDE	DEPTH	MAXP	PARAM
X43	XBT	090600	0102	DE	32°10.01′N	141°01.53′E	3808		*TSK T-7*
X44	XBT	090600	0117	DE	32°07.51′N	141°04.45′E	3525		*TSK T-7*
X45	XBT	090600	0132	DE	32°05.01′N	141°07.11′E	3361		*TSK T-7*
X46	XBT	090600	0147	DE	32°02.51′N	141°09.77′E	3637		*TSK T-7*
C01	ROS	090600	0230	BE	32°00.98′N	141°12.82′E	3580	3902	1,2/LADCP
X47	XBT	090600	0236	DE	32°01.72′N	141°13.10′E	3716		*TSK T-7*
C02	ROS	090600	0627	BE	32°00.01′N	141°27.44′E	4763	5178	1,2/LADCP
C03	ROS	090600	1053	BE	32°00.28′N	141°42.51′E	6578	6408	1,2/LADCP
C04	ROS	090600	1531	BE	32°00.11′N	141°57.45′E	6575	6502	1,2/LADCP
C05	ROS	090600	2018	BE	32°00.47′N	142°12.71′E	8793	6501	1,2/LADCP
C06	ROS	090700	0110	BE	32°00.03′N	142°28.46′E	6120	6507	1,2
C07	ROS	090700	0657	BE	32°00.09′N	142°42.88′E	6670	6502	1,2/LADCP
C08	ROS	090700	1139	BE	32°00.07′N	142°57.78′E	5662	5241	1,2/LADCP
C09	ROS	090700	1534	BE	32°00.12′N	143°12.69′E	5655	6117	1,2/LADCP
C10	ROS	090700	1950	BE	32°00.23′N	143°28.16′E	5662	6144	1,2/LADCP
ER4	MOR	090800	0104	DE	31°59.78′N	143°20.42′E	5670		*3 CMs. 40.100MHz. A/R 1A*
ER3	MOR	090800	0448	DE	31°58.81′N	142°51.04′E	6027		*3 CMs. 40.150MHz. A/R 2E*
C11	ROS	090800	0720	BE	32°29.85′N	143°00.55′E	5600	6070	1,2/LADCP
C12	ROS	090800	1244	BE	33°00.14′N	143°00.35′E	5597	5588	1,2/LADCP
C13	ROS	090800	1744	BE	33°29.96′N	142°59.85′E	5537	5980	1,2/LADCP
ER2	MOR	090800	2343	DE	33°59.74′N	142°49.85′E	5284		*2 CMs, 40.150MHz, A/R 1F*
ER1	MOR	090900	0143	DE	33°59.04′N	142°30.29′E	6102		*3 CMs. 40.200MHz. A/R 1E*
C14	ROS	090900	0348	BE	34°00.08′N	142°59.76′E	5140	5484	1,2/LADCP
C15	ROS	090900	0749	BE	34°00.17′N	142°39.59′E	5833	6364	1,2/LADCP
C16	ROS	090900	1239	BE	33°59.96′N	142°19.63′E	6232	6505	1,2/LADCP
C17	ROS	090900	1703	BE	33°59.86′N	142°04.93′E	7107	6505	1,2/LADCP
C18	ROS	090900	2147	BE	33°59.72′N	141°49.36′E	7752	6502	1,2/LADCP
C19	ROS	091000	0200	BE	34°00.08′N	141°34.86′E	7236	6503	1,2/LADCP
C20	ROS	091000	0743	BE	33°59.99′N	141°19.64′E	6045	6501	1,2/LADCP
C21	ROS	091000	1209	BE	34°00.45′N	141°04.94′E	4200	4578	1,2/LADCP
C22	ROS	091000	1545	BE	34°00.35′N	140°49.92′E	3097	3214	1,2/LADCP
C23	ROS	091000	1848	BE	33°59.77′N	140°35.24′E	2099	2165	1,2/LADCP
C24	ROS	091000	2115	BE	34°00.05′N	140°20.13′E	1418	1452	2/LADCP
EC1	MOR	091100	0026	DE	34°02.69′N	139°49.32′E	1105		*IES with 1 CM. 40.050MHz. A/R 1D*
EC2	MOR	091100	0102	DE	34°04.24′N	139°55.36′E	1174		*IES with 1 CM. 40.100MHz. A/R 4B*
EC3	MOR	091100	0139	DE	33°58.87′N	139°54.03′E	1152		*IES with 1 CM. 40.000MHz. A/R 4A*
C25	ROS	091100	0217	BE	34°02.18′N	139°52.96′E	1163	1167	1,2/LADCP
EC4	MOR	091100	0414	DE	34°01.94′N	139°52.89′E	1168		*IXBT. 40.150MHz, A/R 2B*
EC4	XBT	091100	0425	DE	34°02.10′N	139°52.90′E	1165		*TSK T-5*
DROP	DROP	091100	0447	DE	34°02.50′N	139°52.92′E	1164		*DROP SONDE*
AS01	XBT	091400	0538	DE	32°44.94′N	133°05.67′E	141		*SPARTON XBT-7*
AS01A	XBT	091400	0605	DE	32°39.98′N	133°09.04′E	271		*SPARTON XBT-7*
AS02	XBT	091400	0630	DE	32°34.98′N	133°12.04′E	586		*SPARTON XBT-7*
ES01	XBT	091400	0644	DE	32°32.12′N	133°13.88′E	750		*SPARTON XBT-7*
AS02A	XBT	091400	0656	DE	32°29.94′N	133°15.33′E	788		*SPARTON XBT-7*
AS03	XBT	091400	0722	DE	32°24.96′N	133°18.03′E	946		*SPARTON XBT-7*
AS04	XBT	091400	0812	DE	32°14.96′N	133°22.99′E	1162		*SPARTON XBT-7*
AS05	XBT	091400	0905	DE	32°04.96′N	133°28.99′E	1974		*SPARTON XBT-7*
AS06	CTD	091400	1017	BE	31°55.40′N	133°34.84′E	2986	3100	LADCP
AS07	CTD	091400	1322	BE	31°45.20′N	133°40.10′E	4492	3003	LADCP
AS08	CTD	091400	1655	BE	31°29.97′N	133°48.00′E	4846	4702	LADCP
AS09	CTD	091400	2050	BE	31°15.10′N	133°56.15′E	4540	3000	LADCP
CM07	MOR	091400	2347	DE	31°13.03′N	133°51.43′E	4569		*1 CM. 43.528MHz N61. A/R 1E*
ES06	MOR	091500	0140	DE	31°30.10′N	133°48.00′E	4846		*IES. 43.528MHz O61*
CM06	MOR	091500	0451	DE	31°40.70′N	133°35.88′E	4822		*1 CM. 43.528MHz P61. A/R 1F*
ES05	MOR	091500	0625	DE	31°54.93′N	133°34.07′E	2964		*IES. 43.528MHz L61*
ES05	XBT	091500	0640	DE	31°55.08′N	133°34.47′E	2956		*SPARTON XBT-7*
AS07	XBT	091500	0836	DE	31°43.73′N	133°40.84′E	4703		*SPARTON XBT-7*
AS08	XBT	091500	0934	DE	31°29.92′N	133°48.12′E	4842		*SPARTON XBT-7*
AS09	XBT	091500	1038	DE	31°14.94′N	133°55.97′E	4541		*SPARTON XBT-7*

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AS10	CTD	091500	1155	BE	31°00.10′N	134°04.12′E	4428	4704	LADCP
YAE3	MOR	091700	0238	DE	25°59.78′N	126°30.03′E	1750		*3 CMs. 43.528MHz JS143. A/R 1C*
YAE2	MOR	091700	0651	DE	25°38.00′N	125°29.87′E	2024		*3 CMs. 40.100MHz. A/R 2G*
YC01	ROS	091700	1251	BE	26°23.66′N	124°00.01′E	144	129	1,2/LADCP
YC02	ROS	091700	1355	BE	26°18.53′N	124°02.52′E	143	130	1,2/LADCP
YC03	ROS	091700	1449	BE	26°13.51′N	124°05.11′E	146	131	1,2/LADCP
YC04	ROS	091700	1545	BE	26°08.44′N	124°07.63′E	151	137	1,2/LADCP
YC05	ROS	091700	1640	BE	26°03.41′N	124°10.07′E	162	146	1,2/LADCP
YC06	ROS	091700	1732	BE	25°58.32′N	124°12.66′E	149	140	1,2/LADCP
YC07	ROS	091700	1823	BE	25°53.28′N	124°15.21′E	296	275	1,2/LADCP
YC08	ROS	091700	1921	BE	25°48.29′N	124°17.91′E	463	613	1,2/LADCP
YC09	ROS	091700	2028	BE	25°43.22′N	124°20.20′E	1234	1324	1,2/LADCP
YC10	ROS	091700	2200	BE	25°38.47′N	124°22.86′E	1818	1944	1,2/LADCP
YC11	ROS	091700	2343	BE	25°33.41′N	124°25.33′E	2018	2056	1,2/LADCP
YC12	ROS	091800	0127	BE	25°28.43′N	124°27.15′E	2062	2101	1,2/LADCP
YAE1	MOR	091800	0451	DE	25°24.16′N	124°30.26′E	2088		*3 CMs. 43.528MHz JS144. A/R 1G*
YC13	ROS	091800	0517	BE	25°24.41′N	124°32.74′E	2088	2130	1,2/LADCP
YC14	ROS	091800	0717	BE	25°18.37′N	124°32.66′E	2224	2282	1,2/LADCP
YC15	ROS	091800	0914	BE	25°13.32′N	124°34.97′E	2228	2273	1,2/LADCP
YC16	ROS	091800	1106	BE	25°08.42′N	124°37.43′E	2079	2109	1,2/LADCP
YC17	ROS	091800	1301	BE	25°03.45′N	124°39.85′E	2040	2068	2/LADCP
YC18	ROS	091800	1812	BE	25°39.10′N	125°32.02′E	2064	2103	1,2/LADCP
YC19	ROS	091800	2333	BE	26°00.72′N	126°31.47′E	1734	1768	1,2/LADCP
YC19B	CTD	091900	0108	BE	26°00.51′N	126°31.64′E	1741	1503	LADCP
OT01	XBT	091900	0517	DE	26°06.38′N	127°21.96′E	76		*TSK T-7*
OT02	XBT	091900	0642	DE	26°01.50′N	127°00.00′E	1128		*TSK T-7*
OT03	XBT	091900	0741	DE	25°58.41′N	126°44.93′E	1443		*TSK T-7*
OT04	XBT	091900	0840	DE	25°54.94′N	126°29.79′E	746		*TSK T-7*
OT05	XBT	091900	0938	DE	25°51.54′N	126°15.94′E	1267		*TSK T-7*
OT06	XBT	091900	1037	DE	25°48.44′N	126°00.00′E	994		*TSK T-7*
OT07	XBT	091900	1136	DE	25°45.19′N	125°45.00′E	1977		*TSK T-7*
OT08	XBT	091900	1237	DE	25°41.79′N	125°29.97′E	2085		*TSK T-7*
OT09	XBT	091900	1337	DE	25°38.46′N	125°14.98′E	1402		*TSK T-7*
OT10	XBT	091900	1438	DE	25°35.15′N	125°00.01′E	1365		*TSK T-7*
OT11	XBT	091900	1539	DE	25°31.83′N	124°45.00′E	2080		*TSK T-7*
OT12	XBT	091900	1640	DE	25°28.56′N	124°29.94′E	2066		*TSK T-7*
OT13	XBT	091900	1739	DE	25°25.31′N	124°15.00′E	2020		*TSK T-7*
OT14	XBT	091900	1838	DE	25°21.98′N	124°00.00′E	1986		*TSK T-7*
OT15	XBT	091900	1918	DE	25°19.80′N	123°49.92′E	1932		*TSK T-7*
OT16	XBT	091900	1958	DE	25°17.56′N	123°39.93′E	1902		*TSK T-7*
OT17	XBT	091900	2038	DE	25°15.44′N	123°29.98′E	1886		*TSK T-7*
OT18	XBT	091900	2118	DE	25°13.28′N	123°19.99′E	1793		*TSK T-7*
OT19	XBT	091900	2157	DE	25°11.07′N	123°09.99′E	1614		*TSK T-7*
OT20	XBT	091900	2237	DE	25°08.93′N	122°59.89′E	1683		*TSK T-7*
YONA	TOPO	092000	0224	BE	24°26.26′N	123°01.48′E	85		*YONAGUNI JIMA*
OT21	XBT	092000	0848	DE	25°06.74′N	122°50.00′E	1596		*TSK T-7*
OT22	XBT	092000	0925	DE	25°04.46′N	122°39.94′E	1413		*TSK T-7*
OT23	XBT	092000	1001	DE	25°02.15′N	122°29.96′E	1378		*TSK T-7*
TY01	XBT	092000	1043	DE	25°00.08′N	122°20.02′E	1180		*TSK T-7*
TY02	XBT	092000	1110	DE	24°58.01′N	122°26.00′E	1450		*TSK T-7*
TY03	XBT	092000	1142	DE	24°55.99′N	122°31.99′E	1525		*TSK T-7*
TY04	XBT	092000	1212	DE	24°53.80′N	122°38.10′E	1522		*TSK T-7*
TY05	XBT	092000	1251	DE	24°51.01′N	122°45.99′E	1664		*TSK T-7*
TY06	XBT	092000	1331	DE	24°48.15′N	122°54.00′E	1519		*TSK T-7*
TY07	XBT	092000	1410	DE	24°45.34′N	123°01.97′E	1586		*TSK T-7*
TY08	XBT	092000	1448	DE	24°42.53′N	123°09.98′E	1653		*TSK T-7*
TY09	XBT	092000	1527	DE	24°39.66′N	123°18.00′E	1105		*TSK T-7*
TY10	XBT	092000	1616	DE	24°36.16′N	123°28.02′E	1366		*TSK T-7*
TY11	XBT	092000	1706	DE	24°32.53′N	123°38.02′E	1326		*TSK T-7*
TY12	XBT	092000	1801	DE	24°29.36′N	123°46.94′E	98		*TSK T-7*

STN	TYPE	DATE	GMT	CODE	LATITUDE	LONGITUDE	DEPTH	MAXP	PARAM
TY13	XBT	092000	1848	DE	24°32.56′N	123°37.98′E	1327		TSK T-7
TY14	XBT	092000	1941	DE	24°36.11′N	123°28.00′E	1373		TSK T-7
TY15	XBT	092000	2034	DE	24°39.62′N	123°17.96′E	1087		TSK T-7
TY16	XBT	092000	2117	DE	24°42.55′N	123°09.98′E	1655		TSK T-7
TY17	XBT	092000	2159	DE	24°45.45′N	123°01.96′E	1584		TSK T-7
TY18	XBT	092000	2242	DE	24°48.30′N	122°53.97′E	1515		TSK T-7
TY19	XBT	092000	2325	DE	24°51.02′N	122°46.00′E	1650		TSK T-7
TY20	XBT	092100	0007	DE	24°53.73′N	122°38.02′E	1520		TSK T-7
TY21	XBT	092100	0039	DE	24°55.93′N	122°32.05′E	1525		TSK T-7
TY22	XBT	092100	0110	DE	24°57.96′N	122°26.01′E	1451		TSK T-7
TY23	XBT	092100	0142	DE	25°00.02′N	122°20.01′E	1180		TSK T-7
TY24	XBT	092100	0234	DE	24°57.91′N	122°25.99′E	1456		TSK T-7
TY25	XBT	092100	0304	DE	24°55.96′N	122°32.02′E	1525		TSK T-7
TY26	XBT	092100	0336	DE	24°53.73′N	122°38.02′E	1520		TSK T-7
TY27	XBT	092100	0417	DE	24°50.85′N	122°46.00′E	1653		TSK T-7
TY28	XBT	092100	0458	DE	24°47.93′N	122°54.00′E	1597		TSK T-7
TY29	XBT	092100	0539	DE	24°45.18′N	123°01.99′E	1590		TSK T-7
TY30	XBT	092100	0622	DE	24°42.41′N	123°10.01′E	1644		TSK T-7
TY31	XBT	092100	0704	DE	24°39.54′N	123°18.05′E	1018		TSK T-7
TY32	XBT	092100	0756	DE	24°36.10′N	123°28.06′E	1373		TSK T-7
TY33	XBT	092100	0849	DE	24°32.54′N	123°38.07′E	1328		TSK T-7
TY34	XBT	092100	1640	DE	24°29.36′N	123°46.99′E	96		TSK T-7
TY35	XBT	092100	1718	DE	24°32.64′N	123°37.99′E	1330		TSK T-7
TY36	XBT	092100	1800	DE	24°36.20′N	123°28.00′E	1364		TSK T-7
TY37	XBT	092100	1842	DE	24°39.74′N	123°17.99′E	1189		TSK T-7
TY38	XBT	092100	1916	DE	24°42.65′N	123°09.99′E	1662		TSK T-7
TY39	XBT	092100	1951	DE	24°45.41′N	123°02.00′E	1586		TSK T-7
TY40	XBT	092100	2026	DE	24°48.30′N	122°54.00′E	1521		TSK T-7
TY41	XBT	092100	2100	DE	24°51.07′N	122°45.97′E	1652		TSK T-7
TY42	XBT	092100	2137	DE	24°53.93′N	122°37.97′E	1519		TSK T-7
TY43	XBT	092100	2204	DE	24°55.92′N	122°31.96′E	1524		TSK T-7
TY44	XBT	092100	2232	DE	24°57.99′N	122°25.96′E	1449		TSK T-7
TY45	XBT	092100	2311	DE	24°59.99′N	122°20.22′E	1187		TSK T-7
OT24	XBT	092100	2347	DE	25°02.23′N	122°30.00′E	1374		TSK T-7
OT25	XBT	092200	0024	DE	25°04.61′N	122°40.00′E	1418		TSK T-7
OT26	XBT	092200	0101	DE	25°06.63′N	122°50.00′E	1596		TSK T-7
OT27	XBT	092200	0148	DE	25°08.90′N	122°59.99′E	1685		TSK T-7
OT28	XBT	092200	0225	DE	25°11.13′N	123°10.01′E	1645		TSK T-7
OT29	XBT	092200	0303	DE	25°13.55′N	123°20.02′E	1804		TSK T-7
OT30	XBT	092200	0340	DE	25°15.48′N	123°30.03′E	1885		TSK T-7
OT31	XBT	092200	0416	DE	25°17.61′N	123°40.02′E	1902		TSK T-7
OT32	XBT	092200	0453	DE	25°19.72′N	123°50.03′E	1930		TSK T-7
OT33	XBT	092200	0530	DE	25°21.98′N	124°00.03′E	1989		TSK T-7
OT34	XBT	092200	0607	DE	25°24.28′N	124°10.01′E	2025		TSK T-7
OT35	XBT	092200	0644	DE	25°26.46′N	124°20.00′E	2047		TSK T-7
OT36	XBT	092200	0720	DE	25°28.65′N	124°30.02′E	2065		TSK T-7
OT37	XBT	092200	0758	DE	25°30.84′N	124°40.06′E	2069		TSK T-7
OT38	XBT	092200	0834	DE	25°33.02′N	124°50.05′E	2088		TSK T-7
OT39	XBT	092200	0912	DE	25°35.19′N	125°00.04′E	1360		TSK T-7
OT40	XBT	092200	0949	DE	25°37.37′N	125°10.00′E	1305		TSK T-7
OT41	XBT	092200	1026	DE	25°39.63′N	125°20.50′E	2061		TSK T-7
OT42	XBT	092200	1105	DE	25°41.90′N	125°30.35′E	2084		TSK T-7
OT43	XBT	092200	1142	DE	25°44.03′N	125°40.02′E	2084		TSK T-7
OT44	XBT	092200	1219	DE	25°46.16′N	125°50.04′E	1855		TSK T-7
OT45	XBT	092200	1257	DE	25°48.33′N	126°00.02′E	1022		TSK T-7
OT46	XBT	092200	1335	DE	25°50.56′N	126°10.06′E	1346		TSK T-7
OT47	XBT	092200	1413	DE	25°52.79′N	126°20.05′E	996		TSK T-7
OT48	XBT	092200	1450	DE	25°54.98′N	126°30.04′E	742		TSK T-7

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TKX01	XBT	092900	1638	DE	28°35.01′N	129°30.06′E	439		*TSK T-7*
TKX02	XBT	092900	1719	DE	28°45.30′N	129°34.72′E	775		*TSK T-7*
TKX03	XBT	092900	1800	DE	28°56.00′N	129°39.66′E	804		*TSK T-7*
TKX04	XBT	092900	1841	DE	29°06.61′N	129°44.56′E	991		*TSK T-7*
TKX05	XBT	092900	1923	DE	29°17.28′N	129°49.48′E	1074		*TSK T-7*
TKX06	XBT	092900	2004	DE	29°27.52′N	129°53.81′E	820		*TSK T-7*
TKX07	XBT	092900	2048	DE	29°38.05′N	129°58.13′E	519		*TSK T-7*
TKX08	XBT	092900	2133	DE	29°48.31′N	130°03.79′E	580		*TSK T-7*
TKX09	XBT	092900	2215	DE	29°59.10′N	130°08.32′E	626		*TSK T-7*
TKX10	XBT	092900	2255	DE	30°09.60′N	130°13.20′E	594		*TSK T-7*
TK2	MOR	093000	0121	DE	29°44.18′N	130°01.19′E	620		*Two 300kHz ADCPs, 43.528MHz JS180, A/R 1B*
TK1	MOR	093000	0425	DE	30°07.96′N	130°11.27′E	576		*Upward 75kHz ADCP, 40.150MHz, A/R 2F*
TKX11	XBT	093000	0537	DE	30°20.08′N	130°18.20′E	610		*TSK T-7*
TKX12	XBT	093000	0632	DE	30°35.13′N	130°23.70′E	319		*TSK T-7*
TKX13	XBT	093000	0730	DE	30°50.02′N	130°29.99′E	247		*TSK T-7*
TK14	ROS	093000	0920	BE	31°04.90′N	130°35.87′E	97	93	1-6/LADCP,TP
TK13	ROS	093000	1055	BE	30°49.62′N	130°30.01′E	246	246	1,2/LADCP
TK12	ROS	093000	1235	BE	30°35.19′N	130°23.66′E	328	301	1,2/LADCP
TK11	ROS	093000	1414	BE	30°19.84′N	130°17.98′E	613	595	1-5/LADCP
TK10	ROS	093000	1556	BE	30°09.16′N	130°13.43′E	601	580	1,2/LADCP
TK09	ROS	093000	1730	BE	29°58.66′N	130°08.26′E	637	600	1,2/LADCP
TK08	ROS	093000	1856	BE	29°47.93′N	130°03.42′E	600	576	1-4/LADCP
TK08	ROS	093000	2024	BE	29°47.87′N	130°03.52′E	601	202	5,6,8
TK07	ROS	093000	2147	BE	29°37.74′N	129°59.05′E	563	550	1,2/LADCP
TK06	ROS	093000	2313	BE	29°27.45′N	129°54.06′E	817	823	1,2/LADCP,TP
TK05	ROS	100100	0053	BE	29°16.95′N	129°49.07′E	1099	1083	1,2/LADCP,TP
TK04	ROS	100100	0224	BE	29°06.51′N	129°44.29′E	1006	990	1-4/LADCP,TP
TK04	MER	100100	0339	BE	29°06.61′N	129°44.33′E	1012	144	
TK04	INF	100100	0354	BE	29°06.63′N	129°44.28′E	1009	104	
TK04	ROS	100100	0428	BE	29°06.72′N	129°44.28′E	1011	200	5-8
TK03	ROS	100100	0616	BE	28°55.79′N	129°39.76′E	807	800	1,2/LADCP,TP
TK02	ROS	100100	0745	BE	28°45.33′N	129°34.74′E	780	776	1,2/LADCP,TP
TK01	ROS	100100	0923	BE	28°34.95′N	129°30.20′E	440	429	1-5/LADCP,TP
TKX14	XBT	100100	1051	DE	28°46.67′N	129°35.35′E	793		*TSK T-7*
TKXC1	XCTD	100100	1130	DE	28°56.00′N	129°39.50′E	801		*TSK XCTD-1*
TKXC2	XCTD	100100	1216	DE	29°06.50′N	129°44.40′E	993		*TSK XCTD-1*
TKXC3	XCTD	100100	1259	DE	29°17.00′N	129°49.21′E	1078		*TSK XCTD-1*
TKXC4	XCTD	100100	1342	DE	29°27.50′N	129°54.17′E	819		*TSK XCTD-1*
TKXC5	XCTD	100100	1424	DE	29°38.00′N	129°58.91′E	517		*TSK XCTD-1*
TKXC6	XCTD	100100	1508	DE	29°48.50′N	130°03.83′E	580		*TSK XCTD-1*
TKX15	XBT	100100	1552	DE	29°59.05′N	130°08.56′E	623		*TSK T-7*
TKX16	XBT	100100	1634	DE	30°09.48′N	130°13.34′E	594		*TSK T-7*
TKX17	XBT	100100	1715	DE	30°20.00′N	130°17.89′E	603		*TSK T-7*
TKX18	XBT	100100	1810	DE	30°35.00′N	130°23.71′E	321		*TSK T-7*
TKX19	XBT	100100	1910	DE	30°50.10′N	130°30.03′E	249		*TSK T-7*
QW01	ROS	100100	2018	BE	31°04.96′N	130°35.19′E	131	112	1-6,8/LADCP
QW02	ROS	100100	2226	BE	31°12.60′N	130°11.79′E	147	141	1/LADCP
QW03	ROS	100200	0021	BE	31°22.46′N	129°50.07′E	270	258	1-5,7/LADCP,TP
QW03	MER	100200	0058	BE	31°22.64′N	129°50.42′E	277	154	
QW04	ROS	100200	0256	BE	31°31.29′N	129°27.51′E	770	767	1/LADCP,TP
QW05	ROS	100200	0520	BE	31°39.89′N	129°03.94′E	711	698	1-4/LADCP,TP
QW05	MER	100200	0554	BE	31°39.76′N	129°05.32′E	706	150	
QW05	INF	100200	0613	BE	31°39.75′N	129°05.53′E	706	101	
QW05	ROS	100200	0630	BE	31°39.80′N	129°05.81′E	704	200	5-8
QW06	ROS	100200	0853	BE	31°52.97′N	128°46.94′E	646	648	1/LADCP,TP
QW07	ROS	100200	1109	BE	32°05.79′N	128°28.69′E	201	207	1/LADCP,TP
QW08	ROS	100200	1315	BE	32°18.57′N	128°09.33′E	153	140	1-5/LADCP
QW09	ROS	100200	1530	BE	32°32.03′N	127°48.95′E	153	141	1/LADCP
QW10	ROS	100200	1738	BE	32°44.31′N	127°32.05′E	136	125	1/LADCP

STN	TYPE	DATE	GMT	CODE	LATITUDE	LONGITUDE	DEPTH	MAXP	PARAM
KA01A	ROS	100200	2006	BE	32°14.69′N	127°25.52′E	131	121	1-6,8/LADCP
A	ROS	100200	2232	BE	31°50.06′N	127°07.13′E	119	108	1/LADCP
B	ROS	100300	0052	BE	31°24.84′N	126°48.51′E	98	91	1,7/LADCP
B	MER	100300	0122	BE	31°24.82′N	126°48.08′E	98	90	
ST01A	ROS	100300	0337	BE	31°01.12′N	126°30.38′E	82	68	1-8/LADCP
ST01A	MER	100300	0359	BE	31°01.07′N	126°30.22′E	83	75	
ST01A	INF	100300	0427	BE	31°00.93′N	126°29.59′E	83	53	
KB01A	ROS	100300	0705	BE	30°28.40′N	126°18.60′E	78	67	1,7/LADCP
KB01A	MER	100300	0721	BE	30°28.20′N	126°18.80′E	78	71	
C	ROS	100300	0944	BE	30°00.09′N	126°31.09′E	88	75	1/LADCP
D	ROS	100300	1209	BE	29°33.29′N	126°14.01′E	100	92	1/LADCP
KC02A	ROS	100300	1436	BE	29°06.31′N	125°55.95′E	91	84	1-5/LADCP
E	ROS	100300	1658	BE	28°44.20′N	125°38.50′E	107	96	1/LADCP
F	ROS	100300	1914	BE	28°22.02′N	125°19.74′E	108	99	1-6/LADCP
G	ROS	100300	2135	BE	28°00.14′N	125°00.88′E	96	88	1/LADCP
H	MER	100300	2330	BE	27°51.27′N	124°36.13′E	98	90	
H	ROS	100300	2354	BE	27°51.34′N	124°36.09′E	98	91	1,7/LADCP
KD01	ROS	100400	0204	BE	27°40.43′N	124°10.09′E	95	94	1-8/LADCP
KD01	MER	100400	0228	BE	27°40.61′N	124°09.87′E	95	91	
KD01	INF	100400	0245	BE	27°40.71′N	124°09.80′E	95	53	
KD02	ROS	100400	0418	BE	27°26.60′N	124°17.08′E	99	92	1,2,7/LADCP
KD02	MER	100400	0434	BE	27°26.66′N	124°17.08′E	99	93	
KD03	ROS	100400	0602	BE	27°12.25′N	124°24.11′E	106	94	1-4/LADCP
KD04	ROS	100400	0726	BE	26°58.14′N	124°30.97′E	117	106	1,2/LADCP
KD05	ROS	100400	0855	BE	26°44.54′N	124°37.88′E	120	108	1-4/LADCP
KD06	ROS	100400	1008	BE	26°35.32′N	124°42.78′E	156	143	1,2/LADCP
KD07	ROS	100400	1122	BE	26°26.03′N	124°47.53′E	185	180	1,2/LADCP
KD08	ROS	100400	1241	BE	26°16.79′N	124°51.98′E	1009	972	1-5/LADCP
KD09	ROS	100400	1429	BE	26°07.42′N	124°56.74′E	1583	1545	1,2/LADCP
KD10	ROS	100400	1646	BE	25°58.21′N	125°01.45′E	1771	1721	1,2/LADCP
KD11	ROS	100400	1858	BE	25°48.75′N	125°05.88′E	2132	2076	1-4/LADCP
KD11	ROS	100400	2059	BE	25°48.97′N	125°06.01′E	2133	200	5,6,8
KD12	ROS	100400	2251	BE	25°34.80′N	125°13.03′E	2039	2037	1,2/LADCP
KD13	ROS	100500	0118	BE	25°20.88′N	125°19.91′E	1970	1992	1,2,7/LADCP
KD13	MER	100500	0253	BE	25°21.01′N	125°19.81′E	2000	150	
KD14	ROS	100500	0430	BE	25°07.00′N	125°26.79′E	162	141	1-8/LADCP
KD14	MER	100500	0505	BE	25°07.01′N	125°26.81′E	163	145	
KD14	INF	100500	0519	BE	25°07.00′N	125°26.65′E	148	101	
SM01	MER	100500	0645	BE	24°52.98′N	125°33.89′E	134	128	
SM01	ROS	100500	0710	BE	24°52.91′N	125°33.73′E	127	117	1,2,7/LADCP
SM02	ROS	100500	0847	BE	24°39.12′N	125°40.90′E	694	692	1,2/LADCP
SM03	ROS	100500	1052	BE	24°25.21′N	125°48.05′E	1512	1463	1,2/LADCP
SM04	ROS	100500	1315	BE	24°11.23′N	125°55.01′E	1554	1523	1-5/LADCP
SM05	ROS	100500	1546	BE	23°57.36′N	126°02.03′E	1825	1762	1,2/LADCP
SM06	ROS	100500	1821	BE	23°43.45′N	126°08.78′E	5640	5540	1-4/LADCP
SM06	ROS	100500	2236	BE	23°44.16′N	126°08.75′E	4957	199	5,6,8
SM07	ROS	100600	0016	BE	23°29.65′N	126°15.95′E	5562	5529	1,2,7/LADCP,TP
SM07	MER	100600	0332	BE	23°30.12′N	126°15.48′E	5618	150	
KG01	ROS	100600	1919	BE	24°52.87′N	125°34.11′E	137	126	1-6,8/LADCP
KG02	ROS	100600	2156	BE	25°04.22′N	125°51.93′E	187	206	1/LADCP
KG03	ROS	100600	2348	BE	25°16.43′N	126°09.99′E	174	165	1-5,7/LADCP
KG03	MER	100700	0023	BE	25°16.32′N	126°10.01′E	173	150	
KG04	ROS	100700	0204	BE	25°28.14′N	126°27.97′E	346	342	1,7/LADCP
KG04	MER	100700	0238	BE	25°28.37′N	126°27.89′E	348	150	
KG05	ROS	100700	0426	BE	25°40.01′N	126°46.04′E	275	280	1-8/LADCP
KG05	MER	100700	0502	BE	25°40.50′N	126°46.07′E	291	150	
KG05	INF	100700	0522	BE	25°40.62′N	126°46.13′E	298	124	
KGAP	ROS	100700	0652	BE	25°47.82′N	126°58.03′E	1284	1323	1/LADCP
KG06	ROS	100700	0831	BE	25°51.47′N	127°03.97′E	948	929	1/LADCP
KG07	ROS	100700	1103	BE	26°03.64′N	127°22.11′E	183	171	1-5/LADCP

STN	TYPE	DATE	GMT	CODE	LATITUDE	LONGITUDE	DEPTH	MAXP	PARAM
KC15	ROS	100700	1835	BE	27°30.29′N	128°25.12′E	964	952	1-4/LADCP
KC15	ROS	100700	2004	BE	27°30.22′N	128°25.42′E	996	199	5,6,8
KC14	ROS	100700	2145	BE	27°38.75′N	128°11.54′E	732	733	1/LADCP
KC13	ROS	100700	2333	BE	27°47.47′N	127°57.93′E	824	806	1-5,7/LADCP
KC13	MER	100800	0023	BE	27°47.46′N	127°58.09′E	820	150	
KC12	ROS	100800	0157	BE	27°56.22′N	127°44.41′E	938	934	1,7/LADCP
KC12	MER	100800	0258	BE	27°56.26′N	127°44.15′E	942	150	
KC11	ROS	100800	0427	BE	28°05.18′N	127°30.97′E	1272	1243	1-4/LADCP
KC11	MER	100800	0528	BE	28°05.93′N	127°31.01′E	1264	150	
KC11	INF	100800	0544	BE	28°06.23′N	127°31.05′E	1261	101	
KC11	ROS	100800	0612	BE	28°06.48′N	127°30.82′E	1269	200	5-8
KC10	MER	100800	0729	BE	28°10.62′N	127°22.26′E	1098	150	
KC10	ROS	100800	0753	BE	28°10.95′N	127°22.43′E	1106	1108	1,5,7/LADCP
KC09	ROS	100800	0942	BE	28°17.09′N	127°12.94′E	986	999	1/LADCP
KC08	ROS	100800	1117	BE	28°22.54′N	127°03.71′E	806	792	1-5/LADCP
KC07	ROS	100800	1256	BE	28°28.48′N	126°54.84′E	270	262	1/LADCP
KC06	ROS	100800	1415	BE	28°34.18′N	126°45.53′E	190	178	1/LADCP
KC05	ROS	100800	1538	BE	28°40.22′N	126°36.64′E	142	130	1-5/LADCP
KC04	ROS	100800	1712	BE	28°48.87′N	126°23.24′E	119	107	1/LADCP
KC03	ROS	100800	1838	BE	28°57.45′N	126°09.67′E	122	113	1/LADCP
KC02	ROS	100800	2014	BE	29°06.62′N	125°56.13′E	95	91	1-6,8/LADCP
D2	ROS	100800	2252	BE	29°33.01′N	126°14.07′E	104	92	1/LADCP
D2	MER	100800	2312	BE	29°32.96′N	126°14.28′E	104	95	
C2	ROS	100900	0321	BE	29°59.94′N	126°31.13′E	90	78	1,5/LADCP
C2	MER	100900	0336	BE	29°59.90′N	126°31.32′E	92	84	
KB01	MER	100900	0612	BE	30°27.85′N	126°16.32′E	82	75	
KB01	INF	100900	0622	BE	30°27.78′N	126°16.25′E	83	63	
KB01	ROS	100900	0635	BE	30°27.75′N	126°16.29′E	82	70	1-8/LADCP
KB02	ROS	100900	0837	BE	30°16.51′N	126°37.01′E	94	83	1/LADCP
KB03	ROS	100900	1026	BE	30°05.21′N	126°56.26′E	102	91	1-5/LADCP
KB04	ROS	100900	1216	BE	29°53.94′N	127°15.61′E	120	110	1/LADCP
KB05	ROS	100900	1324	BE	29°48.43′N	127°25.28′E	139	129	1-5/LADCP
KB06	ROS	100900	1442	BE	29°42.03′N	127°36.11′E	456	442	1/LADCP
KB07	ROS	100900	1603	BE	29°36.98′N	127°44.77′E	722	714	1/LADCP
KB08	ROS	100900	1727	BE	29°31.08′N	127°54.32′E	998	992	1-4/LADCP
KB08	ROS	100900	1900	BE	29°31.30′N	127°54.80′E	998	199	5,6,8
KB09	ROS	100900	2014	BE	29°25.79′N	128°04.18′E	1072	1066	1/LADCP
KB10	ROS	100900	2149	BE	29°20.19′N	128°13.52′E	1110	1093	1/LADCP
KB11	ROS	100900	2325	BE	29°14.65′N	128°22.99′E	1105	1087	1-5/LADCP
KB11	MER	101000	0025	BE	29°14.77′N	128°24.20′E	1094	150	
KB12	ROS	101000	0138	BE	29°08.73′N	128°32.66′E	1172	1158	1,5/LADCP
KB12	MER	101000	0245	BE	29°08.46′N	128°33.44′E	1174	150	
KB13	ROS	101000	0430	BE	28°57.54′N	128°51.51′E	844	843	1-4/LADCP
KB13	MER	101000	0519	BE	28°57.16′N	128°51.33′E	859	150	
KB13	INF	101000	0534	BE	28°57.50′N	128°51.30′E	860	103	
KB13	ROS	101000	0559	BE	28°56.90′N	128°51.41′E	860	200	5-8
KB14	ROS	101000	0756	BE	28°45.87′N	129°10.75′E	816	808	1/LADCP
TK01A	ROS	101000	1002	BE	28°35.06′N	129°29.76′E	450	456	1-5/LADCP
KA15	ROS	101000	1246	BE	29°02.49′N	129°14.50′E	642	652	1/LADCP
KA14	ROS	101000	1447	BE	29°16.19′N	129°05.77′E	554	542	1-5/LADCP
KA13	ROS	101000	1647	BE	29°29.69′N	128°59.15′E	941	924	1/LADCP
KA12	ROS	101000	1848	BE	29°43.82′N	128°51.42′E	970	902	1-4/LADCP
KA12	ROS	101000	2005	BE	29°43.85′N	128°51.41′E	970	200	5,6,8
KA11	ROS	101000	2159	BE	29°57.57′N	128°43.51′E	966	945	1/LADCP
KA10	ROS	101000	2353	BE	30°11.33′N	128°35.77′E	897	874	1-5/LADCP
KA10	MER	101100	0047	BE	30°11.58′N	128°36.06′E	895	150	
KA09	ROS	101100	0210	BE	30°24.94′N	128°27.97′E	862	844	1/LADCP
KA09	MER	101100	0305	BE	30°25.03′N	128°27.89′E	862	150	
KA08	ROS	101100	0439	BE	30°38.73′N	128°20.23′E	748	730	1-4/LADCP
KA08	MER	101100	0528	BE	30°38.88′N	128°20.21′E	750	150	

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KA08	INF	101100	0543	BE	30°38.96′N	128°20.23′E	746	102	
KA08	ROS	101100	0608	BE	30°39.15′N	128°20.19′E	742	200	5-8
KA07	ROS	101100	0746	BE	30°52.61′N	128°12.43′E	502	483	1/LADCP
KA06	ROS	101100	0929	BE	31°06.52′N	128°04.38′E	230	208	1-5/LADCP
KA05	ROS	101100	1101	BE	31°20.15′N	127°57.02′E	145	131	1/LADCP
KA04	ROS	101100	1231	BE	31°33.83′N	127°49.17′E	140	125	1-5/LADCP
KA03	ROS	101100	1400	BE	31°47.54′N	127°41.49′E	141	131	1/LADCP
KA02	ROS	101100	1539	BE	32°01.99′N	127°33.82′E	135	125	1-5/LADCP
KA01	CTD	101100	1718	BE	32°14.94′N	127°26.03′E	134	124	LADCP
A2	ROS	101100	1945	BE	31°49.90′N	127°07.26′E	124	107	1-5/LADCP
B2	CTD	101100	2214	BE	31°25.10′N	126°48.64′E	102	83	LADCP
ST01B	ROS	101200	0034	BE	31°00.01′N	126°30.02′E	87	73	5,7/LADCP
ST01B	MER	101200	0052	BE	31°00.13′N	126°29.98′E	87	81	
ST02A	ROS	101200	0210	BE	30°59.94′N	126°47.57′E	95	81	1-7/LADCP
ST02A	MER	101200	0233	BE	31°00.02′N	126°47.63′E	94	86	
ST03A	ROS	101200	0354	BE	30°59.88′N	127°05.05′E	107	96	5,7/LADCP
ST03A	MER	101200	0419	BE	30°59.55′N	127°05.69′E	108	91	
ST04A	ROS	101200	0541	BE	30°59.98′N	127°22.68′E	120	107	1-5/LADCP
ST05A	CTD	101200	0718	BE	30°59.88′N	127°39.91′E	131	112	LADCP
ST06A	ROS	101200	0850	BE	31°00.21′N	127°57.09′E	101	142	1-8/LADCP
ST07A	CTD	101200	1037	BE	31°00.03′N	128°14.85′E	378	357	LADCP
ST08A	ROS	101200	1216	BE	31°00.01′N	128°32.49′E	515	512	1-5/LADCP
ST09A	ROS	101200	1410	BE	31°00.03′N	128°49.96′E	686		LADCP
ST09A	CTD	101200	1429	BO	31°00.05′N	128°49.78′E	682	652	
ST15	CTD	101300	0316	BE	30°59.82′N	130°35.09′E	172		LADCP
ST15	ROS	101300	0324	BO	30°59.65′N	130°35.25′E	174	160	1-5
ST14	CTD	101300	0509	BE	30°59.77′N	130°17.54′E	343	325	LADCP
ST13	CTD	101300	0651	BE	30°59.93′N	130°00.06′E	408	394	LADCP
ST12	ROS	101300	0846	BE	31°00.25′N	129°42.43′E	515	494	1-5/LADCP
ST11	CTD	101300	1040	BE	31°00.09′N	129°24.96′E	880	861	LADCP
ST10	ROS	101300	1227	BE	30°59.95′N	129°07.54′E	823	794	1-5/LADCP
ST09	CTD	101300	1430	BE	30°59.93′N	128°49.94′E	684	665	LADCP
ST08	CTD	101300	1626	BE	30°59.97′N	128°32.53′E	516	495	LADCP
ST07	ROS	101300	1808	BE	31°00.13′N	128°15.06′E	378	359	1,3-5/LADCP
ST06	CTD	101300	1958	BE	30°59.96′N	127°57.40′E	162	135	LADCP
ST05	ROS	101300	2132	BE	31°00.07′N	127°40.00′E	130	106	1,3-5/LADCP
ST04	CTD	101300	2301	BE	31°00.08′N	127°22.52′E	122	110	LADCP
ST03	CTD	101400	0049	BE	31°00.03′N	127°05.01′E	109	96	LADCP
ST02	ROS	101400	0234	BE	31°00.02′N	126°47.47′E	94	77	1,3-5/LADCP
ST01	CTD	101400	0440	BE	30°59.96′N	126°30.43′E	83	72	LADCP
EW	ROS	101500	2031	BE	34°07.81′N	138°29.96′E	3659	3000	
EC1	MOR	101600	0414	RE	34°03.17′N	139°48.76′E	1082	*IES with 1 CM*	
EC2	MOR	101600	0537	RE	34°04.31′N	139°55.03′E	1177	*IES with 1 CM*	
EC3	MOR	101600	0654	RE	33°58.78′N	139°53.94′E	1155	*IES with 1 CM*	
EC4	MOR	101600	0806	RE	34°01.95′N	139°52.35′E	1168	*IXBT*	
EC4A	XBT	101600	0811	DE	34°01.92′N	139°52.18′E	1165	*TSK T-5*	
EC4KU	CTD	101600	0936	BE	34°02.33′N	139°52.07′E	1161	1139	LADCP
EC4UT	CTD	101600	1054	BE	34°02.10′N	139°52.30′E	1167	1139	LADCP
MER	CTD	101600	2311	BE	34°39.60′N	139°20.91′E	311	133	

KH-01-1 leg 1

STN: Station number
TYPE: CTD=CTDO only, ROS=CTDO plus water sampler, MOR=Mooring, XBT=XBT, XCTD=XCTD.
CODE: BE=Beginning of cast or work, EN=End of work, BO=Bottom
DE=Deployment of mooring or XBT/XCTD, RE=Recovery of mooring
DEPTH: Water depth in meters
MAXP: Maximum pressure in decibars
PARAM: Sampling parameters
1=Salinity, 2=Dissolved Oxygen, 3-5=Nutrients (PO_4,SiO_2,NO_2+NO_3),
6=DIC-^{14}C, 7=DOC-^{14}C, 8=pH, 9=Alkalinity, 10=Total Carbon, 11=^{13}C
LADCP=Lowered ADCP
COMMENTS are included in the columns of MAXP/PARAM

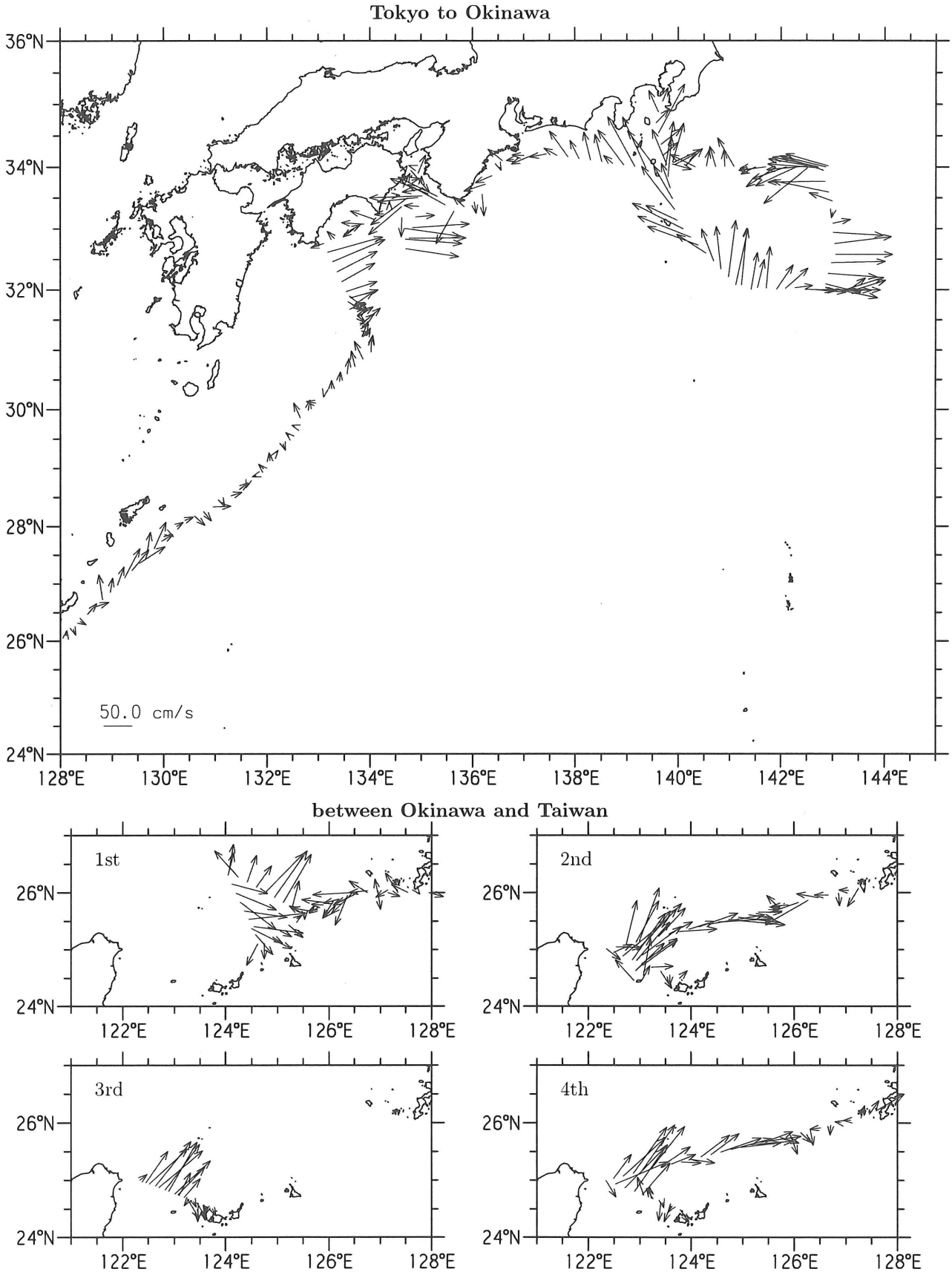
STN	TYPE	DATE	GMT	CODE	LATITUDE	LONGITUDE	DEPTH	MAXP	PARAM
X01	XBT	061801	0955	DE	34°29.83′N	139°47.98′E	1660		*TSK T-7*
X02	XBT	061801	1155	DE	34°00.06′N	139°54.50′E	1158		*TSK T-7*
X03	XBT	061801	1347	DE	33°30.06′N	140°00.46′E	241		*TSK T-7*
X04	XBT	061801	1543	DE	32°59.85′N	140°06.52′E	573		*TSK T-7*
X05	XBT	061801	1737	DE	32°29.91′N	140°12.56′E	1451		*TSK T-7*
X06	XBT	061801	1931	DE	31°59.89′N	140°18.26′E	1906		*TSK T-7*
X07	XBT	061801	2123	DE	31°30.01′N	140°23.78′E	1273		*TSK T-7*
X08	XBT	061801	2315	DE	31°00.00′N	140°29.66′E	2166		*TSK T-7*
X09	XBT	061901	0105	DE	30°30.00′N	140°35.57′E	1538		*TSK T-7*
X10	XBT	061901	0258	DE	29°59.93′N	140°41.06′E	2805		*TSK T-7*
X11	XBT	061901	0450	DE	29°29.97′N	140°46.78′E	3038		*TSK T-7*
X12	XBT	061901	0640	DE	28°59.98′N	140°52.40′E	3580		*TSK T-7*
X13	XBT	061901	0827	DE	28°29.96′N	140°57.85′E	3605		*TSK T-7*
X14	XBT	061901	1019	DE	27°59.94′N	141°00.52′E	4081		*TSK T-7*
X15	XBT	061901	1208	DE	27°30.06′N	141°08.69′E	3822		*TSK T-7*
X16	XBT	061901	1404	DE	27°00.06′N	141°14.47′E	3477		*TSK T-7*
X17	XBT	061901	1604	DE	26°28.85′N	141°20.13′E	3251		*TSK T-7*
X18	XBT	061901	1755	DE	25°59.92′N	141°25.44′E	3275		*TSK T-7*
X19	XBT	061901	1950	DE	25°29.89′N	141°30.97′E	2814		*TSK T-7*
X20	XBT	061901	2147	DE	25°00.01′N	141°36.39′E	2570		*TSK T-7*
X21	XBT	061901	2342	DE	24°30.01′N	141°38.69′E	2264		*TSK T-7*
X22	XBT	062001	0125	DE	24°00.00′N	141°40.74′E	2245		*TSK T-7*
X23	XBT	062001	0314	DE	23°29.86′N	141°42.76′E	1561		*TSK T-7*
X24	XBT	062001	0457	DE	22°59.85′N	141°44.68′E	1666		*TSK T-7*
X25	XBT	062001	0604	DE	22°29.94′N	141°46.59′E	1434		*TSK T-7*
X26	XBT	062001	0831	DE	22°00.03′N	141°48.74′E	2893		*TSK T-7*
X27	XBT	062001	1019	DE	21°30.00′N	141°50.83′E	3630		*TSK T-7*
X28	XBT	062001	1211	DE	21°00.06′N	141°52.80′E	4121		*TSK T-7*
X29	XBT	062001	1405	DE	20°30.06′N	141°54.76′E	4190		*TSK T-7*
X30	XBT	062001	1558	DE	20°00.00′N	141°56.61′E	4037		*TSK T-7*
X31	XBT	062001	1753	DE	19°30.01′N	141°58.48′E	4244		*TSK T-7*
X32	XBT	062001	1949	DE	18°59.92′N	142°00.44′E	4146		*TSK T-7*
X33	XBT	062001	2142	DE	18°30.02′N	142°02.51′E	4215		*TSK T-7*
X34	XBT	062001	2333	DE	18°00.05′N	142°04.46′E	4405		*TSK T-7*
X35	XBT	062101	0125	DE	17°30.06′N	142°06.95′E	4390		*TSK T-7*
X36	XBT	062101	0317	DE	16°59.98′N	142°09.44′E	4374		*TSK T-7*
X37	XBT	062101	0509	DE	16°30.00′N	142°11.76′E	4174		*TSK T-7*
X38	XBT	062101	0700	DE	15°59.92′N	142°14.10′E	4214		*TSK T-7*
X39	XBT	062101	0852	DE	15°30.01′N	142°16.30′E	4244		*TSK T-7*
X40	XBT	062101	1042	DE	15°00.02′N	142°18.56′E	4269		*TSK T-7*
X41	XBT	062101	1232	DE	14°30.00′N	142°20.93′E	4343		*TSK T-7*
X42	XBT	062101	1424	DE	14°00.07′N	142°23.36′E	2402		*TSK T-7*
X43	XBT	062101	1619	DE	13°30.05′N	142°25.57′E	2905		*TSK T-7*
X44	XBT	062101	1813	DE	13°00.02′N	142°27.78′E	3047		*TSK T-7*
X45	XBT	062101	2007	DE	12°29.42′N	142°30.13′E	3820		*TSK T-7*
X46	XBT	062101	2158	DE	12°00.02′N	142°32.45′E	2952		*TSK T-7*
X47	XBT	062101	2351	DE	11°30.07′N	142°34.62′E	8124		*TSK T-7*
CM10	CTD	062201	0144	BE	11°19.84′N	142°25.00′E	10035		

STN	TYPE	DATE	GMT	CODE	LATITUDE	LONGITUDE	DEPTH	MAXP	PARAM	
CM10	CTD	062201	0416	BO	11°20.05′N	142°25.33′E	10044	8907		*SBE9SD CTDO*
CM10	CTD	062201	0700	EN	11°20.50′N	142°25.35′E	10224			
CM05	ROS	062201	1315	BE	11°21.68′N	142°34.88′E	10490		LADCP	
CM05	ROS	062201	1500	BO	11°21.86′N	142°34.83′E	10533	6504	1-6,8-11	*SBE9p608 CTDO*
CM05	ROS	062201	1648	EN	11°21.99′N	142°34.88′E	10541			
MM2	MOR	062201	2333	BE	11°21.03′N	142°32.00′E	10405	*5 current meters*		
MM2	MOR	062301	0124	DE	11°22.17′N	142°36.17′E	10533	*Transmitter 40.050MHz, A/R 3C*		
UPWEL	MOR	062301	0345	BE	11°22.06′N	142°35.78′E	10541	*First deployment of Upwell Pipes*		
UPWEL	MOR	062301	0434	DE	11°21.64′N	142°35.73′E	10243			
UPWEL	MOR	062301	0530	BE	11°21.57′N	142°35.38′E	10313	*Retrieval of surface bouy*		
UPWEL	MOR	062301	0545	RE	11°21.38′N	142°35.23′E	10511			
UPWEL	MOR	062301	0626	BE	11°21.32′N	142°34.67′E	10386	*Recovery of Upwell Pipes*		
UPWEL	MOR	062301	0658	RE	11°21.13′N	142°34.40′E	10293			
CM05A	ROS	062301	1122	BE	11°22.04′N	142°40.57′E	10111			
CM05A	ROS	062301	1422	BO	11°22.25′N	142°40.59′E	10107	10748	1-6,8-11	*SBE9SD CTDO*
CM05A	ROS	062301	1744	EN	11°22.54′N	142°40.34′E	10195			
UPWEL	MOR	062401	0014	BE	11°22.49′N	142°33.72′E	10495	*Second deployment of Upwell Pipes*		
UPWEL	MOR	062401	0133	DE	11°22.49′N	142°33.49′E	10503			
UPWEL	CTD	062401	0234	BE	11°22.42′N	142°33.36′E	10490			
UPWEL	CTD	062401	0426	EN	11°22.20′N	142°33.00′E	10494			
UPWEL	MOR	062401	0654	EN	11°21.91′N	142°32.47′E	10401	*Upwell Pipes Lost*		
MM1	MOR	062501	0000	BE	11°00.79′N	142°32.02′E	6556	*3 current meters*		
MM1	MOR	062501	0107	DE	11°01.98′N	142°34.57′E	6665	*Transmitter 40.100MHz, A/R 3D*		
MM3	MOR	062501	0411	BE	11°41.02′N	142°32.12′E	6385	*3 current meters*		
MM3	MOR	062501	0517	DE	11°41.95′N	142°34.74′E	5517	*Transmitter 40.150MHz, A/R 3B*		
CM07	ROS	062501	0728	BE	11°41.70′N	142°39.99′E	5526		LADCP	
CM07	ROS	062501	0912	BO	11°41.80′N	142°39.65′E	5505	6221	1-6	*SBE9p608 CTDO*
CM07	ROS	062501	1038	EN	11°42.03′N	142°39.30′E	0			
CM06	ROS	062501	1242	BE	11°31.80′N	142°39.68′E	7528		LADCP	
CM06	ROS	062501	1425	BO	11°31.79′N	142°39.61′E	8075	6501	1,2	*SBE9p608 CTDO*
CM06	ROS	062501	1558	EN	11°31.72′N	142°39.78′E	7594			
CM09	ROS	062501	1757	BE	11°21.88′N	142°19.89′E	9993		LADCP	
CM09	ROS	062501	1942	BO	11°21.69′N	142°19.95′E	0	6500	1,2	*SBE9p608 CTDO*
CM09	ROS	062501	2110	EN	11°21.56′N	142°20.09′E	0			
CM10A	ROS	062501	2249	BE	11°21.99′N	142°29.87′E	0			
CM10A	ROS	062601	0034	BO	11°22.29′N	142°29.66′E	0	6501	1,2	*SBE9p608 CTDO*
CM10A	ROS	062601	0207	EN	11°22.44′N	142°29.52′E	0			
CM11	ROS	062601	0407	BE	11°21.98′N	142°49.88′E	9194			
CM11	ROS	062601	0550	BO	11°22.42′N	142°49.89′E	9324	6503	1,2	*SBE9p608 CTDO*
CM11	ROS	062601	0719	EN	11°22.64′N	142°49.86′E	9348			
CM12	ROS	062601	0916	BE	11°22.12′N	142°59.89′E	8711			
CM12	ROS	062601	1104	BO	11°22.54′N	142°59.61′E	8753	6507	1,2	*SBE9p608 CTDO*
CM12	ROS	062601	1235	EN	11°22.70′N	142°59.49′E	8742			
CM04	ROS	062601	1401	BE	11°11.78′N	142°39.99′E	7933			
CM04	ROS	062601	1617	BO	11°12.14′N	142°39.83′E	8106	6509	1,2	*SBE9p608 CTDO*
CM04	ROS	062601	1750	EN	11°12.25′N	142°39.76′E	7990			
CM03	ROS	062601	1939	BE	11°01.92′N	142°39.44′E	8354		LADCP	
CM03	ROS	062601	2123	BO	11°02.16′N	142°39.25′E	0	6500	1-6	*SBE9p608 CTDO*
CM03	ROS	062601	2250	EN	11°02.49′N	142°39.08′E	0			
CM02	ROS	062701	0035	BE	10°52.07′N	142°39.94′E	5902		LADCP	
CM02	ROS	062701	0220	BO	10°52.44′N	142°39.80′E	6608	6503	1,2	*SBE9p608 CTDO*
CM02	ROS	062701	0350	EN	10°52.81′N	142°39.66′E	5620			
CM01	ROS	062701	0531	BE	10°42.04′N	142°39.96′E	5307		LADCP	
CM01	ROS	062701	0705	BO	10°42.35′N	142°39.81′E	5858	5777	1-11	*SBE9p608 CTDO*
CM01	ROS	062701	0823	EN	10°42.64′N	142°39.58′E	5052			
CM08	ROS	062701	1316	BE	11°51.94′N	142°39.71′E	3038		LADCP	
CM08	ROS	062701	1412	BO	11°52.02′N	142°39.55′E	3192	3266	1-11	*SBE9p608 CTDO*
CM08	ROS	062701	1503	EN	11°52.15′N	142°39.47′E	3100			
YAE2	MOR	063001	2323	BE	25°38.80′N	125°30.64′E	2044			
YAE2	MOR	063001	2355	RE	25°39.72′N	125°31.11′E	2050	*3 current meters*		
YAE1	MOR	070101	0449	BE	25°24.12′N	124°30.61′E	2067			

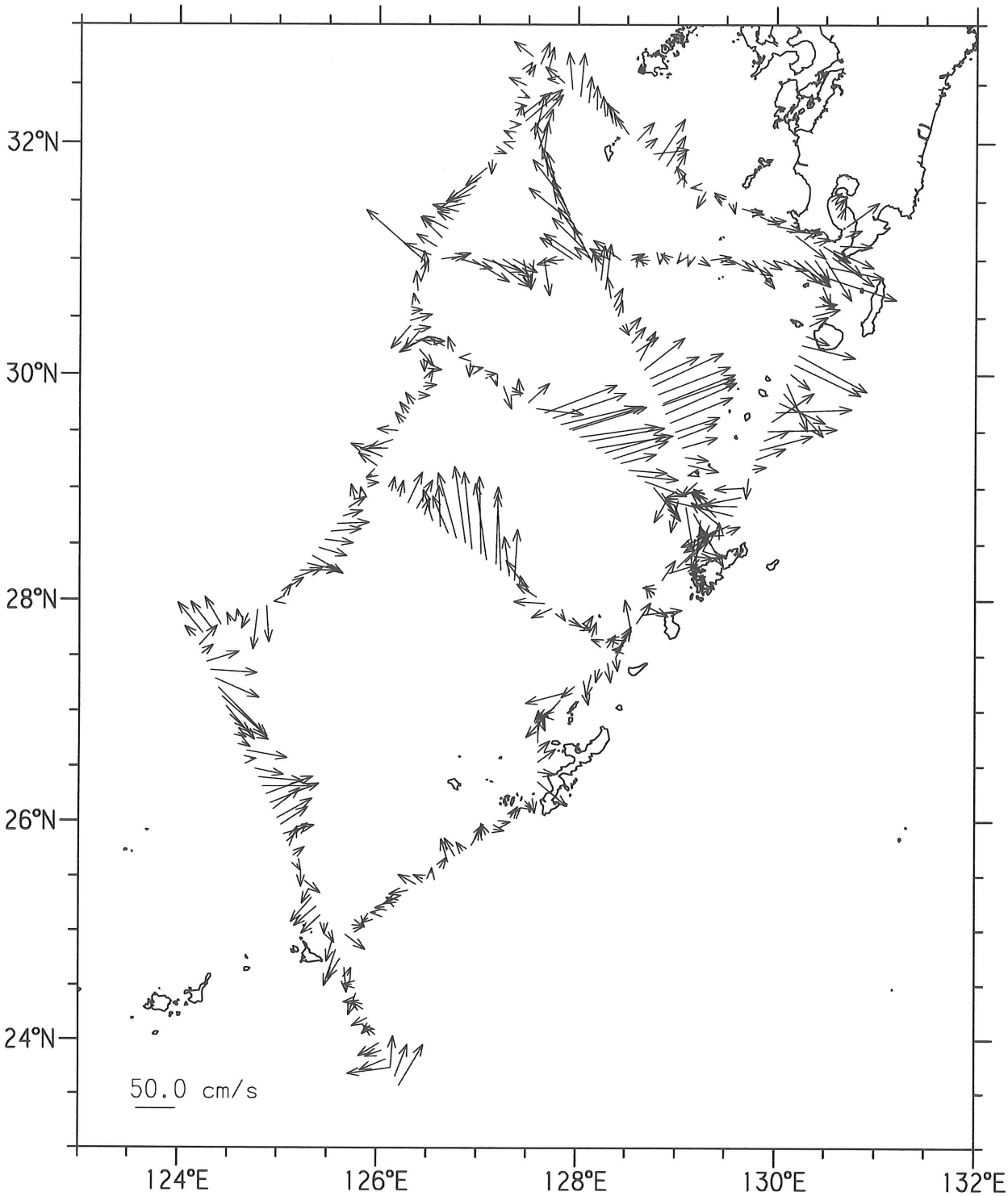
STN	TYPE	DATE	GMT	CODE	LATITUDE	LONGITUDE	DEPTH	MAXP	PARAM	
YAE1	MOR	070101	0524	RE	25°24.44′N	124°31.05′E	2064	*3 current meters*		
YAE1	ROS	070101	0559	BE	25°23.45′N	124°30.12′E	2072		LADCP	
YAE1	ROS	070101	0640	BO	25°23.54′N	124°30.67′E	0	2132	1,2	*SBE9p608 CTDO*
YAE1	ROS	070101	0718	EN	25°23.61′N	124°30.99′E	2072			
YAE1A	ROS	070101	0912	BE	25°23.44′N	124°30.13′E	2072		LADCP	
YAE1A	ROS	070101	0953	BO	25°23.54′N	124°30.48′E	0	2083	1,2	*SBE9+tf CTDO*
YAE1A	ROS	070101	1031	EN	25°23.55′N	124°30.73′E	2072			
YAE2	ROS	070101	1426	BE	25°37.92′N	125°30.14′E	2016		LADCP	
YAE2	ROS	070101	1505	BO	25°38.20′N	125°30.37′E	0	2050	1,2	*SBE9+tf CTDO*
YAE2	ROS	070101	1541	EN	25°38.32′N	125°30.62′E	2044			
YAE3	ROS	070101	1955	BE	25°59.16′N	126°26.57′E	1719		LADCP	
YAE3	ROS	070101	2028	BO	25°59.22′N	126°26.57′E	0	1723	1,2	*SBE9+tf CTDO*
YAE3	ROS	070101	2058	EN	25°59.29′N	126°26.61′E	1722			
YAE3	MOR	070101	2330	BE	25°59.61′N	126°30.20′E	1748			
YAE3	MOR	070101	2352	RE	25°59.72′N	126°30.36′E	1726	*3 current meters*		
TK2	MOR	070201	2348	BE	29°44.16′N	130°01.55′E	601			
TK2	MOR	070301	0012	RE	29°44.23′N	130°01.91′E	601	*2 ADCPs. 1 current meter*		
TK1	MOR	070301	0334	BE	30°07.46′N	130°11.86′E	557			
TK1	MOR	070301	0343	RE	30°07.22′N	130°12.12′E	559	*1 ADCP*		
TK14	CTD	070301	0807	BE	31°05.04′N	130°34.98′E	146			
TK14	CTD	070301	0815	BO	31°05.02′N	130°34.97′E	0	122		*SBE9+tf CTDO*
TK14	CTD	070301	0817	EN	31°05.02′N	130°34.98′E	145			
TK13	CTD	070301	0948	BE	30°50.24′N	130°30.43′E	252			
TK13	CTD	070301	0957	BO	30°50.26′N	130°30.49′E	0	233		*SBE9+tf CTDO*
TK13	CTD	070301	1004	EN	30°50.32′N	130°30.54′E	253			
TK12	CTD	070301	1133	BE	30°34.97′N	130°23.68′E	328			
TK12	CTD	070301	1143	BO	30°34.97′N	130°23.78′E	0	300		*SBE9+tf CTDO*
TK12	CTD	070301	1153	EN	30°34.98′N	130°23.87′E	305			
TK11	CTD	070301	1339	BE	30°19.64′N	130°18.55′E	592			
TK11	CTD	070301	1352	BO	30°19.60′N	130°18.81′E	0	566		*SBE9+tf CTDO*
TK11	CTD	070301	1405	EN	30°19.50′N	130°18.94′E	586			
TK10	CTD	070301	1509	BE	30°09.22′N	130°13.50′E	587			
TK10	CTD	070301	1525	BO	30°08.94′N	130°14.01′E	0	572		*SBE9+tf CTDO*
TK10	CTD	070301	1538	EN	30°08.78′N	130°14.28′E	588			
TK09	CTD	070301	1644	BE	29°59.08′N	130°08.27′E	620			
TK09	CTD	070301	1659	BO	29°59.20′N	130°08.25′E	0	605		*SBE9+tf CTDO*
TK09	CTD	070301	1711	EN	29°59.31′N	130°08.23′E	618			
TK08	CTD	070301	1820	BE	29°48.42′N	130°03.97′E	573			
TK08	CTD	070301	1834	BO	29°48.26′N	130°04.29′E	0	561		*SBE9+tf CTDO*
TK08	CTD	070301	1844	EN	29°48.18′N	130°04.46′E	566			
TK07	CTD	070301	1951	BE	29°37.86′N	129°59.18′E	508			
TK07	CTD	070301	2003	BO	29°37.66′N	129°59.36′E	0	592		*SBE9+tf CTDO*
TK07	CTD	070301	2014	EN	29°37.49′N	129°59.54′E	548			
TK06	CTD	070301	2121	BE	29°27.51′N	129°54.18′E	803			
TK06	CTD	070301	2140	BO	29°27.50′N	129°54.66′E	0	800		*SBE9+tf CTDO*
TK06	CTD	070301	2155	EN	29°27.52′N	129°55.00′E	837			
TK05	CTD	070301	2314	BE	29°16.68′N	129°49.50′E	1069			
TK05	CTD	070301	2337	BO	29°16.52′N	129°49.83′E	0	1046		*SBE9+tf CTDO*
TK05	CTD	070301	2357	EN	29°16.41′N	129°50.08′E	1054			
TK04	CTD	070401	0104	BE	29°06.52′N	129°44.42′E	981			
TK04	CTD	070401	0124	BO	29°06.57′N	129°44.74′E	0	982		*SBE9+tf CTDO*
TK04	CTD	070401	0143	EN	29°06.60′N	129°45.04′E	992			
TK03	CTD	070401	0255	BE	28°56.07′N	129°39.54′E	791			
TK03	CTD	070401	0312	BO	28°56.14′N	129°39.64′E	0	793		*SBE9+tf CTDO*
TK03	CTD	070401	0329	EN	28°56.31′N	129°39.64′E	807			
TK02	CTD	070401	0436	BE	28°45.39′N	129°34.55′E	759			
TK02	CTD	070401	0453	BO	28°45.30′N	129°34.32′E	0	758		*SBE9+tf CTDO*
TK02	CTD	070401	0507	EN	28°45.47′N	129°34.26′E	760			
TK01	CTD	070401	0618	BE	28°34.99′N	129°30.27′E	852			
TK01	CTD	070401	0629	BO	28°35.07′N	129°30.38′E	0	417		*SBE9+tf CTDO*
TK01	CTD	070401	0640	EN	28°35.16′N	129°30.35′E	832			

7. Chart of Surface Currents

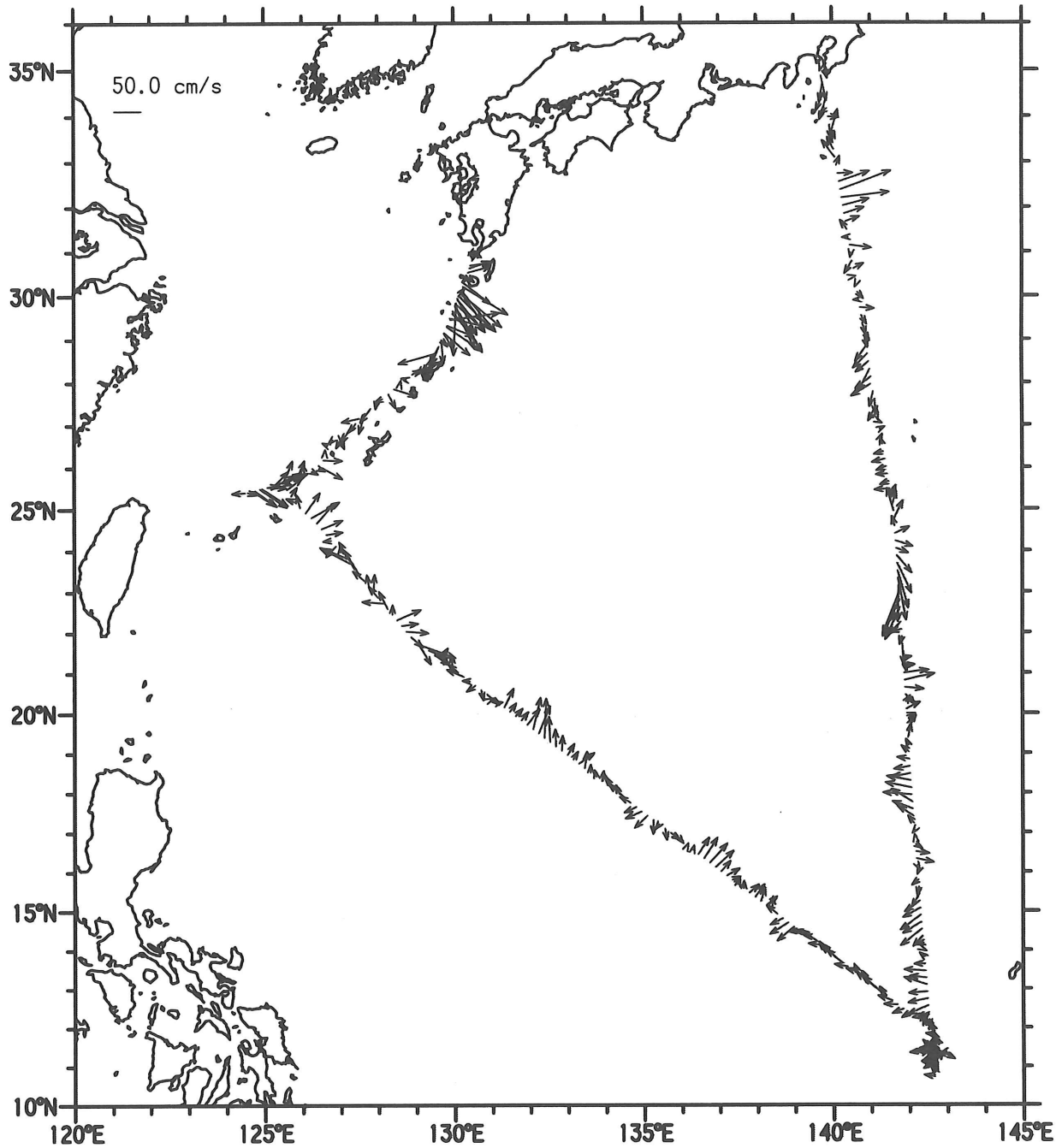
KH-00-4 leg 1: Furuno ADCP (50 m depth)



KH-00-4 leg 2: Furuno ADCP (15 m depth)

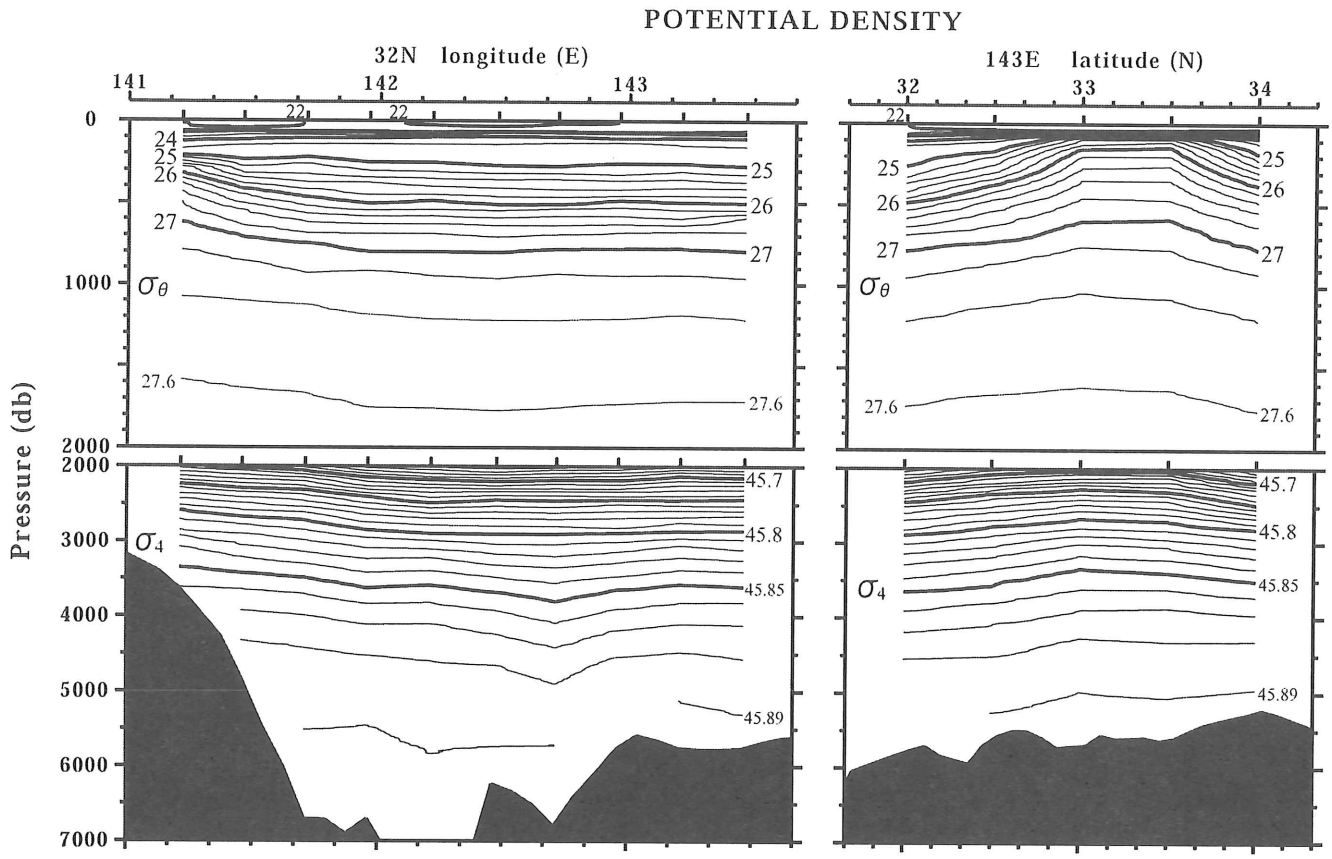


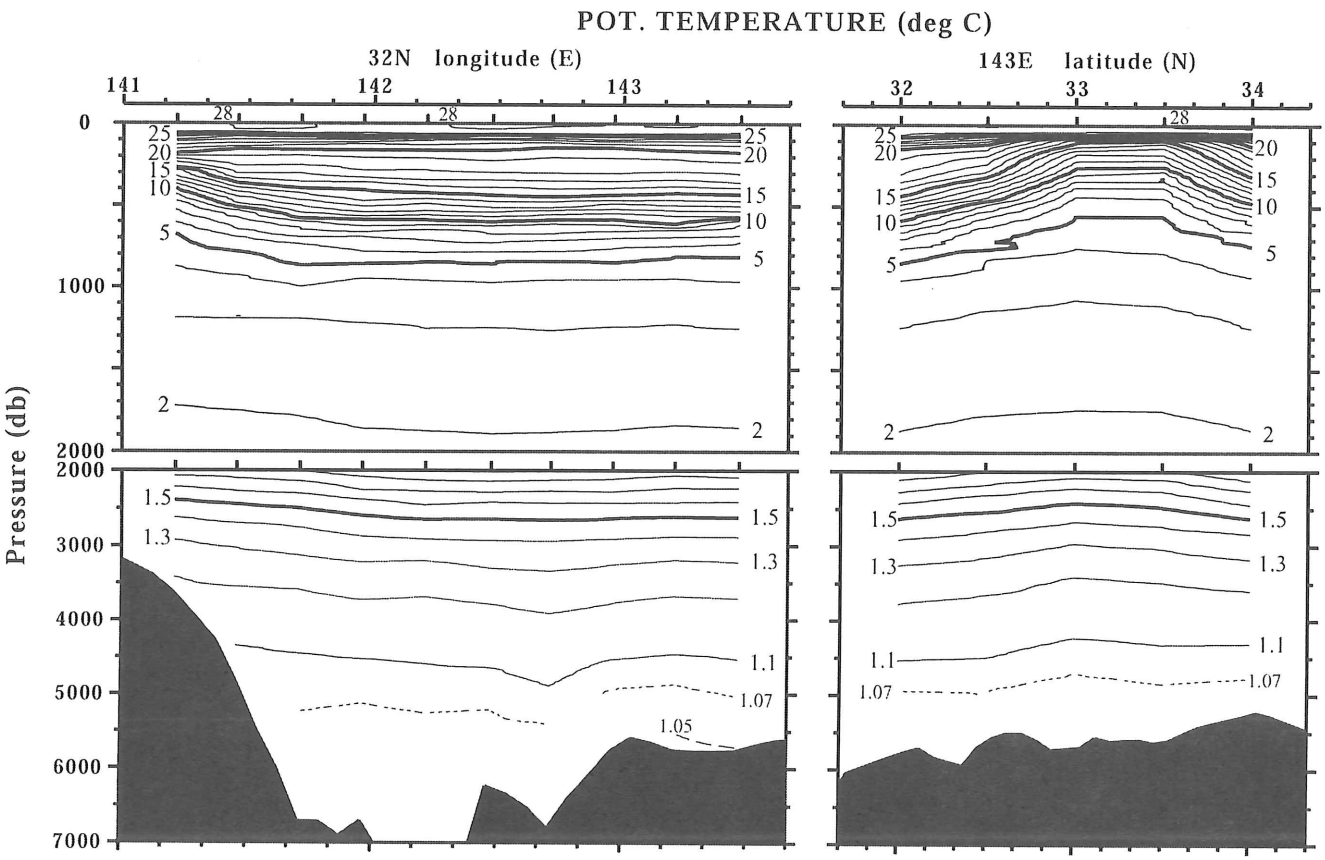
KH-01-1 leg 1: Furuno ADCP (at 50 m depth)

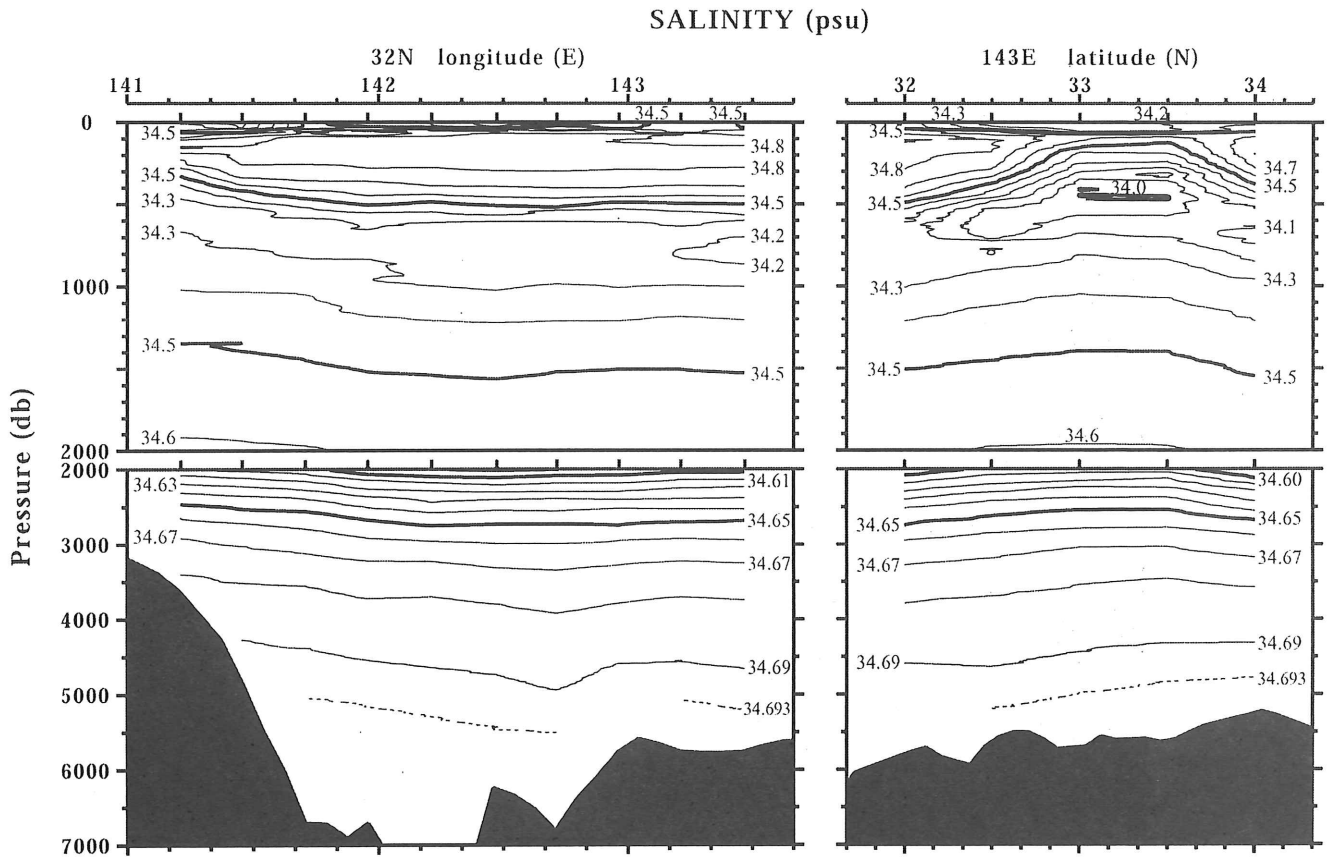


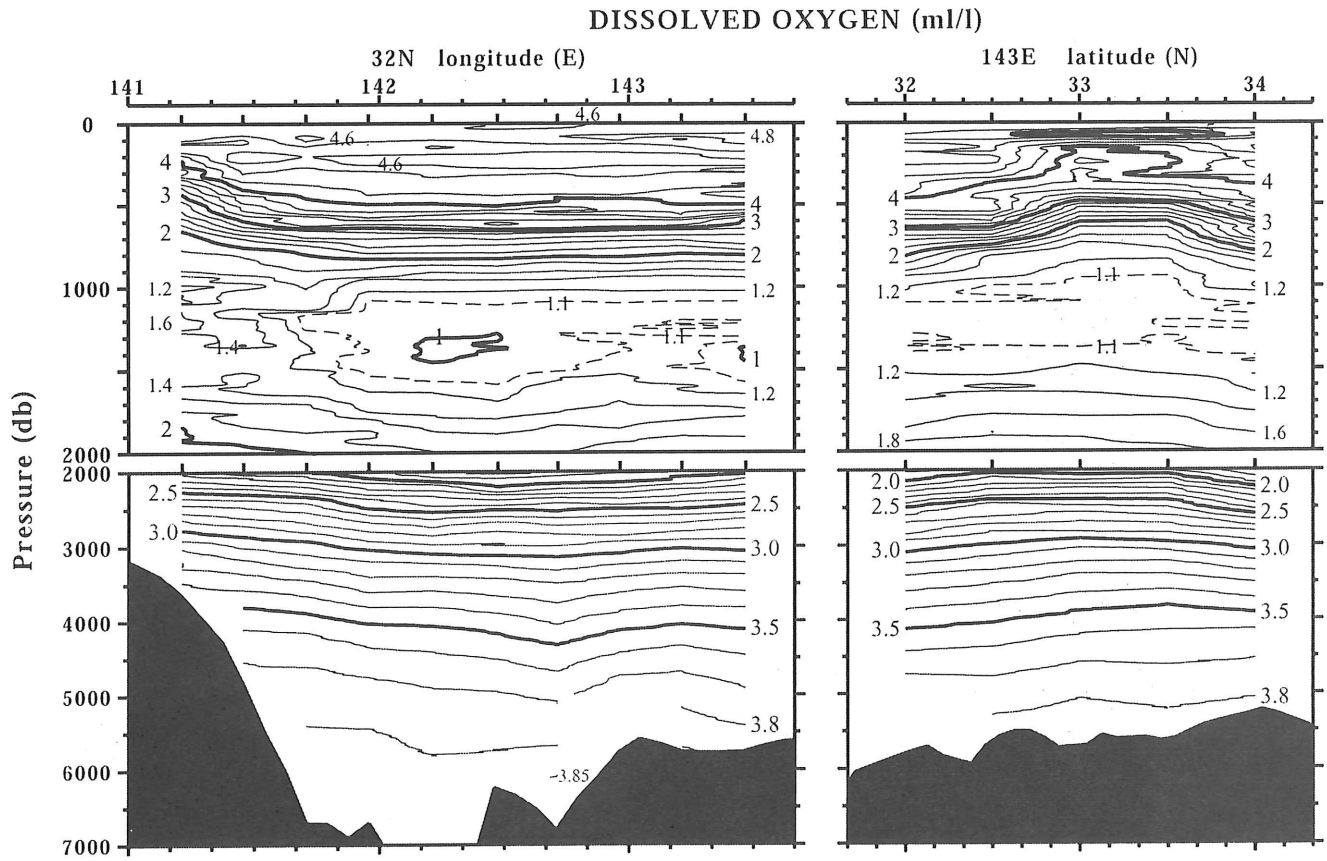
8. Vertical Sections of CTDO2 Data

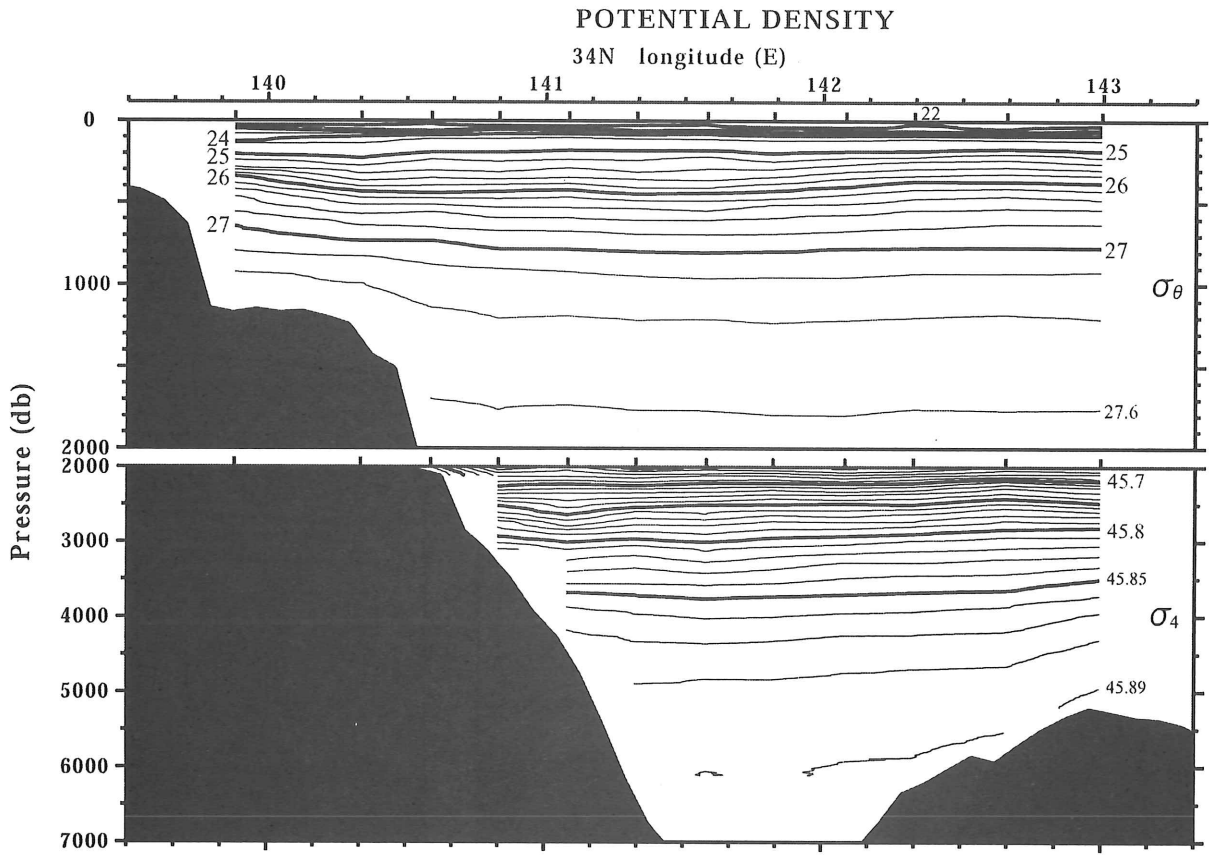
KH-00-4 leg 1

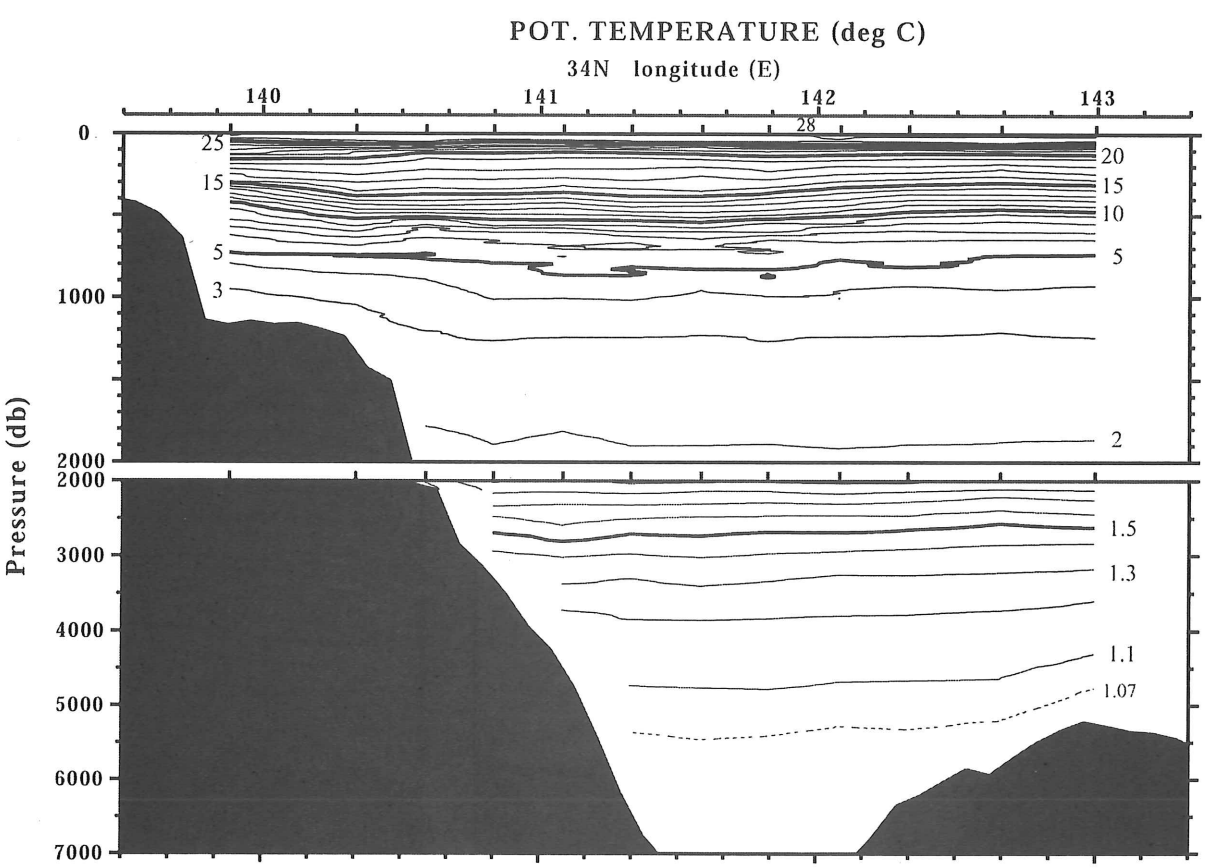


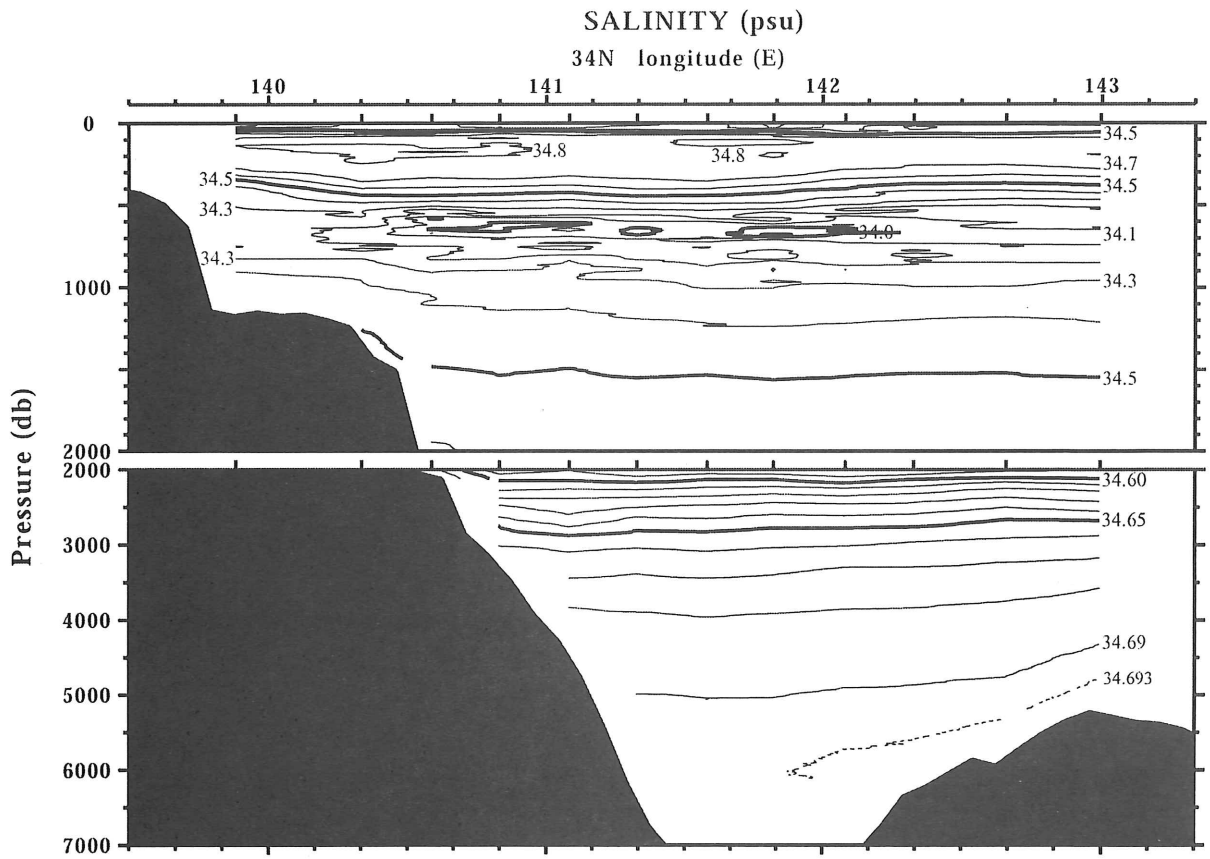


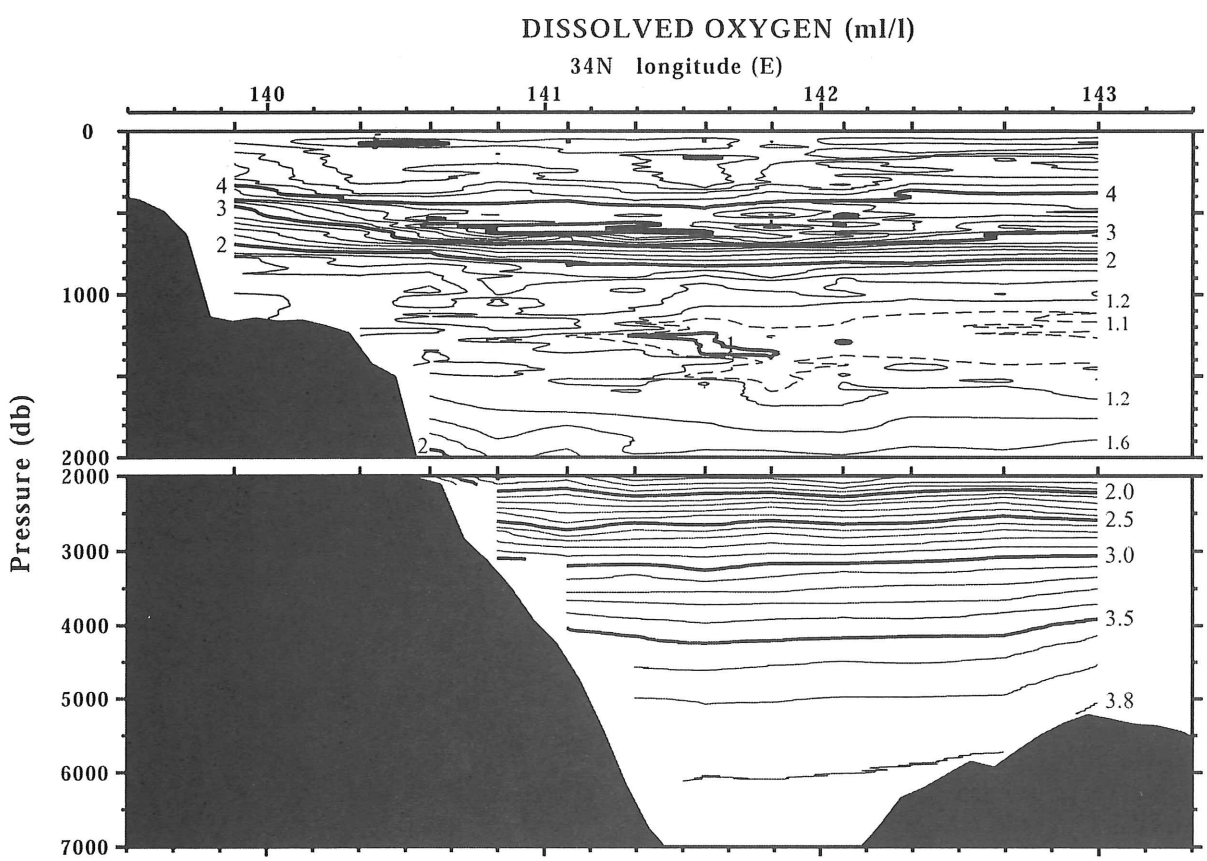

SALINITY (psu)
32N longitude (E)
143E latitude (N)
Pressure (db)


DISSOLVED OXYGEN (ml/l)
32N longitude (E)
143E latitude (N)
Pressure (db)


POTENTIAL DENSITY
34N longitude (E)
140
141
142
143
0
1000
2000
3000
4000
5000
6000
7000
Pressure (db)
22
24
25
26
27
25
26
27
σ_θ
27.6
45.7
45.8
45.85
σ_4
45.89


POT. TEMPERATURE (deg C)
34N longitude (E)
140
141
142
143
0
1000
2000
3000
4000
5000
6000
7000
Pressure (db)
28
25
15
5
3
20
15
10
5
2
1.5
1.3
1.1
1.07


SALINITY (psu)
34N longitude (E)
140
141
142
143
Pressure (db)
0
1000
2000
3000
4000
5000
6000
7000
34.5
34.8
34.8
34.5
34.7
34.5
34.3
34.0
34.1
34.3
34.3
34.5
34.60
34.65
34.69
34.693

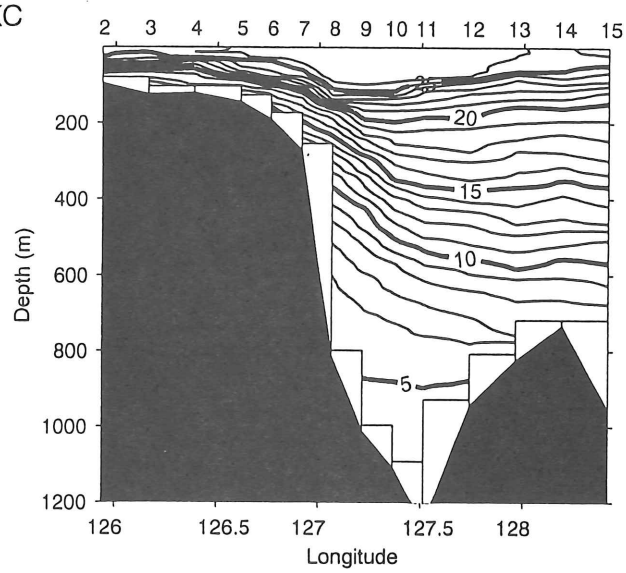

DISSOLVED OXYGEN (ml/l)
34N longitude (E)
140
141
142
143
Pressure (db)
0
1000
2000
3000
4000
5000
6000
7000
4
3
2
4
3
2
1.2
1.1
1.2
1.6
2
2.0
2.5
3.0
3.5
3.8

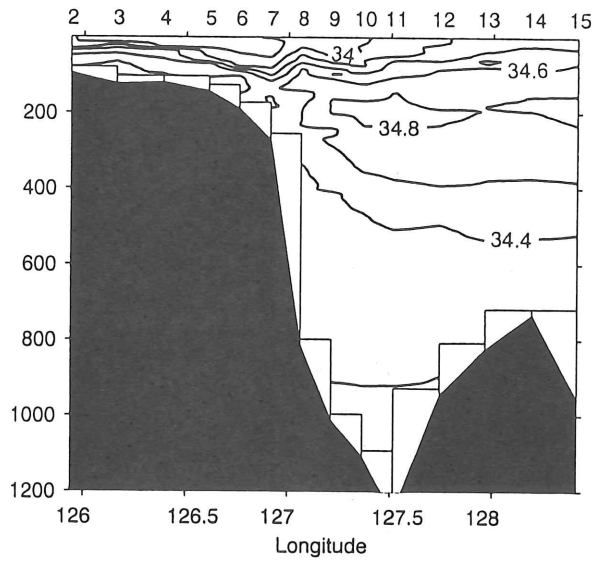
KH-00-4 leg 2

Temperature

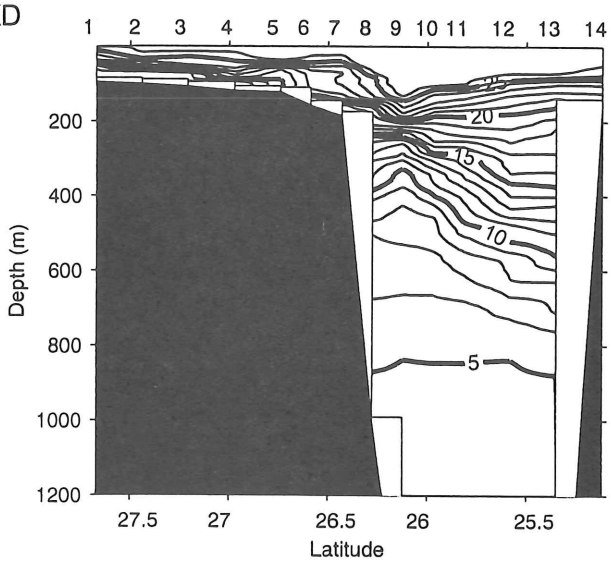
Salinity

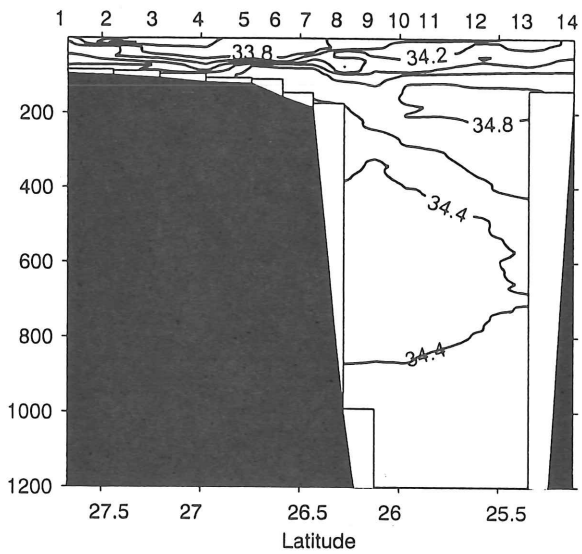
KC



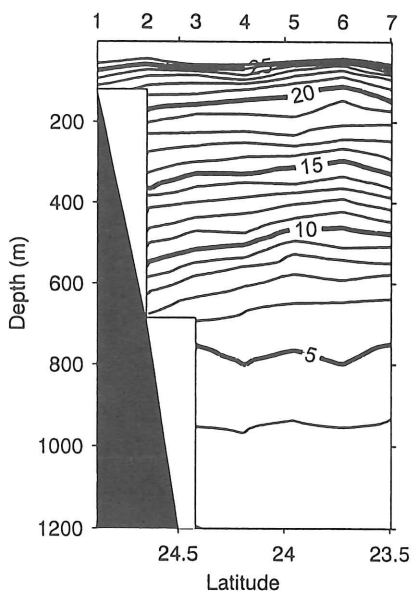


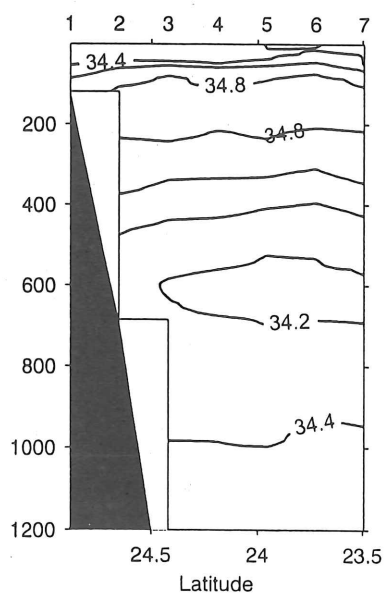
KD

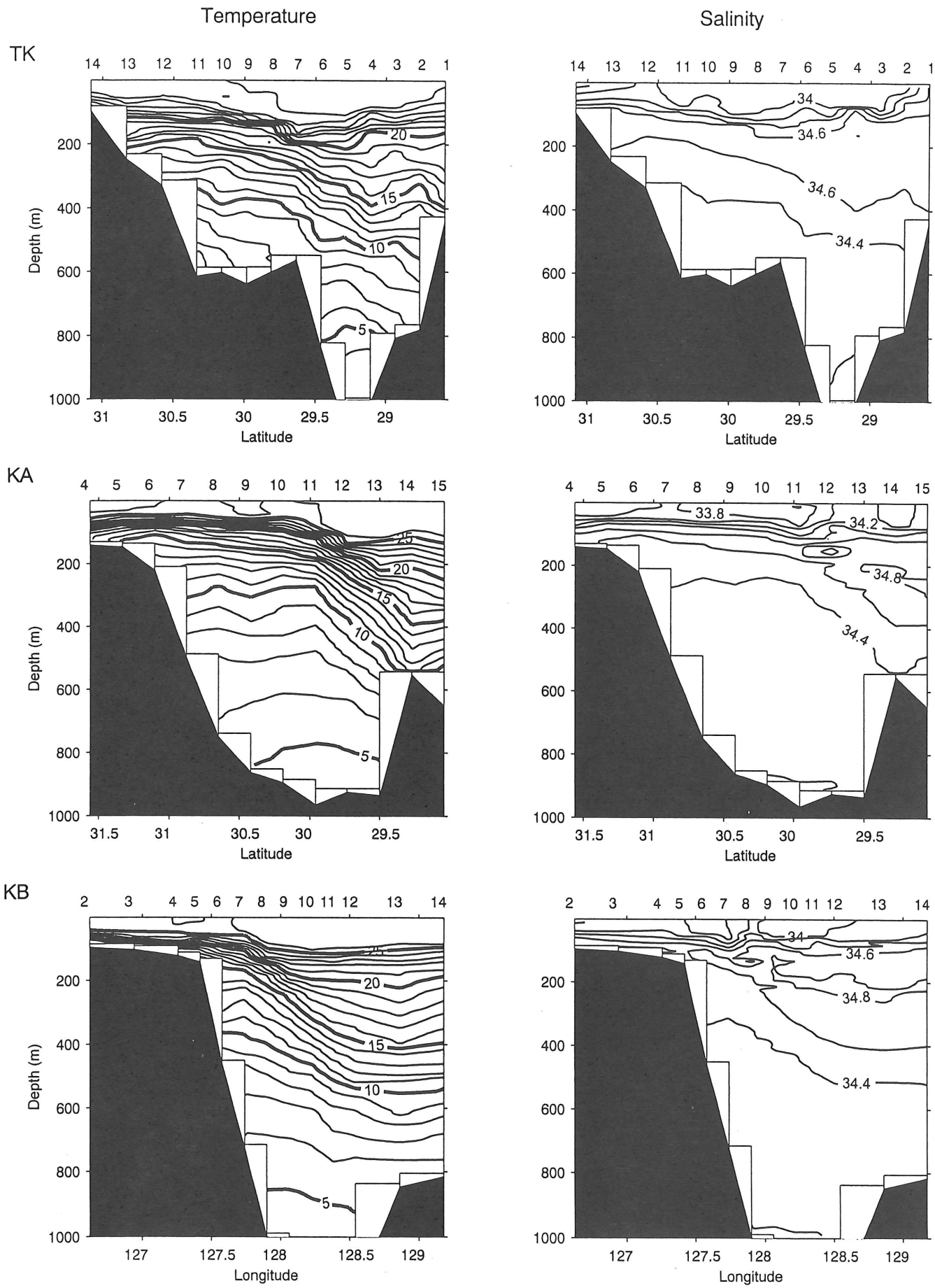


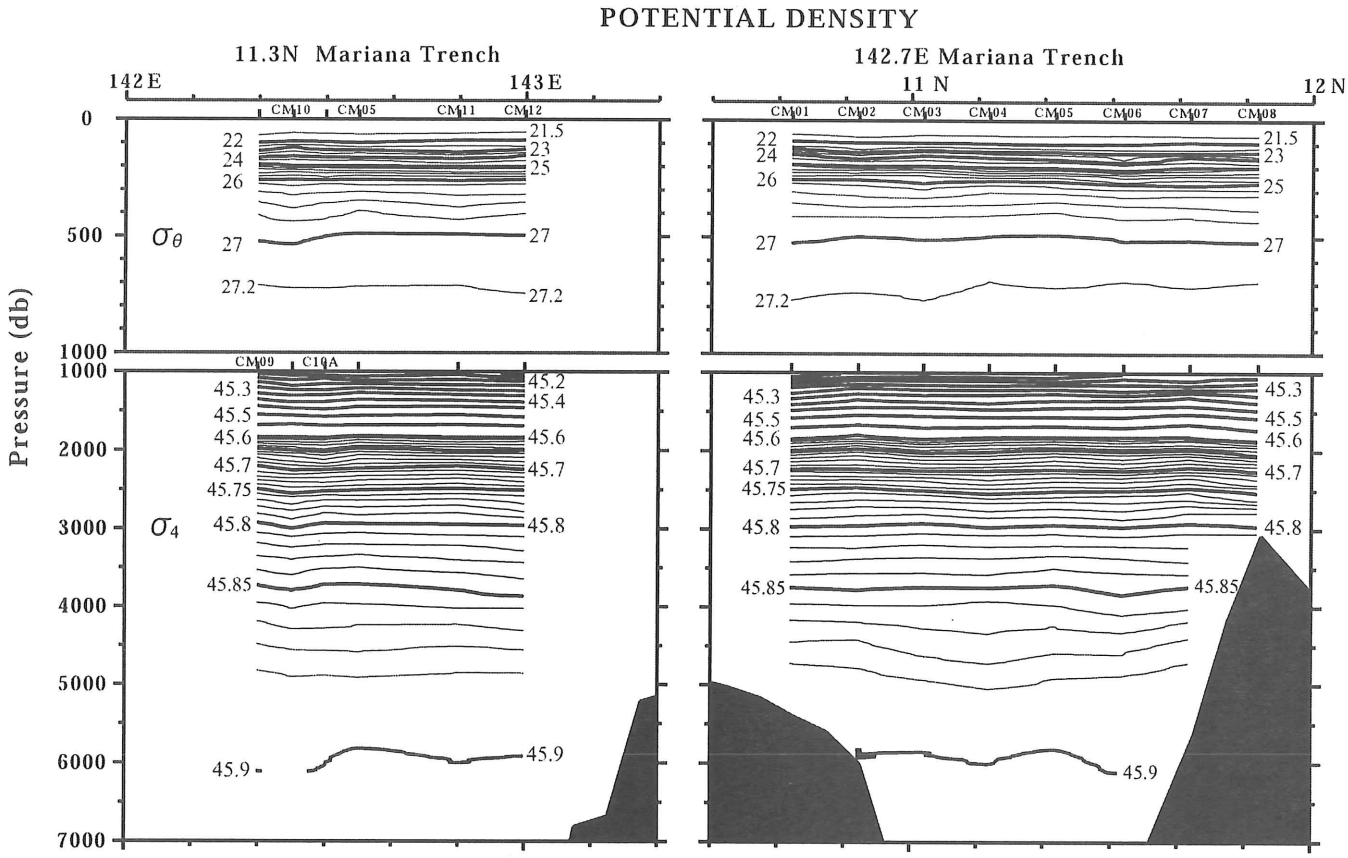


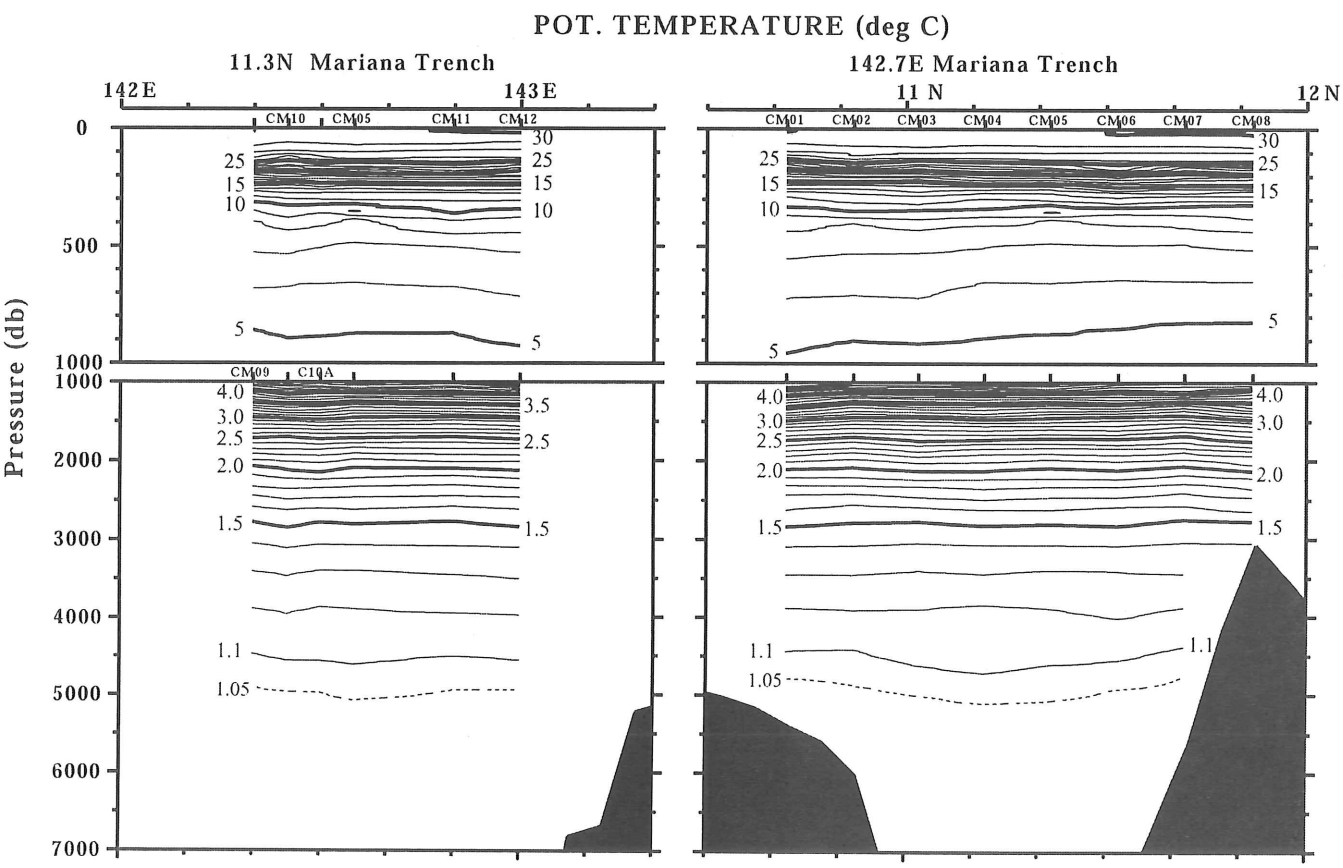
SM



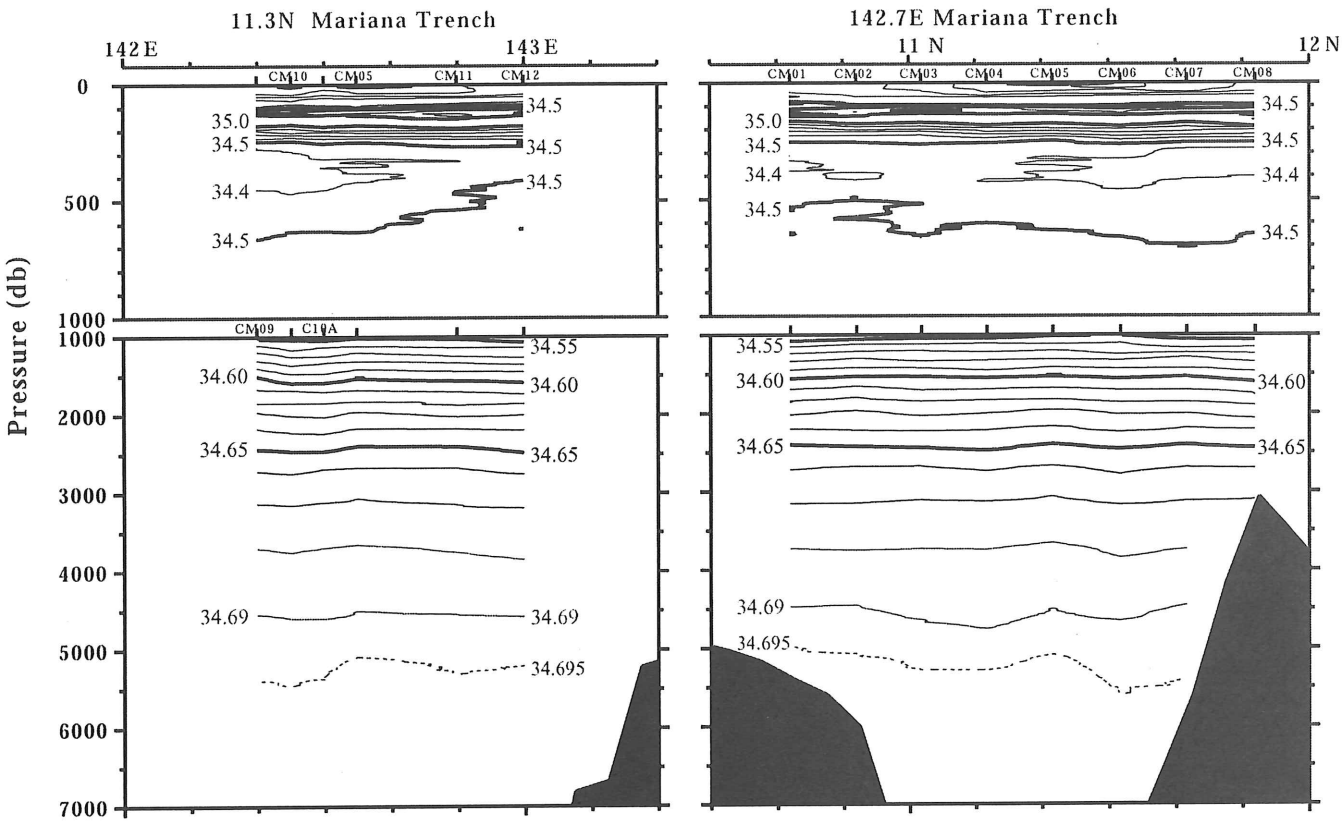



Temperature
Salinity
TK
KA
KB
Depth (m)
Latitude
Longitude
20
15
10
5
34
34.6
34.4
33.8
34.2
34.8

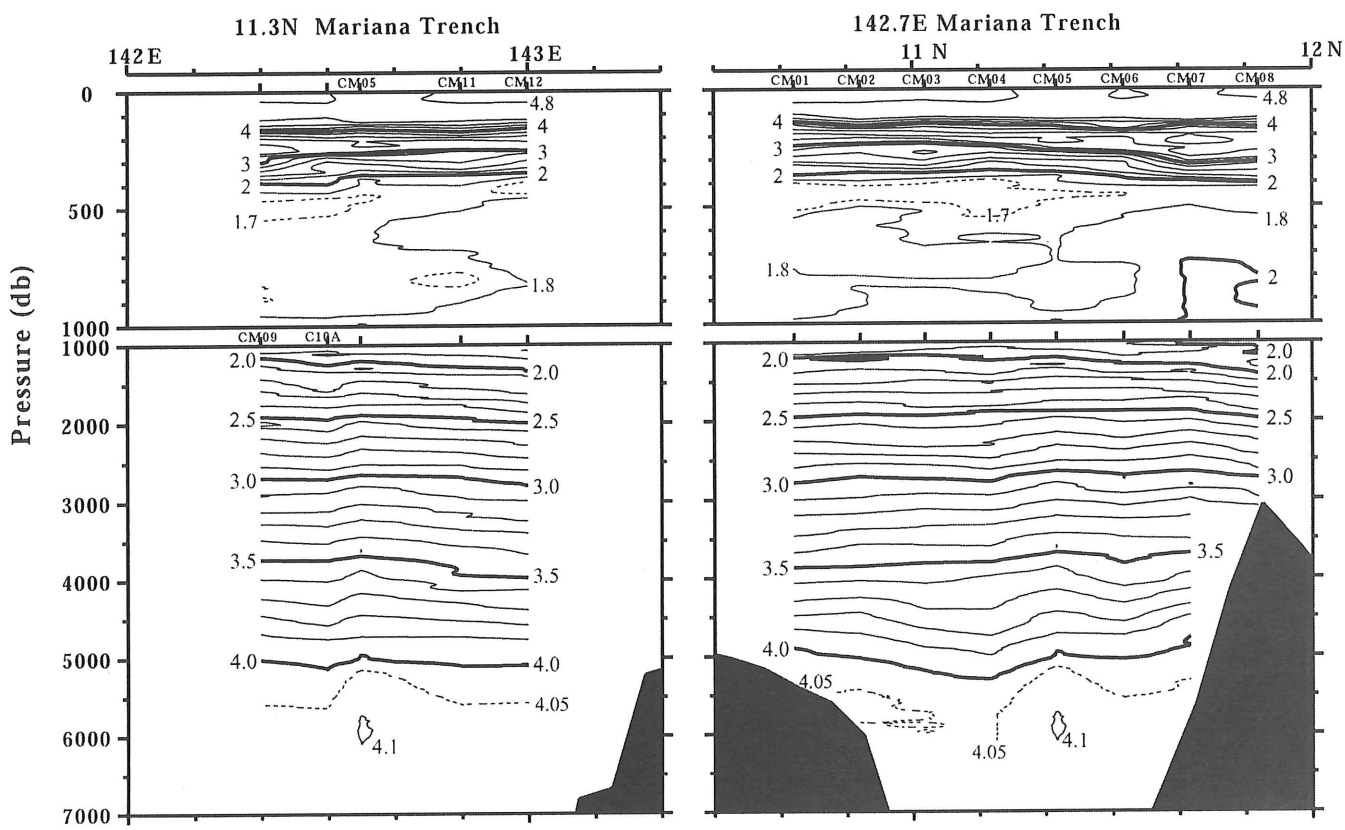

POTENTIAL DENSITY
11.3N Mariana Trench
142.7E Mariana Trench
142E
143E
11 N
12 N
CM10
CM05
CM11
CM12
CM01
CM02
CM03
CM04
CM05
CM06
CM07
CM08
CM09
C10A
Pressure (db)
σθ
σ4
0
500
1000
2000
3000
4000
5000
6000
7000
22
24
26
27
27.2
21.5
23
25
45.3
45.5
45.6
45.7
45.75
45.8
45.85
45.9
45.2
45.4


POT. TEMPERATURE (deg C)
11.3N Mariana Trench
142.7E Mariana Trench
142E
143E
11 N
12 N
CM10
CM05
CM11
CM12
CM01
CM02
CM03
CM04
CM05
CM06
CM07
CM08
CM09
C10A
Pressure (db)
0
500
1000
2000
3000
4000
5000
6000
7000
30
25
15
10
5
4.0
3.0
2.5
2.0
1.5
1.1
1.05
3.5

SALINITY (psu)

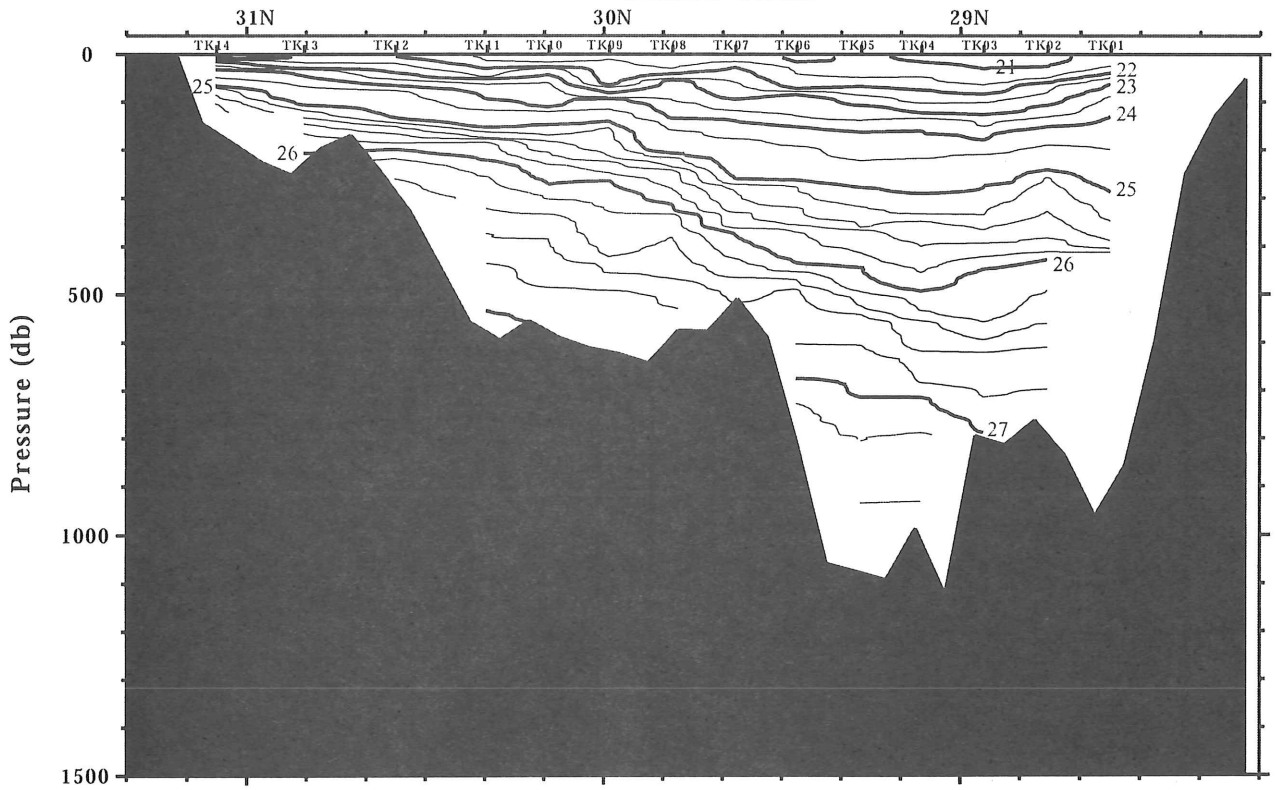


DISSOLVED OXYGEN (ml/l)



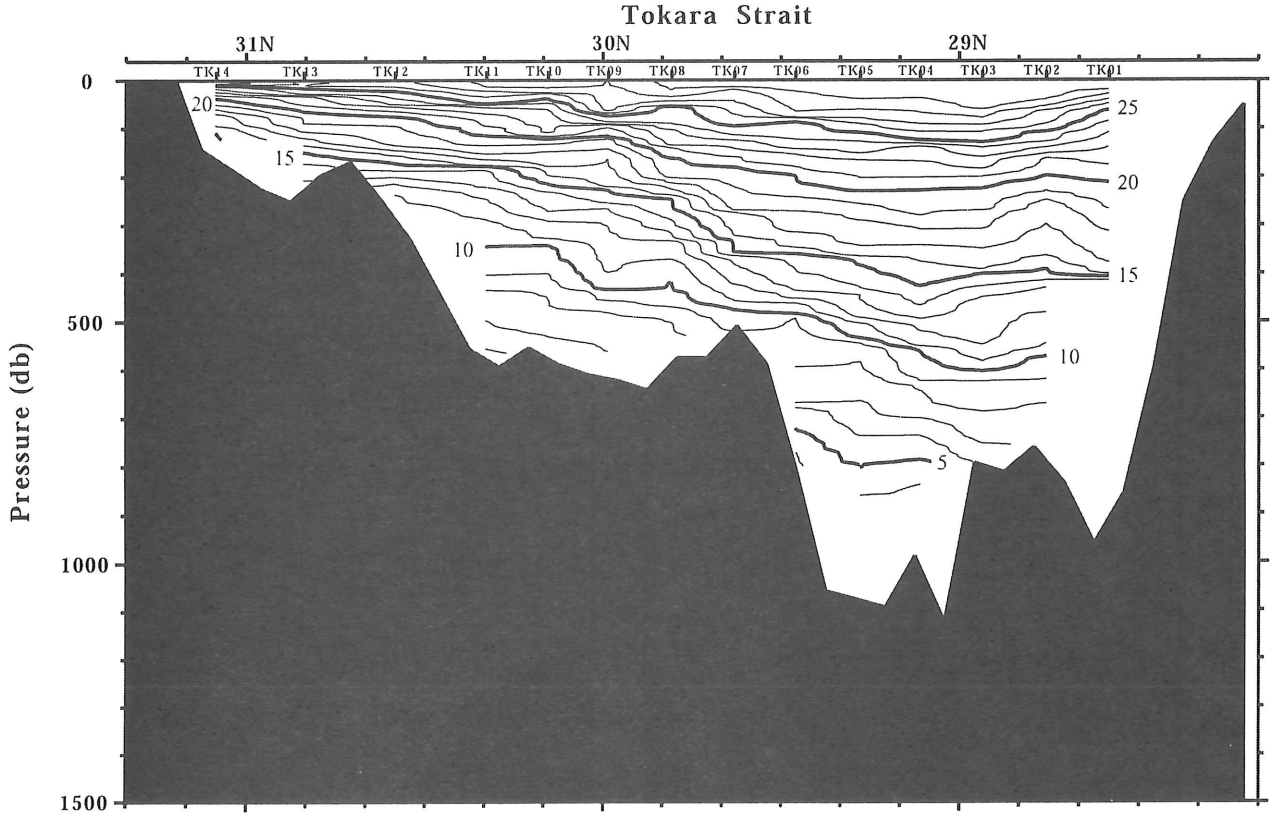
POTENTIAL DENSITY

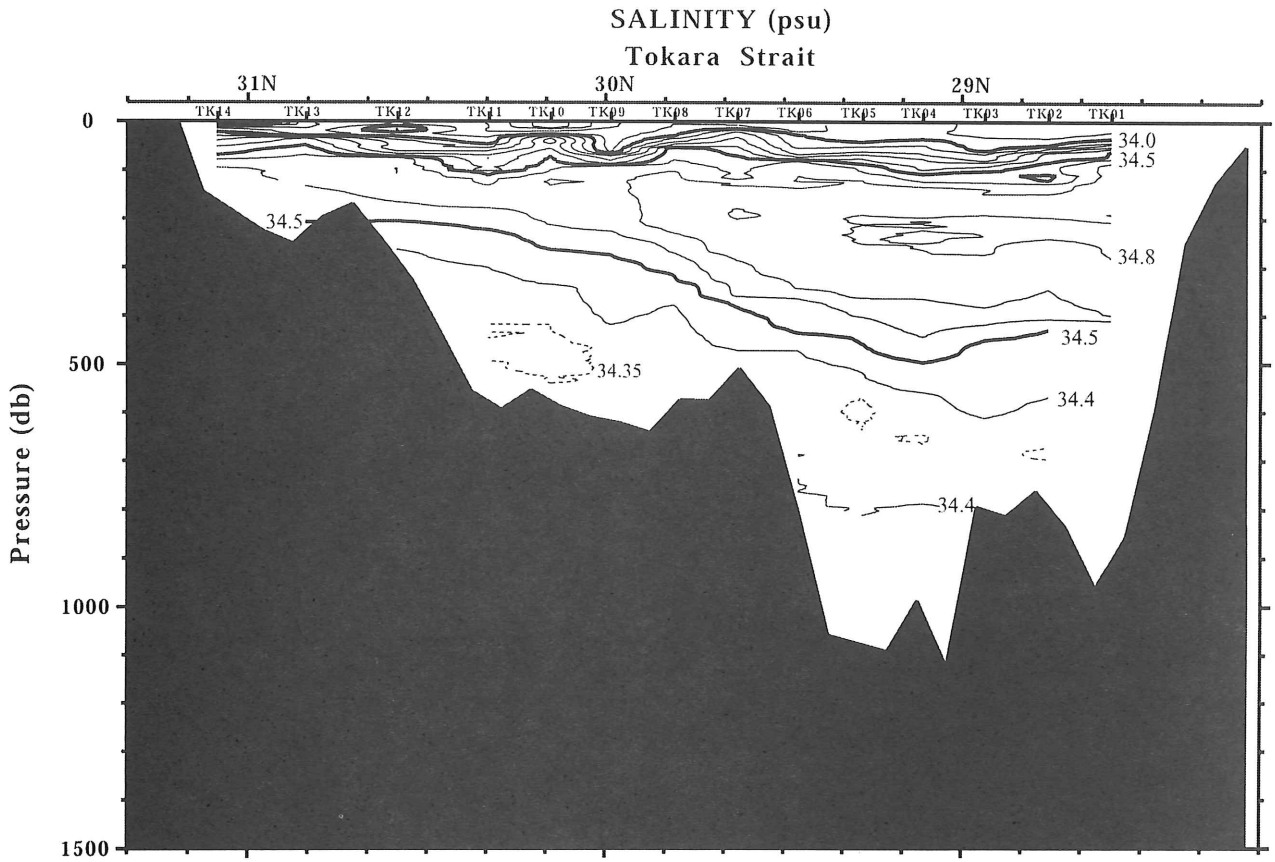
Tokara Strait

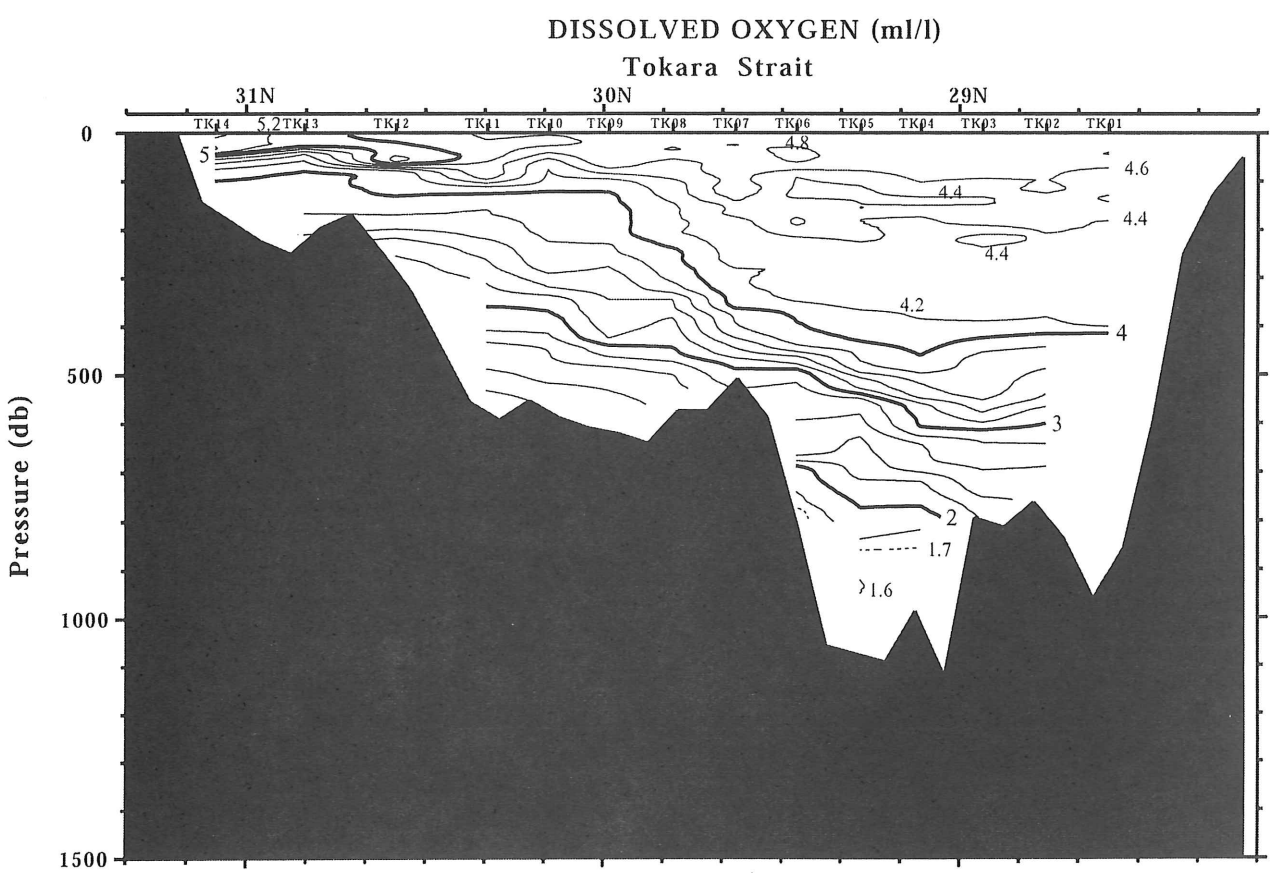


POT. TEMPERATURE (deg C)

Tokara Strait

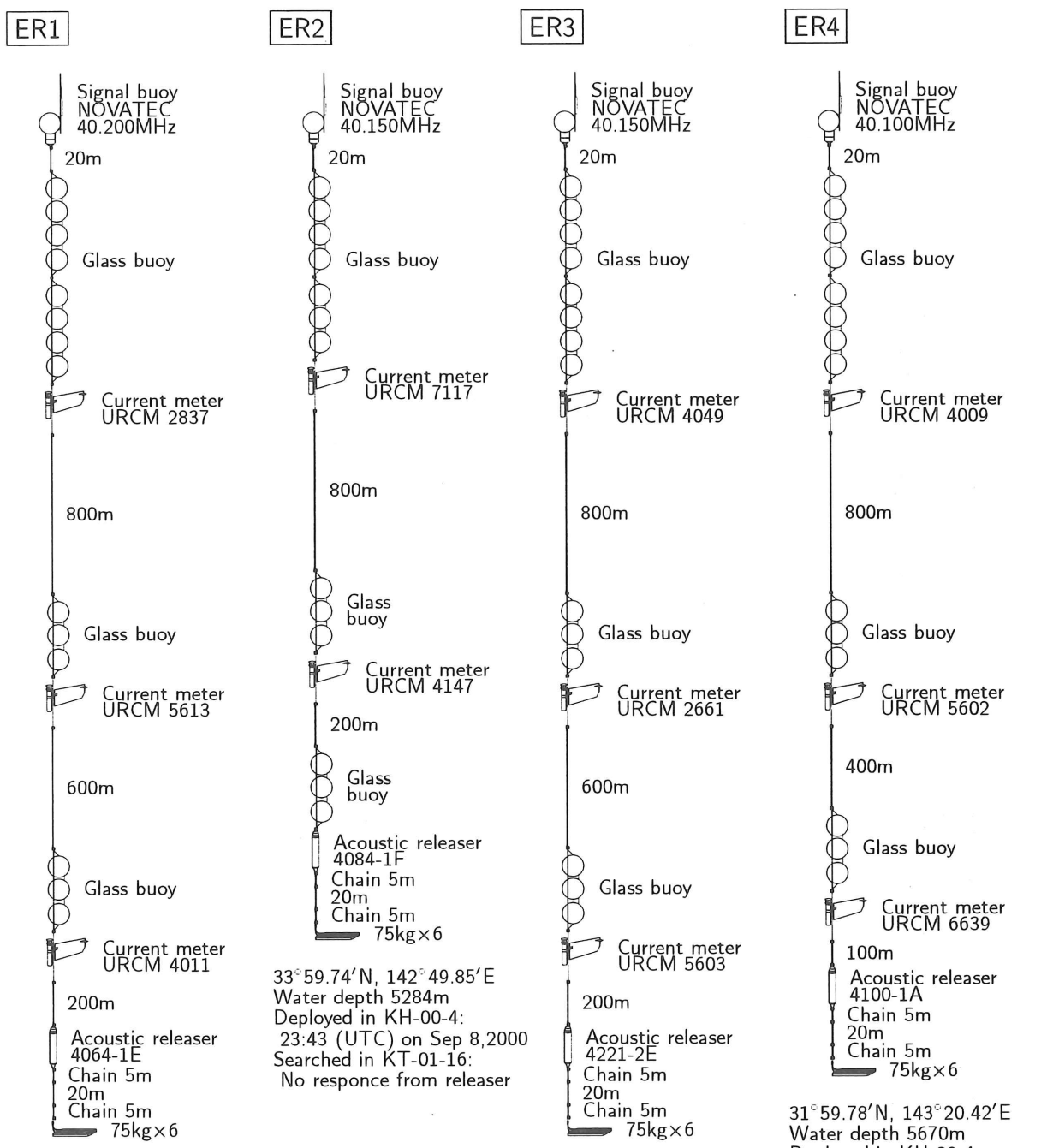



SALINITY (psu)
Tokara Strait
31N
30N
29N
TK14 TK13 TK12 TK11 TK10 TK09 TK08 TK07 TK06 TK05 TK04 TK03 TK02 TK01
0
500
1000
1500
Pressure (db)
34.0
34.5
34.5
34.8
34.5
34.35
34.4
34.4


DISSOLVED OXYGEN (ml/l)
Tokara Strait
31N
30N
29N
TK14 TK13 TK12 TK11 TK10 TK09 TK08 TK07 TK06 TK05 TK04 TK03 TK02 TK01
0
500
1000
1500
Pressure (db)
5.2
5
4.8
4.6
4.4
4.4
4.4
4.2
4
3
2
1.7
1.6

9. Mooring Systems

Deployed in KH-00-4



33°59.04′N, 142°30.29′E
Water depth 6102m
Deployed in KH-00-4:
01:43 (UTC) on Sep 9,2000
Recovered in KT-01-16:
21:36 (UTC) on Nov 22,2001

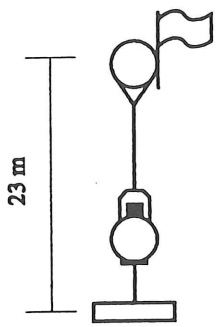
33°59.74′N, 142°49.85′E
Water depth 5284m
Deployed in KH-00-4:
23:43 (UTC) on Sep 8,2000
Searched in KT-01-16:
No responce from releaser

31°58.81′N, 142°51.04′E
Water depth 6027m
Deployed in KH-00-4:
04:48 (UTC) on Sep 8,2000
Recovered in KT-01-16:
22:39 (UTC) on Nov 27,2001

31°59.78′N, 143°20.42′E
Water depth 5670m
Deployed in KH-00-4:
01:04 (UTC) on Sep 8,2000
Recovered in KT-01-16:
03:14 (UTC) on Nov 28,2001

ES05

2000/09/15 06:25 UTC
31-54.93 N, 133-34.07 E, 2964 m



Glass buoy (17 inch, Yellow)
Radio beacon TB-309E, S/N 3361190
43.528 MHz, L61
Flag (Orange)
Chane 15 kg

PC 20 m

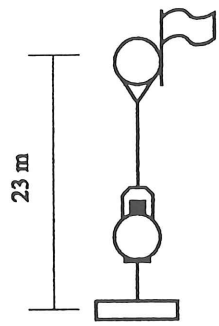
PIES (17inch, Yellow), S/N 013
Receive 10.5 kHz, Transmit 11.0 kHz
Enable F, Release G
SW/ON 2000/09/15 05:00 UTC

NL 1m

Anchor
rail 1 m
air 50 kg, water 44 kg

ES06

2000/09/15 01:40 UTC
31-30.10 N, 133-48.00 E, 4846m



Glass buoy (17 inch, Yellow)
Radio beacon TB-309E, S/N 3361207
43.528 MHz, O61
Flag (Orange)
Chane 15 kg

PC 20 m

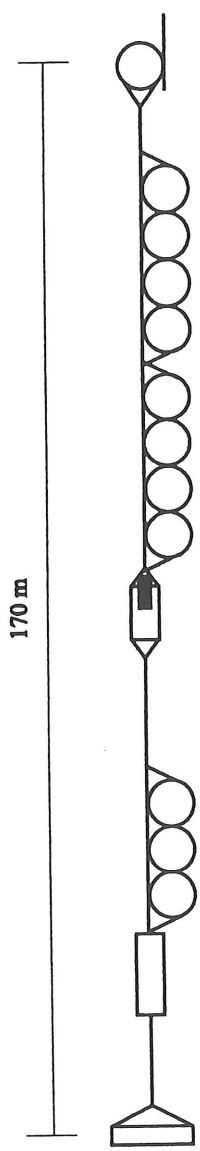
PIES (17 inch, Yellow), S/N 014
Receive 9.0 kHz, Transmit 10.5 kHz
Enable F, Release G
SW/ON 2000/09/15 01:00 UTC

NL 1 m

Anchor
rail 1 m
air 50 kg, water 44 kg

CM06

2000/09/15 04:51 UTC
31-40.70 N, 133-35.88 E, 4822 m



Glass buoy (17 inch, Yellow)
Radio beacon TB-309E, S/N 3361208
43.528 MHz, P61
Chane 15 kg

PC 20 m

Glass buoy (17 inch, Yellow)
4 buoys x 2

3DACM, S/N 1632
SW/ON 2000/09/12 00:00 UTC

KV 100 m

Glass buoy (17 inch, Yellow)
3 buoys

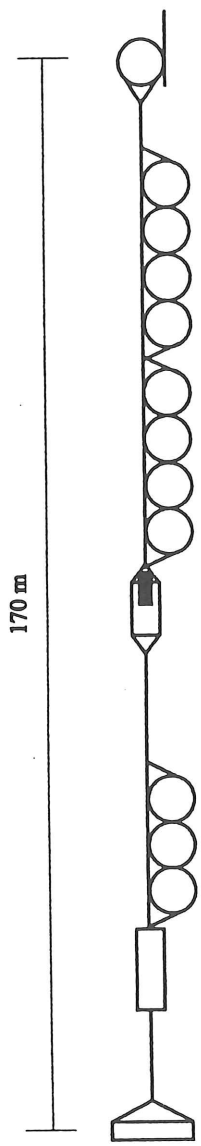
A/R
NY, S/N 4419-1F
SW/ON 2000/07/26
battery 2-year

Chane 5 m
NC 20 m
Chane 8 m
Chane 1 m x 2

Anchor
rail 1.5 m x 5 + 1.6m x 2
air 535 kg, water 470 kg

CM07

2000/09/14 23:47 UTC
31-13.03 N, 133-51.43 E, 4569 m



Glass buoy (17 inch, Yellow)
Radio beacon TB-309E, S/N 3361206
43.528 MHz, N61
Chane 15 kg

PC 20 m

Glass buoy (17 inch, Yellow)
4 buoys x 2

3DACM, S/N 1633
SW/ON 2000/09/12 00:00 UTC

KV 100 m

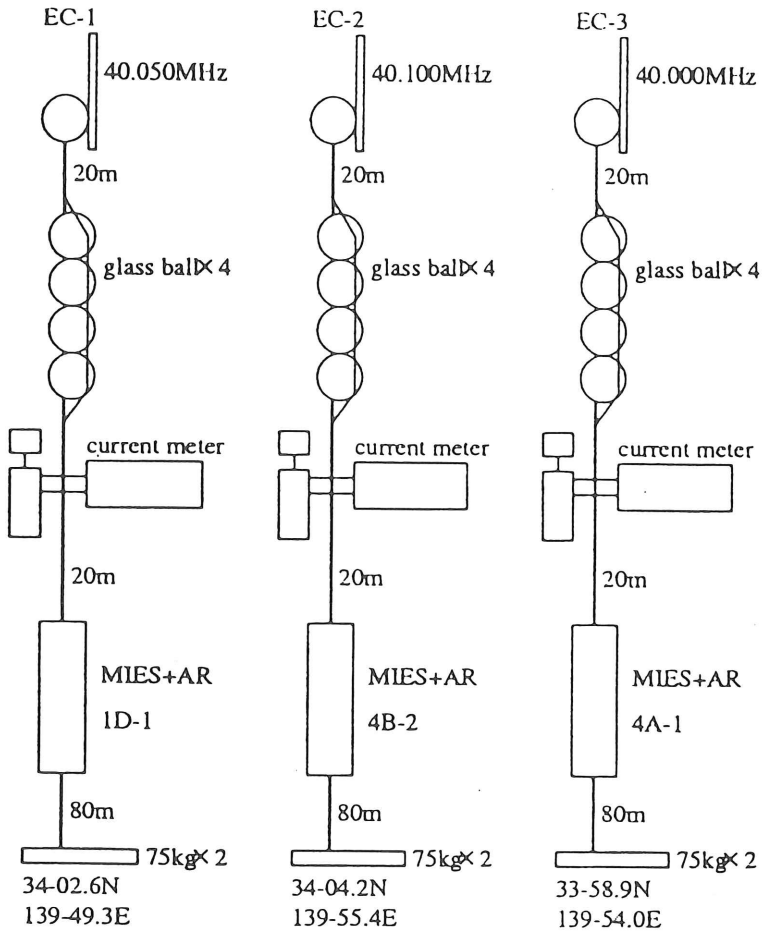
Glass buoy (17 inch, Yellow)
3 buoys

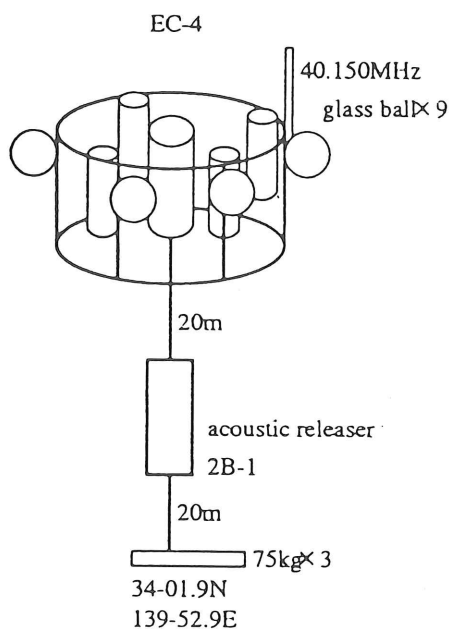
A/R
NY, S/N 4428-1E
SW/ON 2000/07/26
battery 2-year

Chane 5 m
NC 20 m
Chane 8 m
Chane 1 m x 2

Anchor
rail 1.5 m x 5 + 1.6m x 2
air 535 kg, water 470 kg

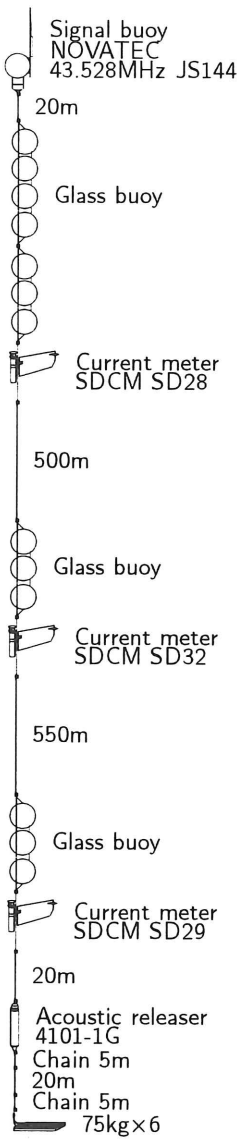
Deployed and recovered in KH-00-4





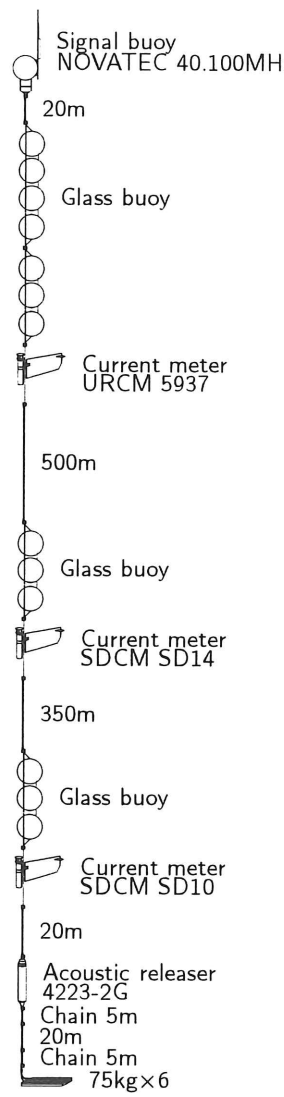
Deployed in KH-00-4 and recovered in KH-01-1

YAE-1



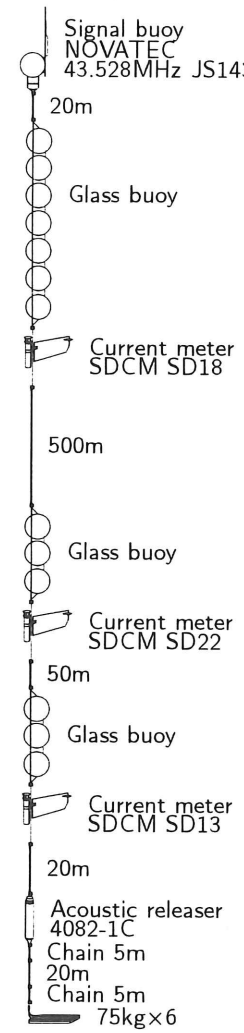
25° 24.16′N, 124° 30.26′E
Water depth 2088m
Deployed in KH-00-4:
04:51 (UTC) on Sep 18,2000
Recovered in KH-01-1:
04:20 (UTC) on Jul 1,2001

YAE-2



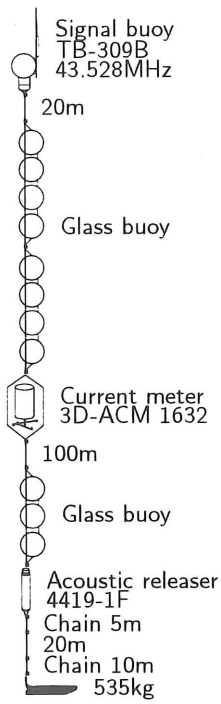
25° 38.00′N, 125° 29.87′E
Water depth 2024m
Deployed in KH-00-4:
06:51 (UTC) on Sep 17,2000
Recovered in KH-01-1:
22:03 (UTC) on Jun 30,2001

YAE-3



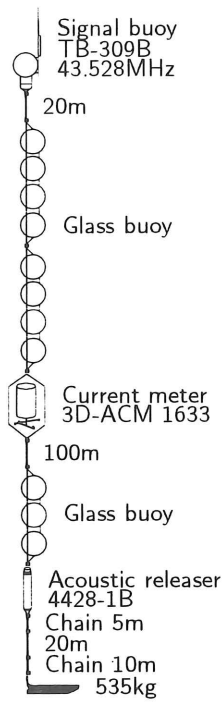
25° 59.78′N, 126° 30.03′E
Water depth 1750m
Deployed in KH-00-4:
02:38 (UTC) on Sep 17,2000
Recovered in KH-01-1:
23:00 (UTC) on Jul 1,2001

CM06



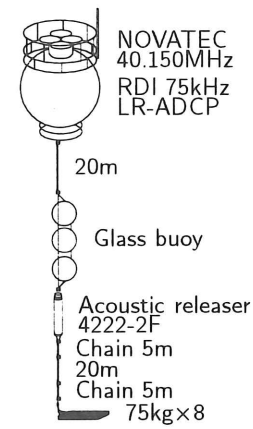
Deployed:
04:51 (UTC) on Sep 15,2000
31° 40.70′N, 133° 35.88′E
Water depth 4822m

CM07



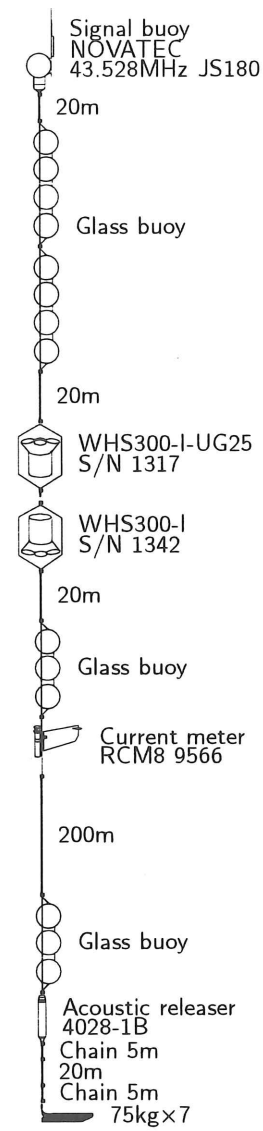
Deployed:
23:47 (UTC) on Sep 14,2000
31° 13.03′N, 133° 51.43′E
Water depth 4569m

TK1



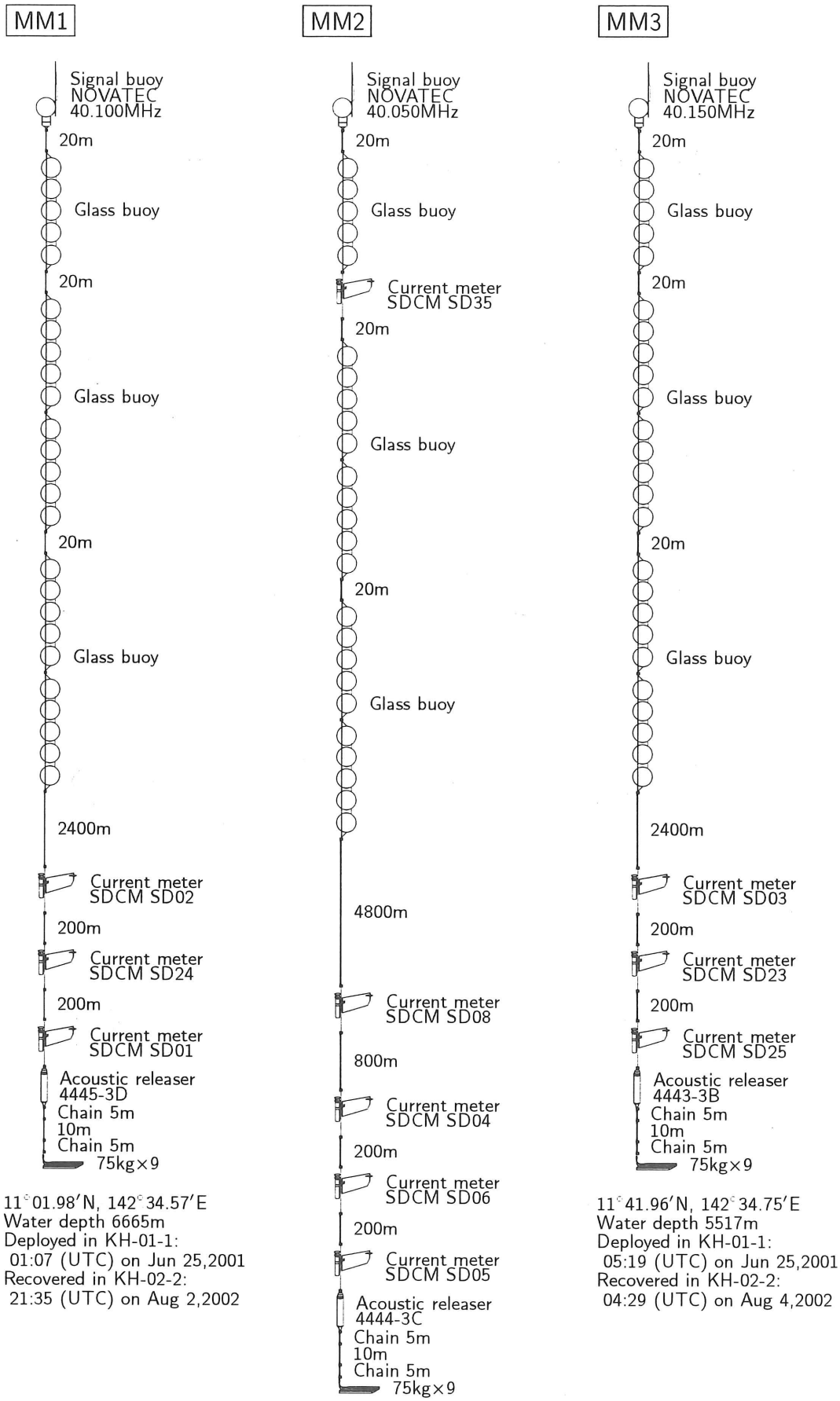
30° 07.960′N, 130° 11.274′E
Water depth 576m
Deployed in KH-00-4:
04:25 (UTC) on Sep 30,2000
Recovered in KH-01-1:
03:18 (UTC) on Jul 3,2001

TK2



29° 44.180′N, 130° 01.192′E
Water depth 619m
Deployed in KH-00-4:
01:20 (UTC) on Sep 30,2000
Recovered in KH-01-1:
23:24 (UTC) on Jul 2,2001

Deployed in KH-01-1



11°01.98′N, 142°34.57′E
Water depth 6665m
Deployed in KH-01-1:
01:07 (UTC) on Jun 25,2001
Recovered in KH-02-2:
21:35 (UTC) on Aug 2,2002

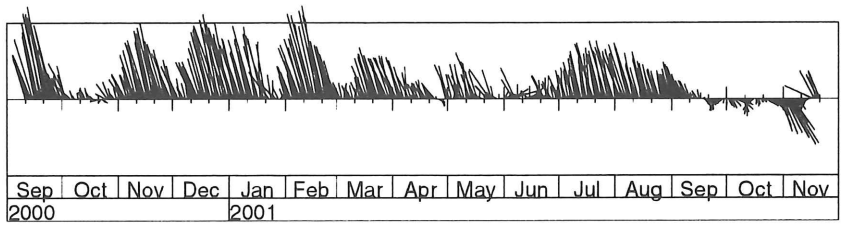
11°22.17′N, 142°36.17′E
Water depth 10533m
Deployed in KH-01-1:
01:24 (UTC) on Jun 23,2001
Recovered in KH-02-2:
01:47 (UTC) on Aug 3,2002

11°41.96′N, 142°34.75′E
Water depth 5517m
Deployed in KH-01-1:
05:19 (UTC) on Jun 25,2001
Recovered in KH-02-2:
04:29 (UTC) on Aug 4,2002

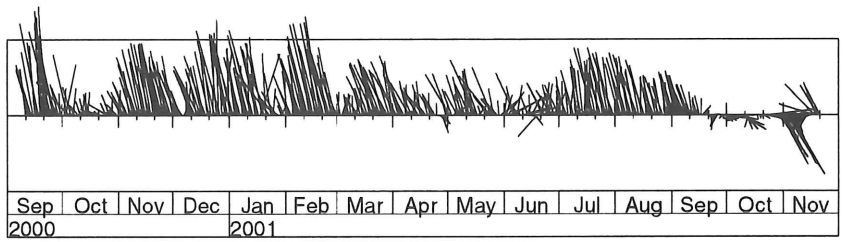
10. Results of Moored Current Meters

ER1

4470m



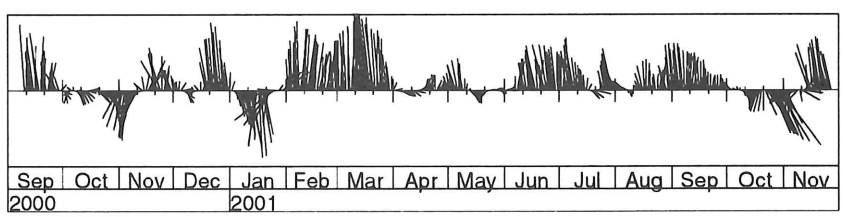
5870m



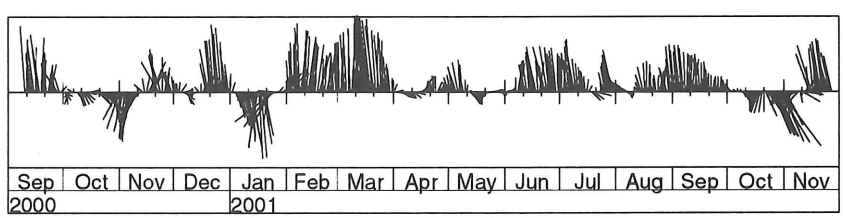
N
E
10 cm/s

ER3

5190m

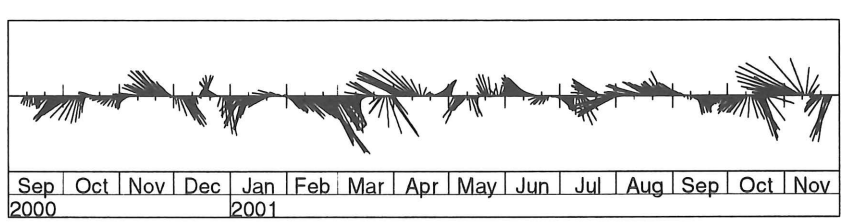


5790m

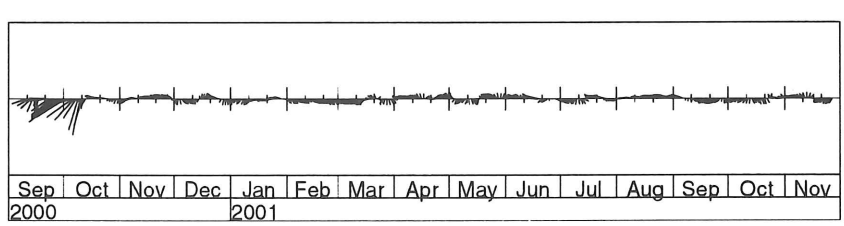


ER4

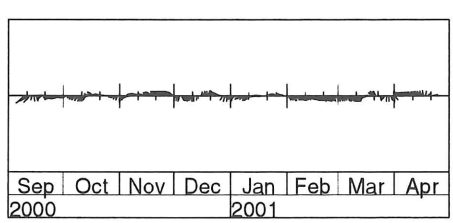
4340m



5140m

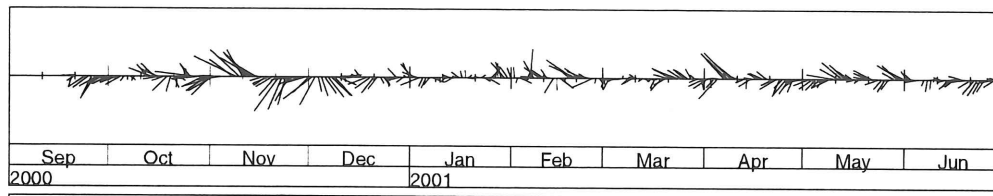


5540m

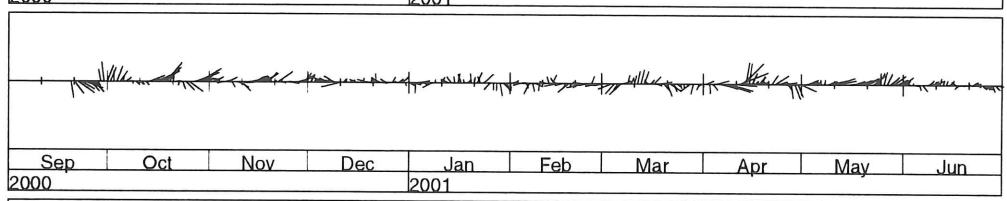


YAE1

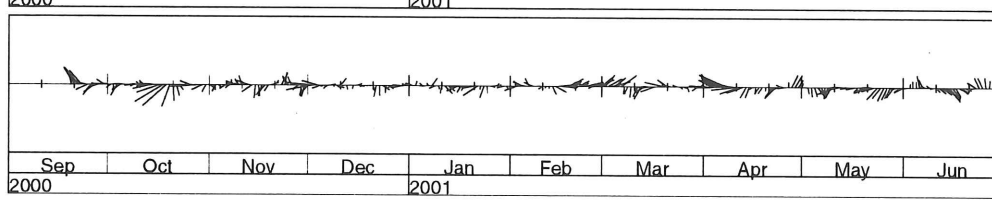
980m



1480m

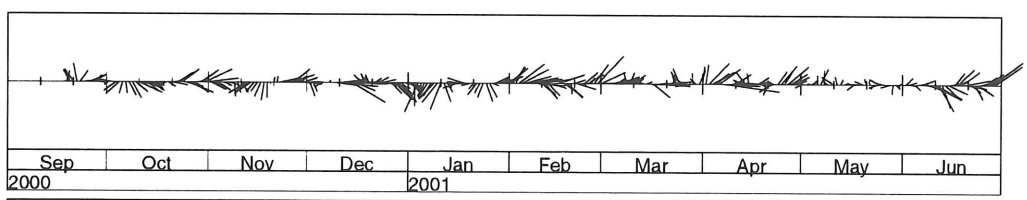


2036m

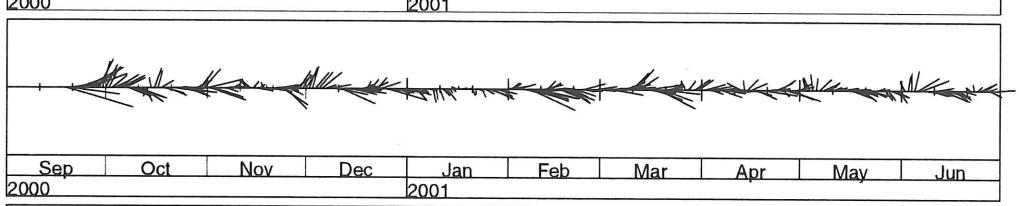


YAE2

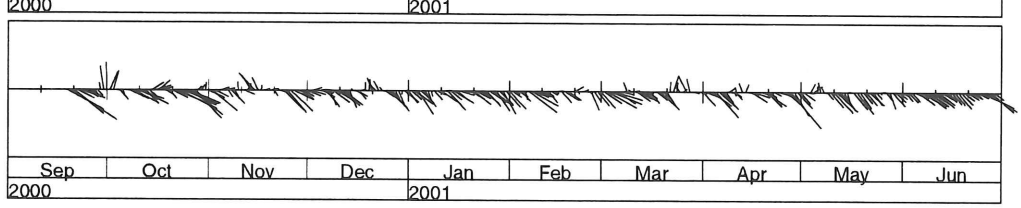
1120m



1620m

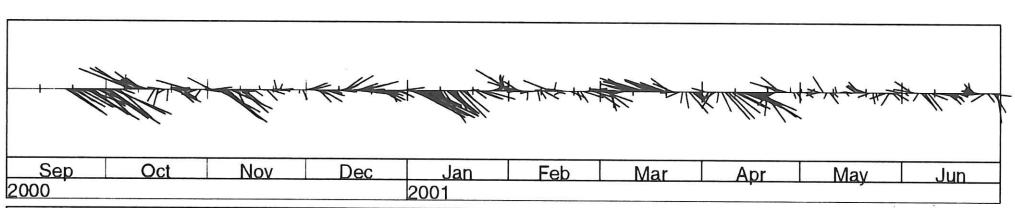


1972m

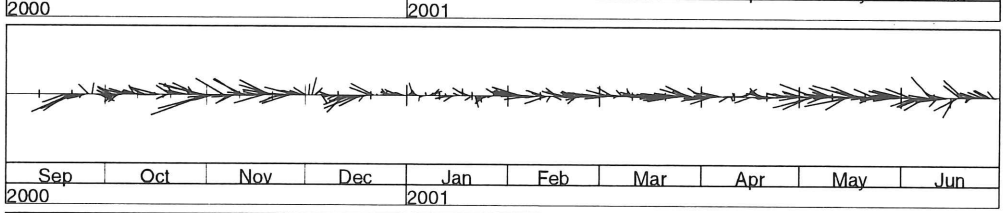


YAE3

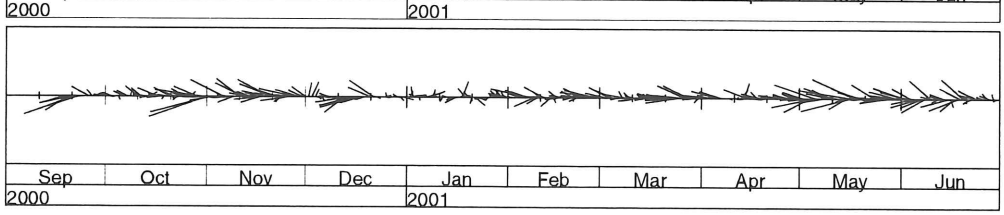
1140m



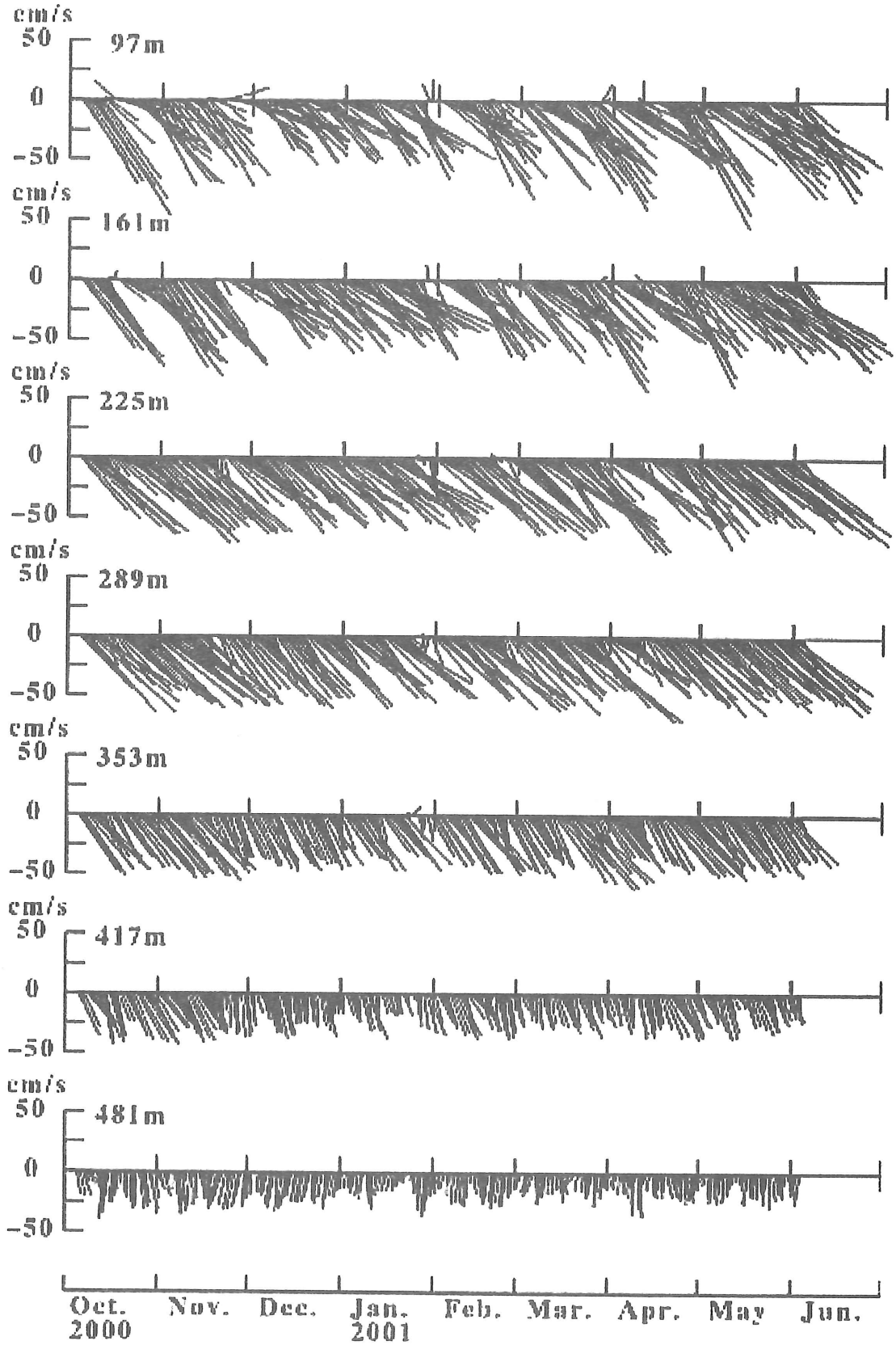
1644m



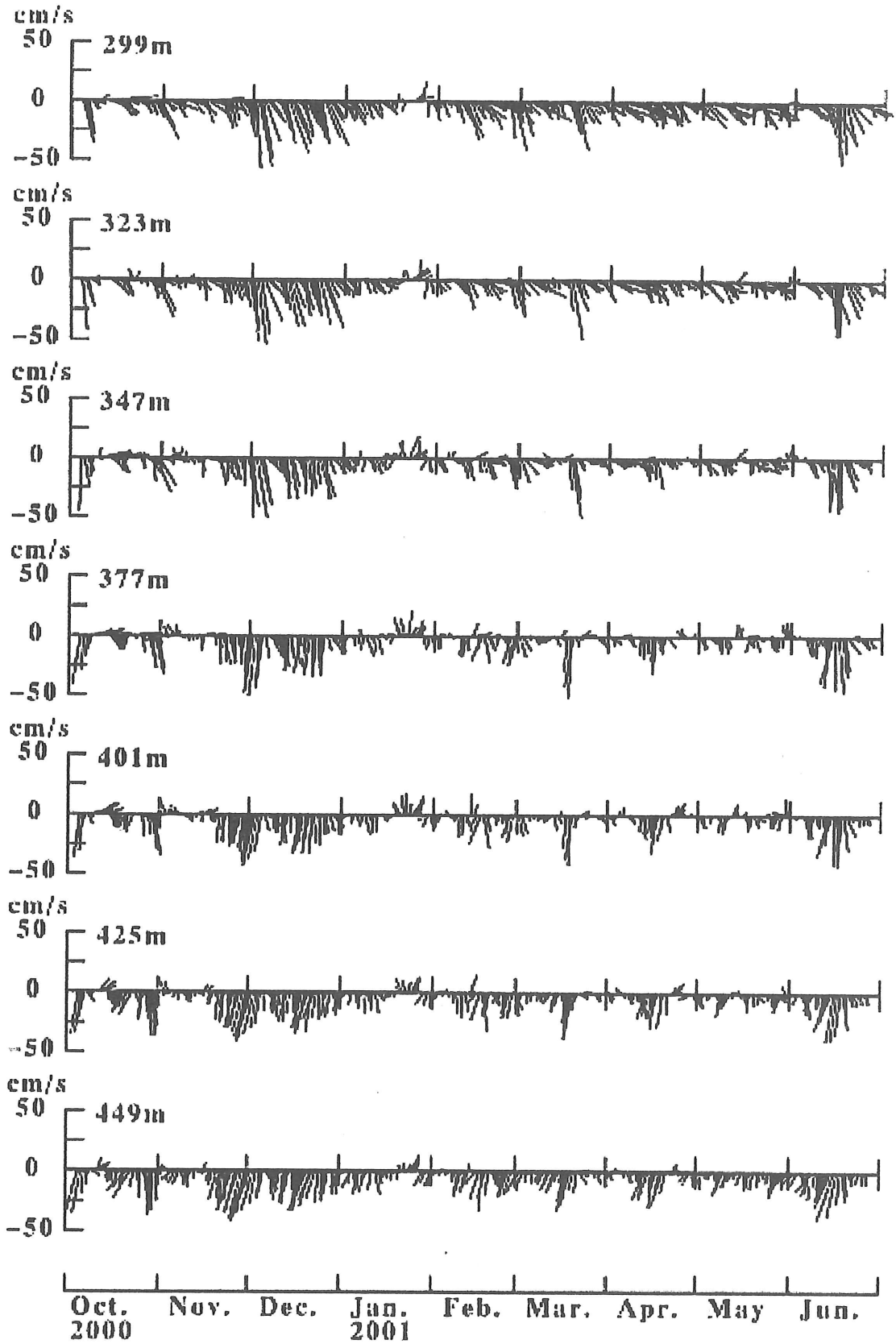
1698m



TK1

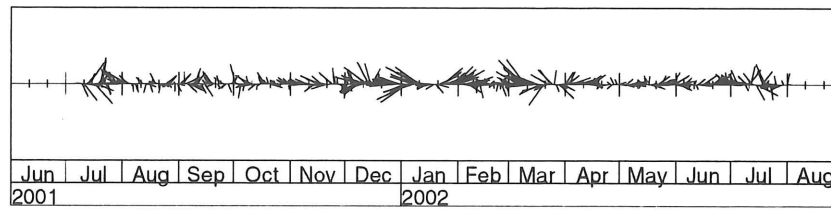

cm/s
50
0
-50
97m
161m
225m
289m
353m
417m
481m
Oct.
2000
Nov.
Dec.
Jan.
2001
Feb.
Mar.
Apr.
May
Jun.

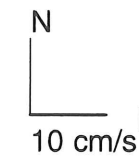
TK2


cm/s
50
299m
0
-50
cm/s
50
323m
0
-50
cm/s
50
347m
0
-50
cm/s
50
377m
0
-50
cm/s
50
401m
0
-50
cm/s
50
425m
0
-50
cm/s
50
449m
0
-50
Oct.
2000
Nov.
Dec.
Jan.
2001
Feb.
Mar.
Apr.
May
Jun.

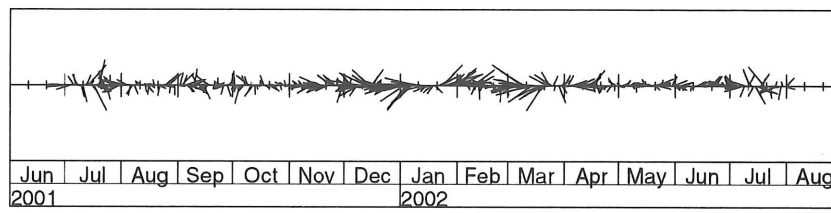
MM1

6240m

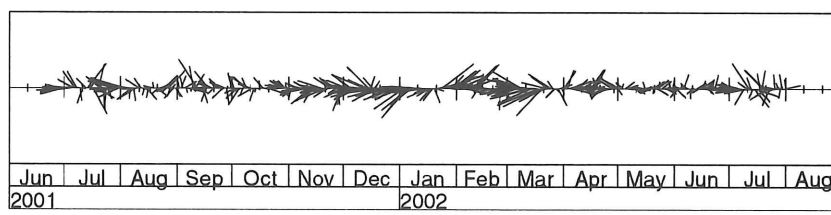




6440m

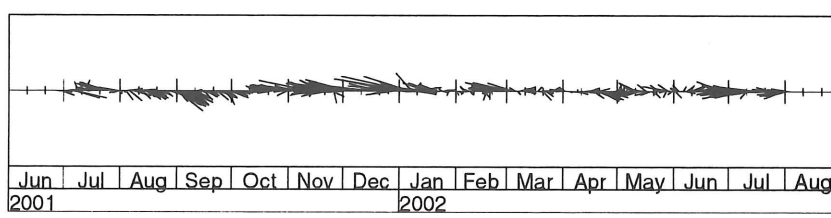


6640m

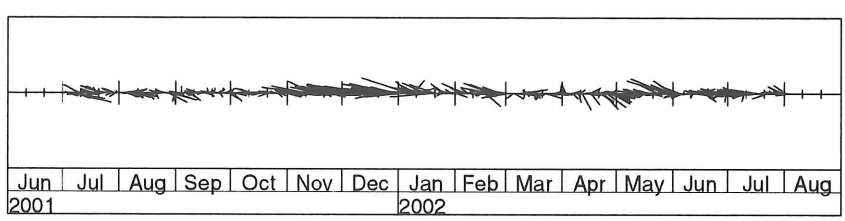


MM3

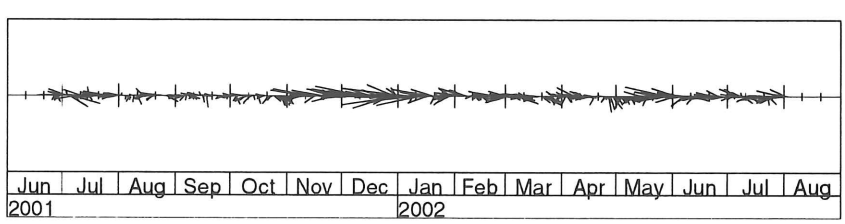
5100m



5300m

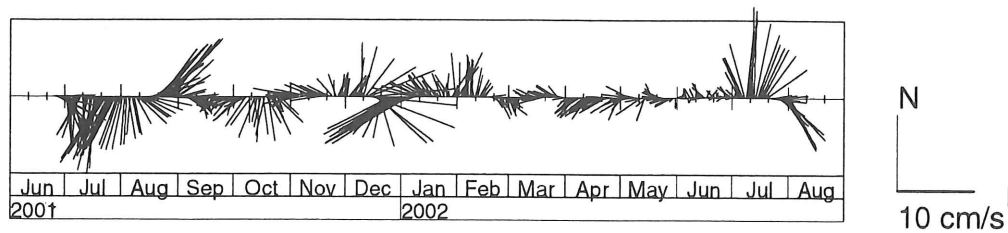


5500m

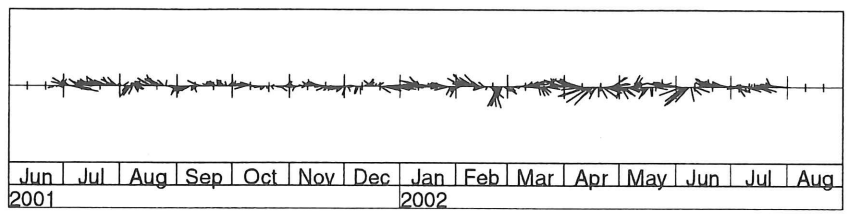


MM2

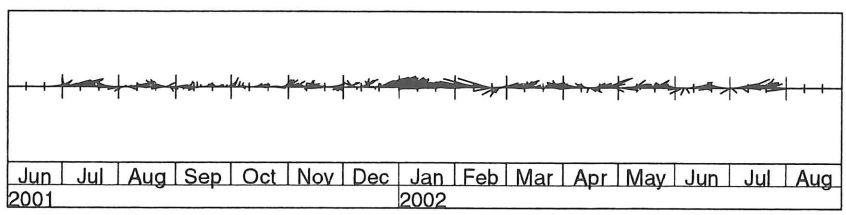
4450m



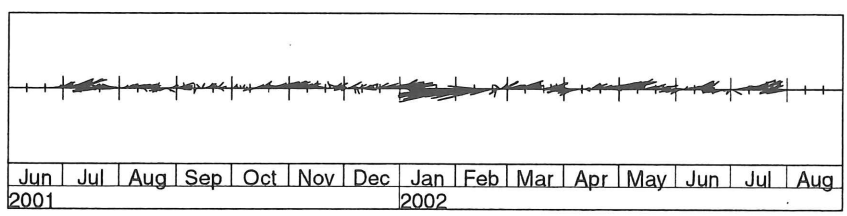
9310m



10110m



10310m



10510m