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CRUISE REPORT
TOCS K9406
December 1994-January 1995

TOCS CRUISE REPORT NO.4
JAMSTEC

CONTENTS

1. Cruise Summary
Ship: R/V KAIYO
Institute: Japan Marine Scienceand Technology Center
Chief scientist: Yoshifumi Kuroda, JAMSTEC
Cruise code: K9406
Project title: Tropical Ocean Climate Study (TOCS)
Period: 19 December 1994 - 11 January 1995
Port of call:

Majuro, Republic of the Marshal Islands (15-19 December 1994)
Kavieng, Papua New Guinea (30 December 1994-2 January 1995)
Palau, Republic of Palau (11-14 January 1995)

Purpose:

The purpose of this cruise was to observe physical oceanographic conditions in the western tropical Pacific for better understanding of ocean-atmosphere interaction and its affects on the ENSO phenomena (El Nino/Southern Oscillation) and climate change. The cruise was carried out under the research program of Tropical Ocean Climate Study (TOCS) at Japan Marine Science and Technology Center. The program is supported by the Science and Technology Agency of Japan. During this cruise recoveries and deployments of meteorological and oceanographic buoys as part of the TAO array were conducted by Pacific Marine Environmental Laboratory (PMEL) of National Oceanic and Atmospheric Administration (NOAA), USA. Mr. Andrew J. Shepherd of PMEL participated in the cruise for the moorings.

Observation summary:

The following measurements were completed; 41 CTD (Conductivity-Temperature-Depth profiler) casts, 57 upper air soundings (Omega sonde), continuous CO_2 measurements, continuous ADCP (Acoustic Doppler Current Profiler) measurements, two recoveries and deployments of subsurface current meter buoys. Two recoveries, four deployments and one repair of TAO surface buoys were carried out successfully.

Observational results:

The observational results are summarized preliminally as followed although further analysis and dicussion will be needed.
The ocean and atmospheric data showed that the ocean was in an El Nino event. On the section from 165E to 142E, westerlies were dominant, especially along the 165E the westeries were strengthened by a tropical storm. Due to these westeries, the surface currents flowed to east along the

equator. On the previous LIDAR leg, the deepest surface mixed layer (29 C, 95 m) was reported around the dateline. The warm water over 30 C was observed at 165W where the cool water upwelled by easterly winds in normal condition. In this TOCS cruise, the deepest surface mixed layer (80 m) also was observed in eastern side of 0,165E. However, the 20 C isotherm-depth was at 128 m, which was much shallower compare to a 150 m depth reported in the October Climate Diagnostics Bulletin.
The 20 C isotherm-depth along the equator from 147E to 142E was in the range of 130-140 m, becoming much shallower than 170 m observed on the April 1994 cruise. The surface salinity showed a minimum value (<34 psu) at 0, 165E down to 80 m depth. This showes that the area had heavy precipitation associated with active convection in the atmosphere. Thus, the ocean was under the typical El Nino conditions. The warm pool is shifted east of the date line and also active atmospheric convection area. In the west side of the warm water, westerlies are enhanced and cause the eastward currents.

Next, we describe the water mass distribution and some features from CTD sections. Along the 142E section, the 28 isotherm was deepest on the equator. This means warm water convergence by Ekman transport caused by the westeries. This is consistent with strong eastward currents obtained by shipboard ADCP. However, as described above the 20 C isotherm was shallow and the surface water may lose the heat from the Spring to this Winter.
Tropical Water (TW) over 35.5 psu with a potential density =25 was found from 2-40S to 1-30S at 150 m depth, which is originated in the south Pacific. The tropical water is characterized by high salinity and high oxygen, but it was found relatively less oxygen (<3.4ml/l) than surounded waters. Below the water, Antarctic Intermediate Water (AAIW) was found with high oxygen (>3.4ml/l). In the region deeper than 150 m the isopycnals deepened to the south (the New Guinea coast) and suggested a northward New Guinea Coastal Under Current. The undercurrent was also detected by a new vessel mounted RDI ADCP. The similar water with the TW was found around 3N at 130 m depth with potential density =24.5 which may be carried by the North Equatorial Counter Current from the west.
Below the water, Equatorial Pacific Water (EPW) characterized by low salinity (<34.6) and low oxygen was found. The prominent salinity front was formed around 0-30N between TW and EPW.

Along 147E, TW was found at 0-30S at a 150 m depth with potential density = 25. AAIW was also found at1.5S at a 300 m depth with high oxygen.

In the section from 0,165E to 5S,156E, TW showed the highest salinity over 35.8 psu with a potential density =24.5 at a 150 m depth between 3S,160E and 4S, 157E.

In the moored ADCP buoy data, we notice several features.
Regarding the Climate Diagnostics Bulletin, the TAO current meter data showed three major events in the daily averaged surface zonal currents.
At 0,156E the strong eastward currents of 50 cm/s, 60 cm/s and 90 cm/s were observed in mid May 1994, late July and early September respectively, those were also found similarly at 0,165E with time delay.
Similar events have been observed by our subsurface ADCP buoys at 0,142E and 0,147E.
The first event, the eastward strong current over 50 cm/s, continued for 5 days from May 8th. At 0, 142E (0,147E), the maximum daily averaged data was 65 cm/s (80 cm/s) with sampled over 80 cm/s (100cm/s) with semidiurnal fluctuations.
The second event, the eastward currents over 30 cm/s continued for 4 days from July 13th at 0, 147E. At 0,142E, these currents of 20cm/s to 30 cm/s from July 11th persisted to August.
The third event, the eastward strong current over 50 cm/s continued for 6 days from September 2nd with sampled over 80 cm/s. On the contrary, at 0,142E we observe very weak eastward currents of 10 cm/s to 15 cm/s.
Following the September event the 1994 El Nino has been kicked off.

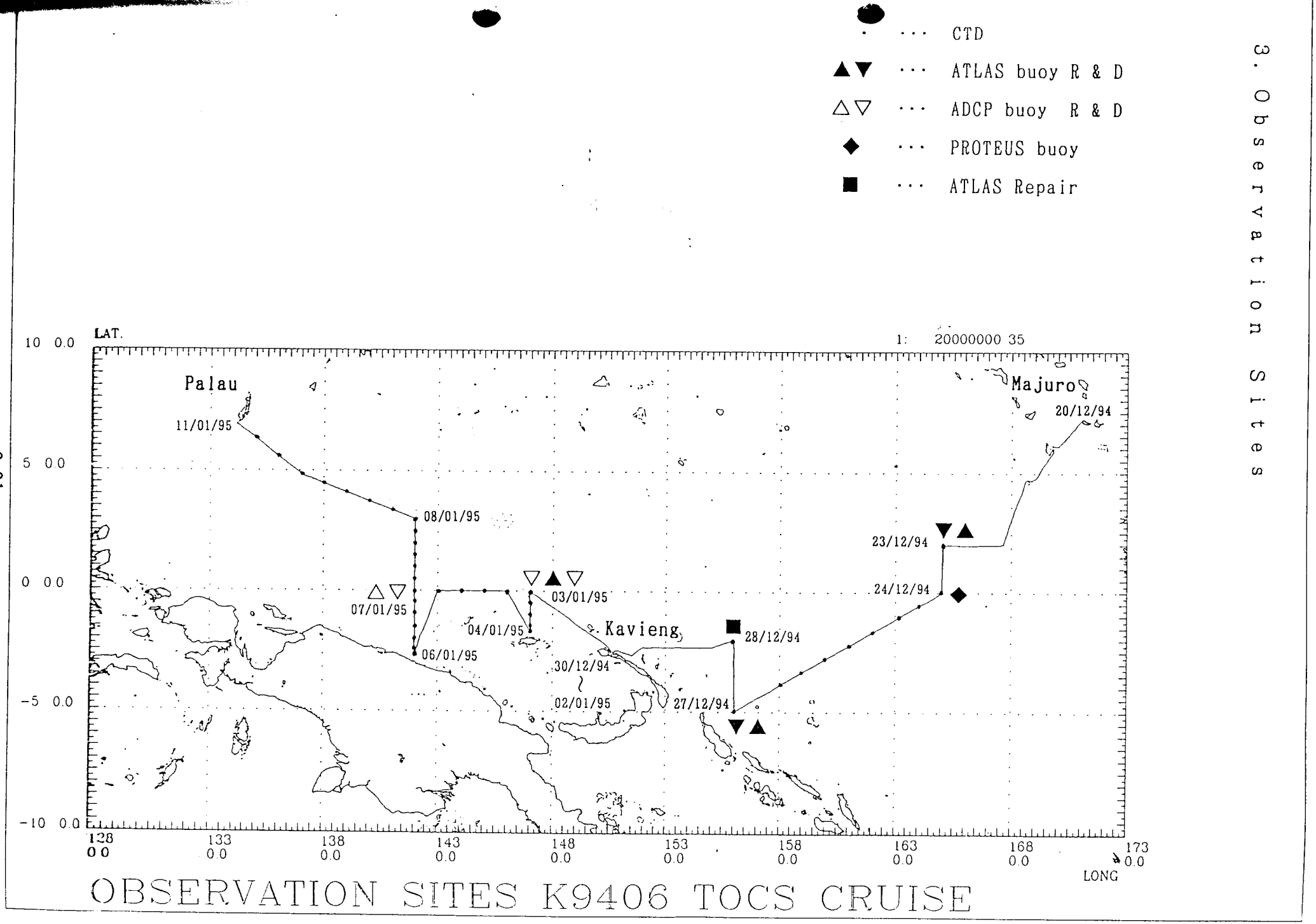
2. List of Shipboard Instruments

(1) CTD (Conductivity-Temperature-Depth profiler)
SBE 9-11plus system, Sea Bird Electronics, Inc, USA
for 6800m depth

(2) Shipboard ADCP (Acoustic Doppler Current Profiler)
a. JLN 610, Japan Radio Co. Ltd
(125kHz, 6 m bin width, 3 depth layers of 20m, 50m and 80m)
b. VM-ADCP, RD Instruments, USA
(75kHz, 16m bin length, Nominal range 560m starting 30m depth)

(3) Upper air soundings (Omega sonde)
Digi CORA MW11 Vaisala, Finland
Omega Sonde Rs-80N

(4) CO_2 measurements
MRI equilibrator
Gas analyzer (Binos 1.4, Germany)
CO_2 coulometer Model (UIC Inc., USA)

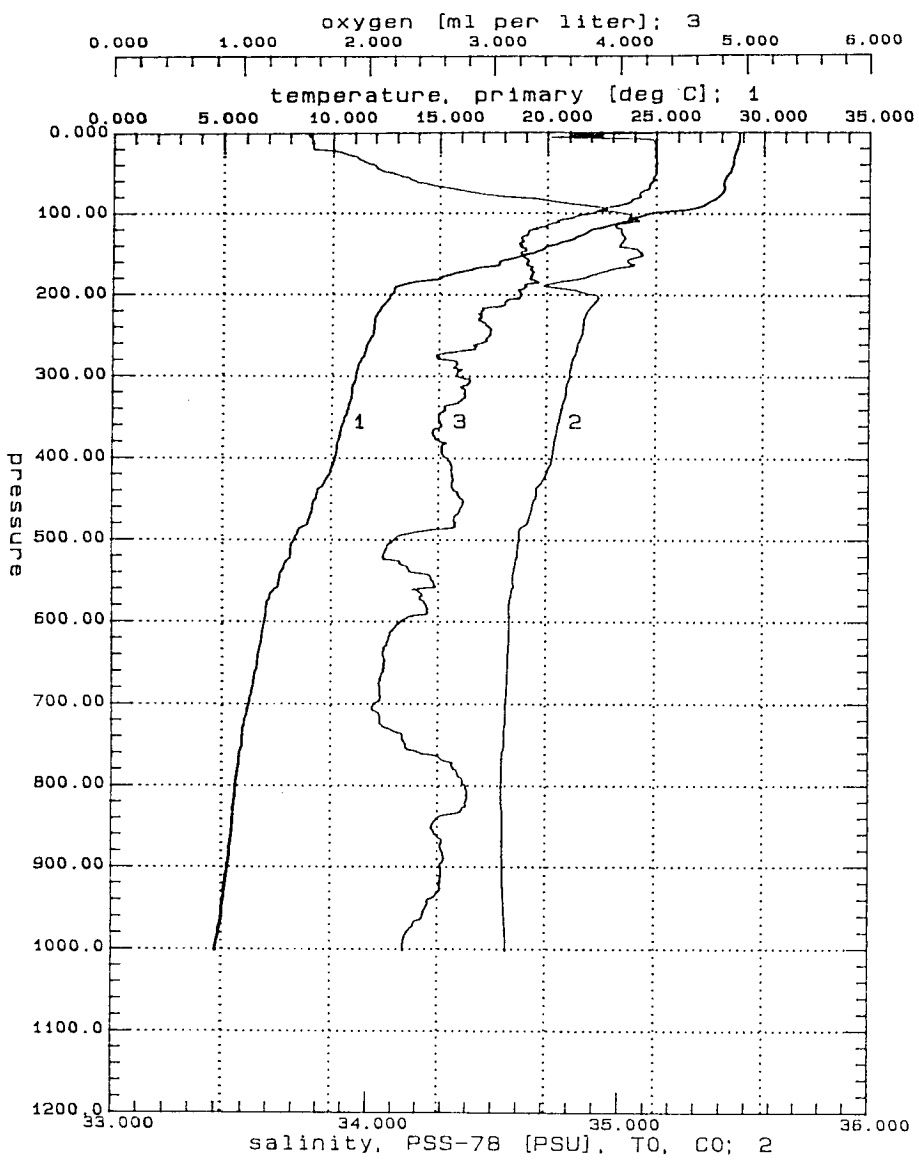


OBSERVATION SITES K9406 TOCS CRUISE

4. CTD Casts

4.1 CTD Casting Sites

No.	Time(GMT)	Position		SST	SSS	Bottom Water Sampling Point		
	YYMMDDHHMM	Lat.	Lon.	(°C)	(PSU)	P2111	T662	T730
01	9412230707	02°00N,	165°01E	28.799	33.761	1003.9	-----	4.670
02	9412240551	00°00N,	164°56E	29.091	33.831	1006.6	4.688	4.683
03	9412241452	00°33S,	164°00E	29.141	33.853	------	-----	-----
04	9412242210	01°07S,	163°00E	29.231	33.953	1007.7	4.580	4.577
05	9412250533	01°40S,	162°00E	29.427	33.951	------	-----	-----
06	9412251244	02°14S,	161°00E	29.478	34.012	1008.3	4.528	4.524
07	9412251950	02°47S,	160°00E	29.591	34.231	1008.3	4.438	4.434
08	9412260252	03°20S,	159°00E	29.511	34.353	1010.6	4.325	4.318
09	9412260940	03°53S,	158°00E	29.690	34.170	1010.1	4.364	4.357
10	9412270540	04°59S,	156°01E	29.794	34.165	1009.4	4.496	4.494
11	9412280030	02°00S,	156°01E	29.260	33.994	1005.9	4.500	4.495
12	9501032321	00°00S,	146°58E	29.115	34.336	1009.5	-----	4.679
13	9501040234	00°30S,	147°00E	29.059	34.246	1013.6	4.586	4.578
14	9501040550	01°00S,	147°00E	28.928	34.314	1004.2	4.567	4.562
15	9501040908	01°30S,	147°00E	29.213	34.189	1003.5	-----	4.574
16	9501041044	01°40S,	147°00E	28.943	34.272	1003.3	4.603	4.597
17	9501042134	00°00S,	146°00E	28.919	34.291	1009.5	4.543	4.536
18	9501050345	00°00N,	145°00E	28.638	34.477	1003.2	4.576	4.571
19	9501050956	00°00N,	144°00E	28.775	34.433	1002.0	-----	4.644
20	9501051600	00°00S,	143°00E	28.731	34.436	1013.7	4.626	4.616
21	9501060647	02°40S,	142°00E	28.716	34.461	1010.0	4.480	4.473
22	9501060820	02°30S,	142°00E	28.852	34.282	1005.5	4.439	4.439
23	9501061139	02°00S,	142°00E	28.996	34.386	1002.9	4.328	4.327
24	9501061555	01°30S,	142°00E	28.858	34.120	1003.5	4.521	4.515
25	9501061820	01°00S,	142°00E	28.876	34.119	1009.1	4.482	4.480
26	9501062148	00°30S,	142°00E	29.018	34.401	1004.8	4.639	4.635
27	9501070602	00°00N,	141°58E	28.884	34.568	1006.2	4.610	4.605
28	9501071154	00°30N,	142°00E	28.684	34.374	1006.1	4.563	4.561
29	9501071513	01°00N,	142°00E	28.796	34.103	1021.0	4.484	4.448
30	9501071836	01°30N,	142°00E	29.028	33.784	1006.2	4.654	4.647
31	9501072158	02°00N,	142°00E	28.808	34.071	1005.0	4.926	4.920
32	9501080117	02°30N,	142°00E	28.648	34.312	1004.7	4.648	4.646
33	9501080433	03°00N,	142°00E	28.595	34.377	1012.5	4.641	4.681
34	9501081040	03°22N,	141°00E	28.451	34.523	1005.8	4.640	4.630
35	9501081708	03°44N,	140°00E	28.399	34.300	1009.1	4.579	4.573
36	9501082339	04°06N,	139°00E	28.142	34.385	1003.1	4.526	4.530
37	9501090625	04°28N,	138°00E	28.379	34.173	1008.1	4.476	4.469
38	9501091300	04°50N,	137°00E	28.369	33.964	1009.5	4.573	4.568
39	9501092022	05°35N,	136°00E	28.490	34.009	1008.5	4.517	4.511
40	9501100315	06°20N,	135°00E	28.447	34.090	------	-----	-----



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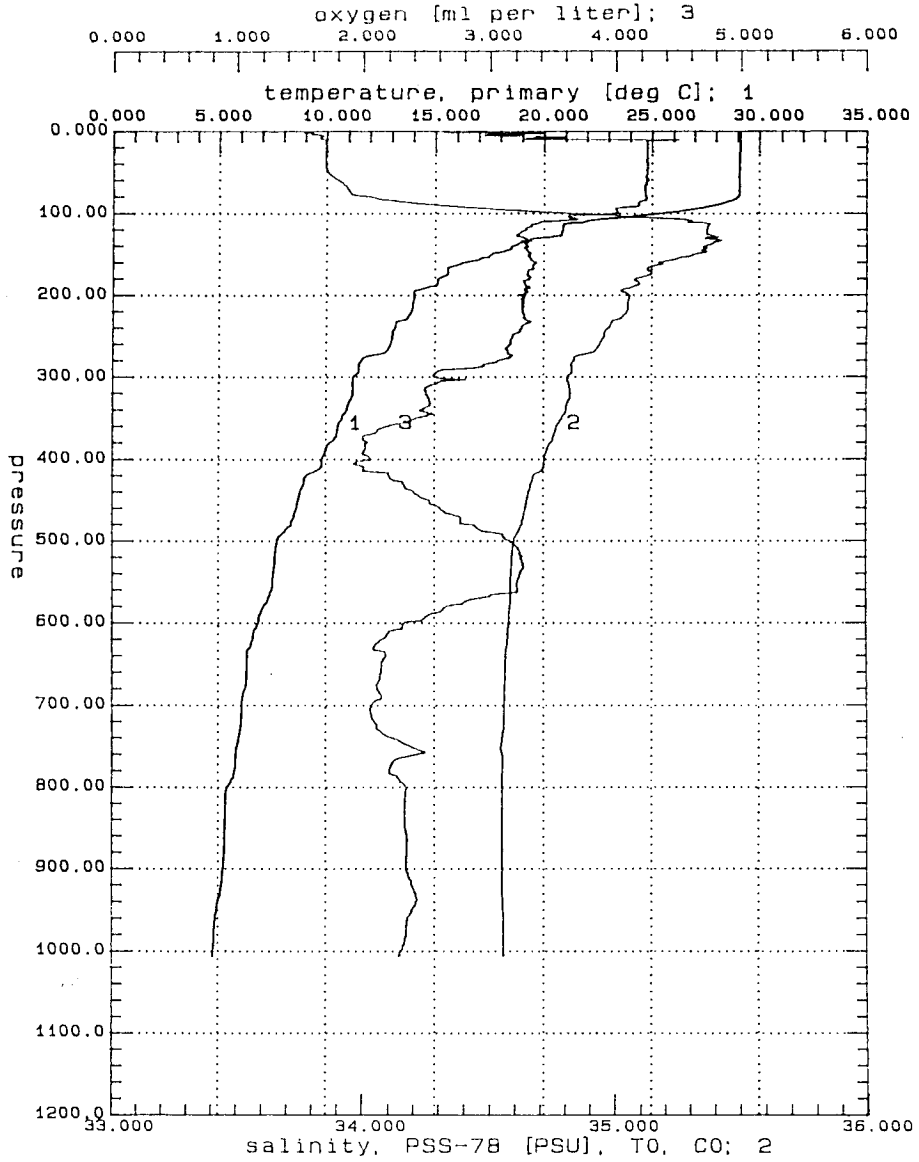

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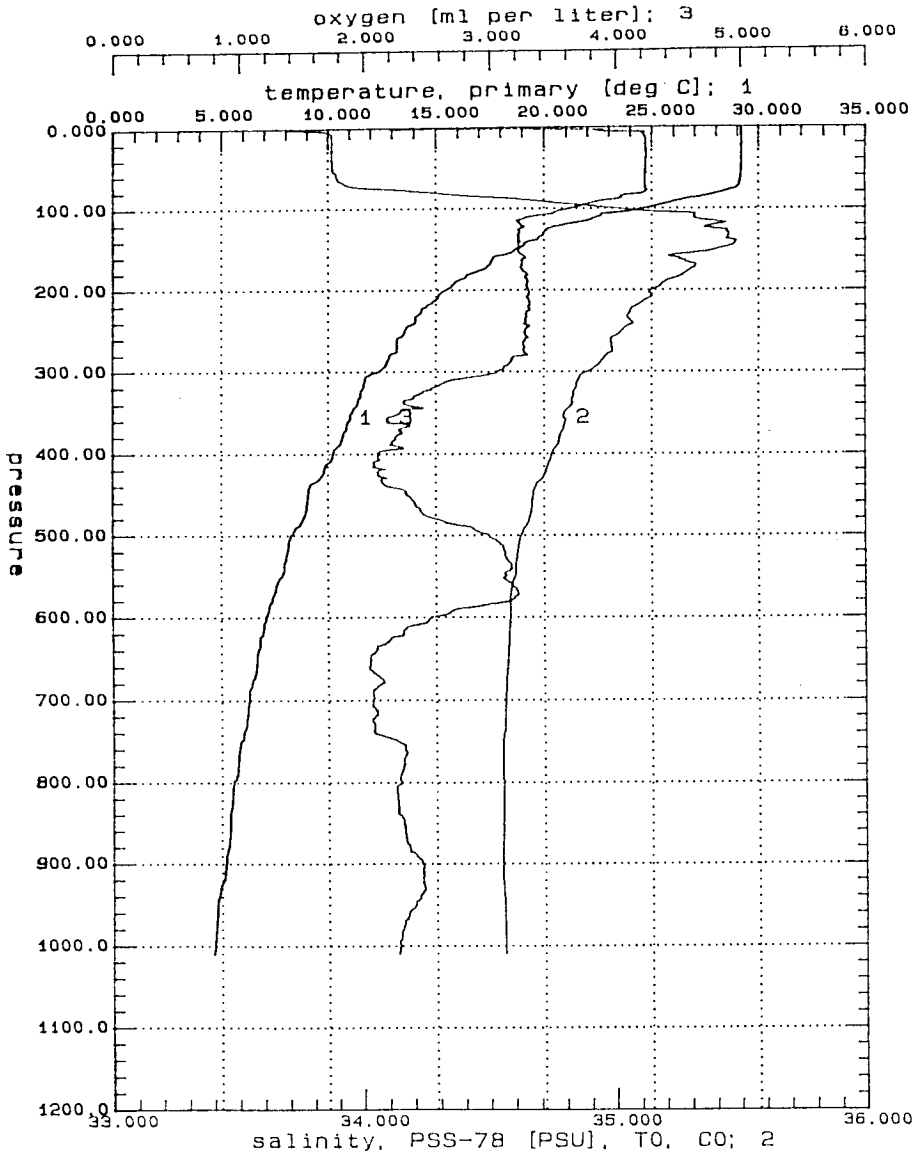

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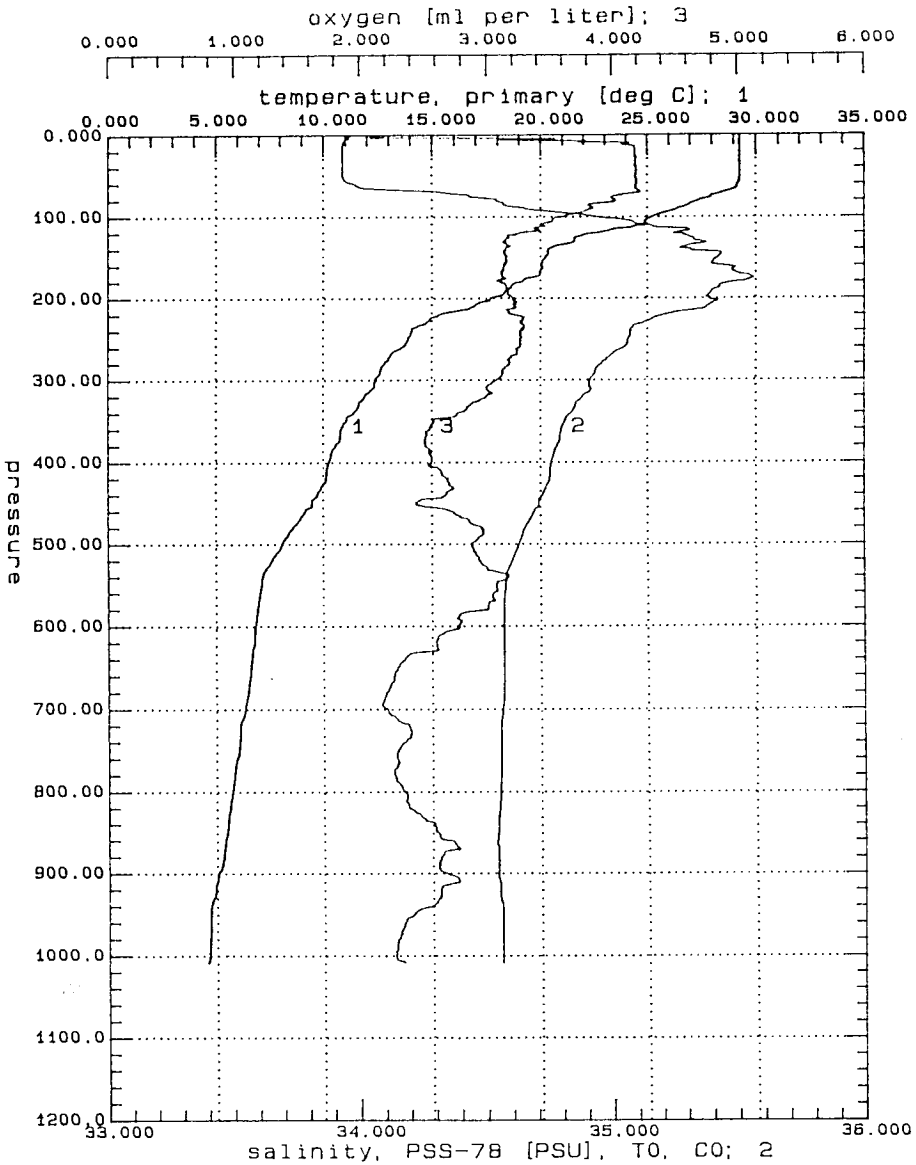

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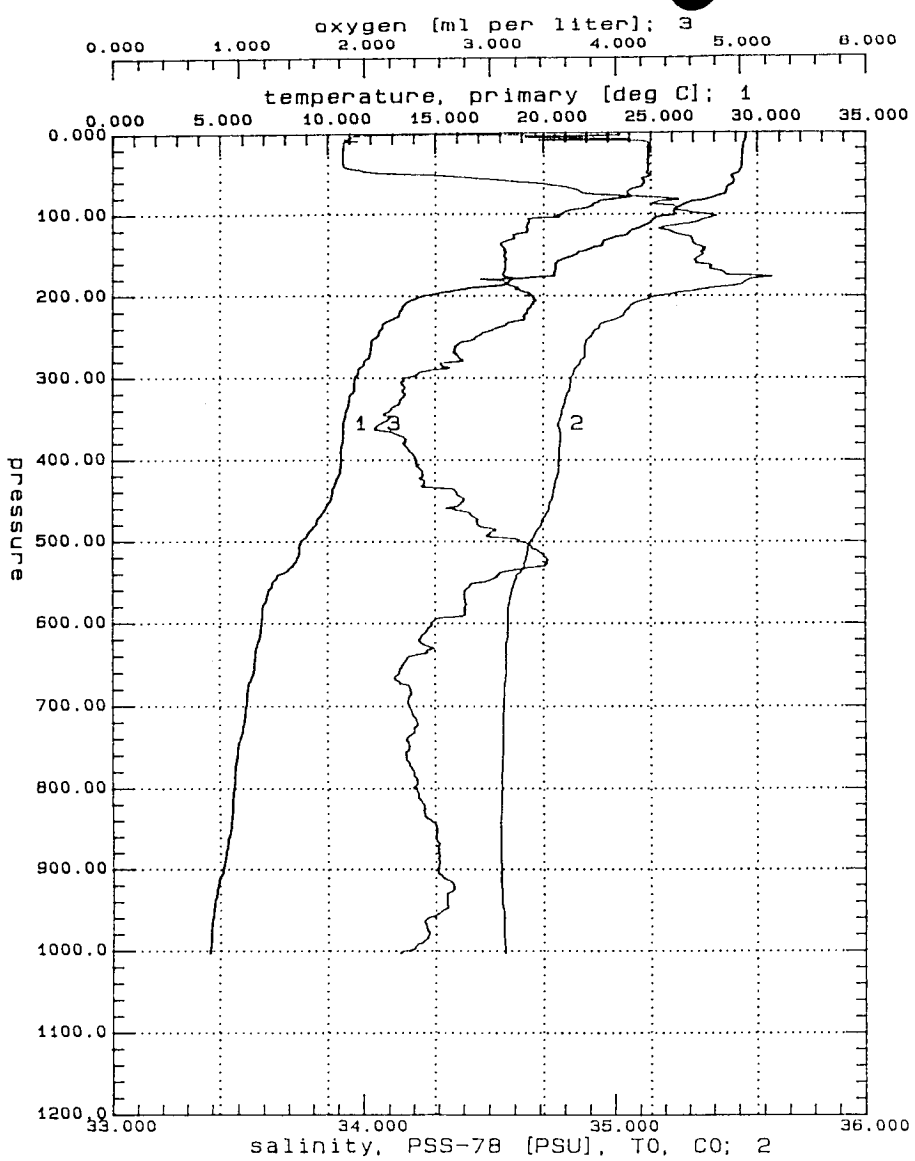

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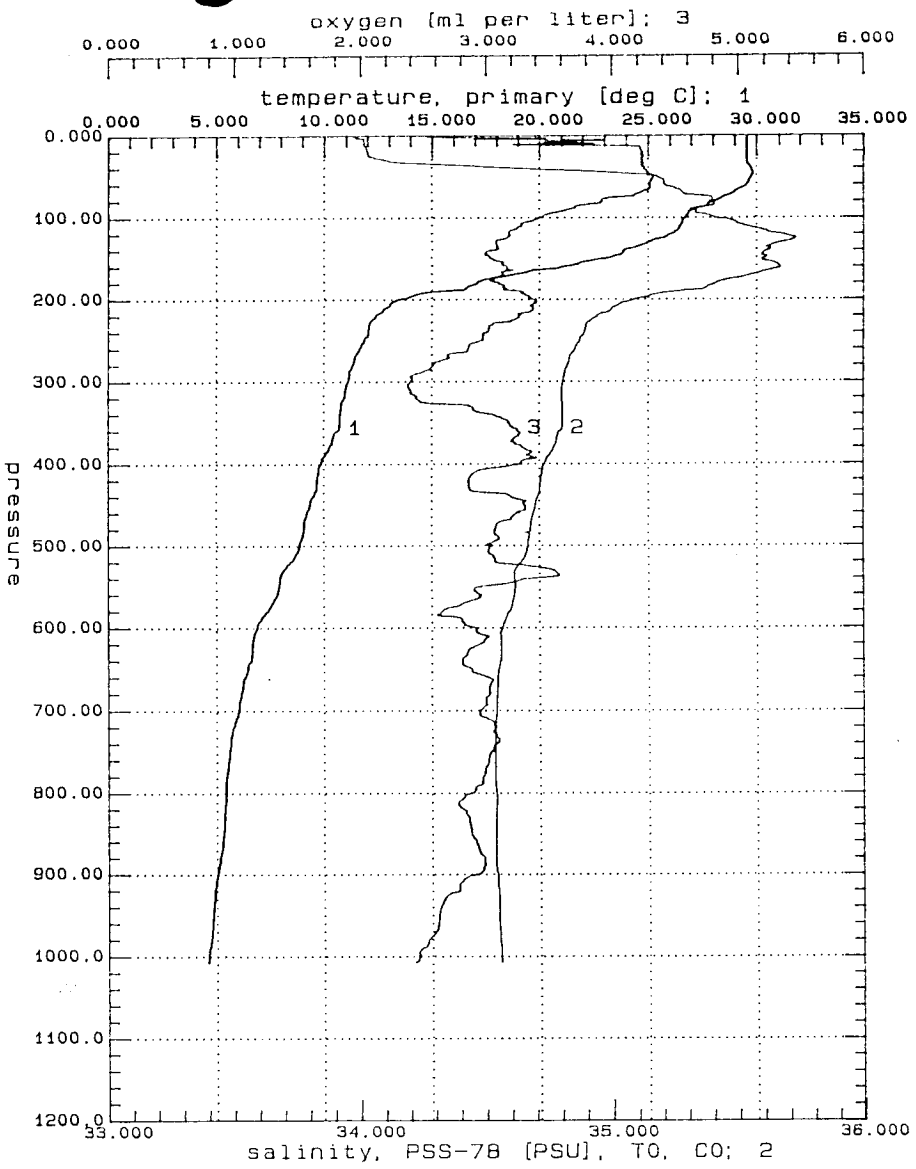

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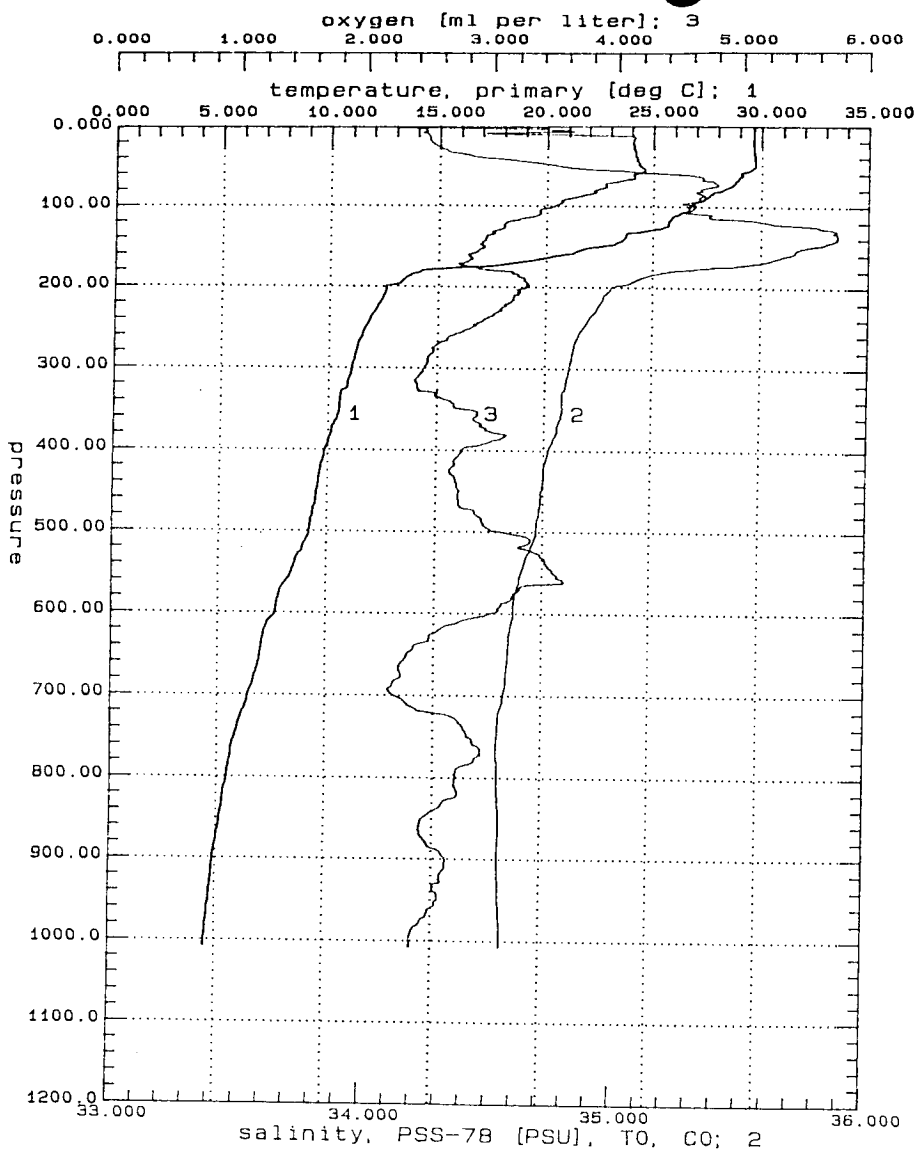

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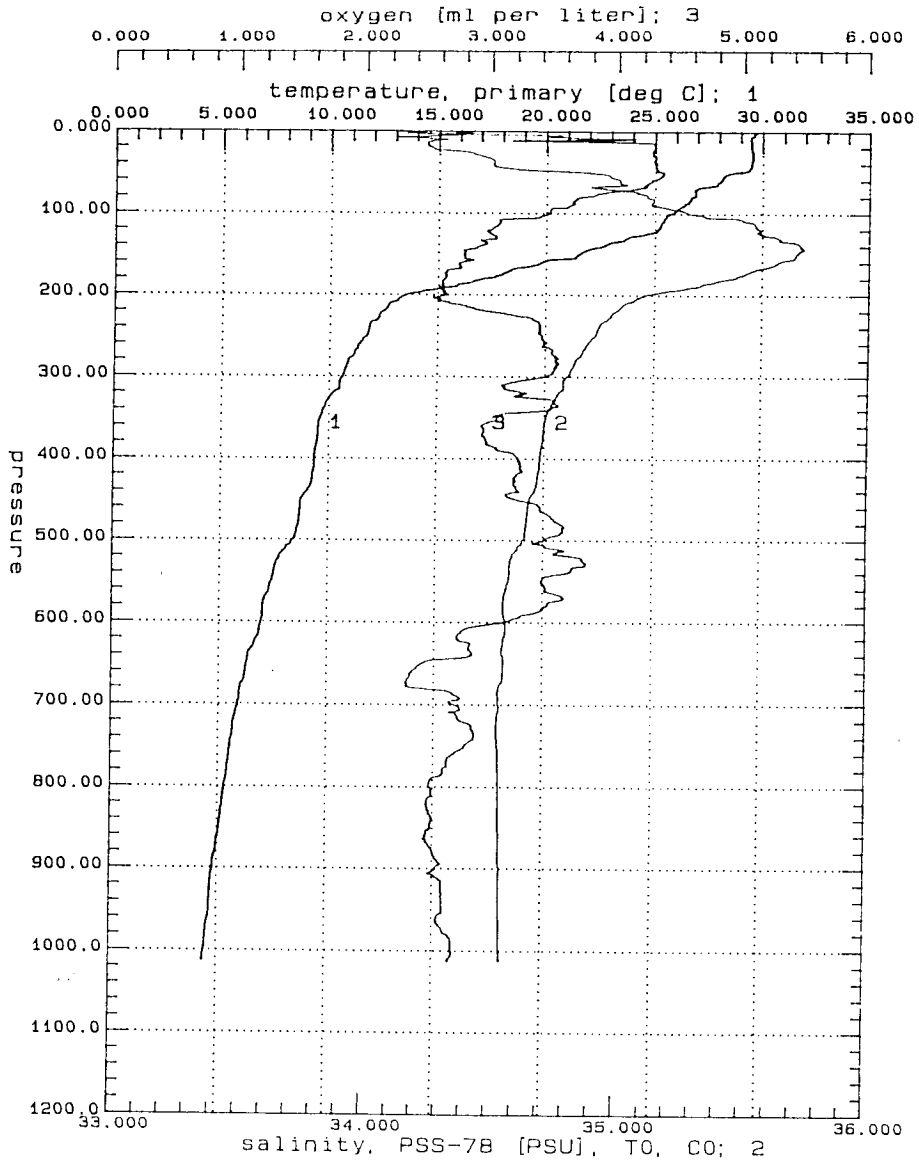

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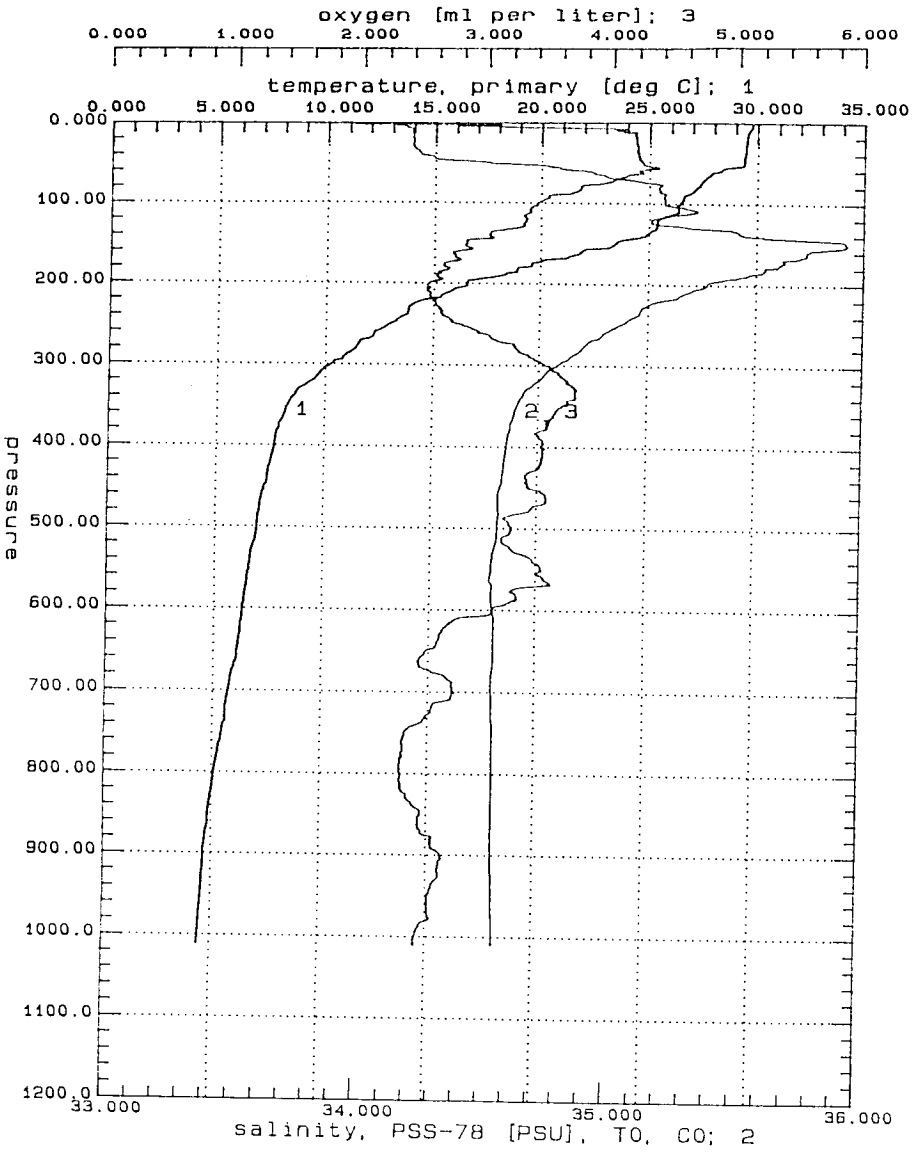

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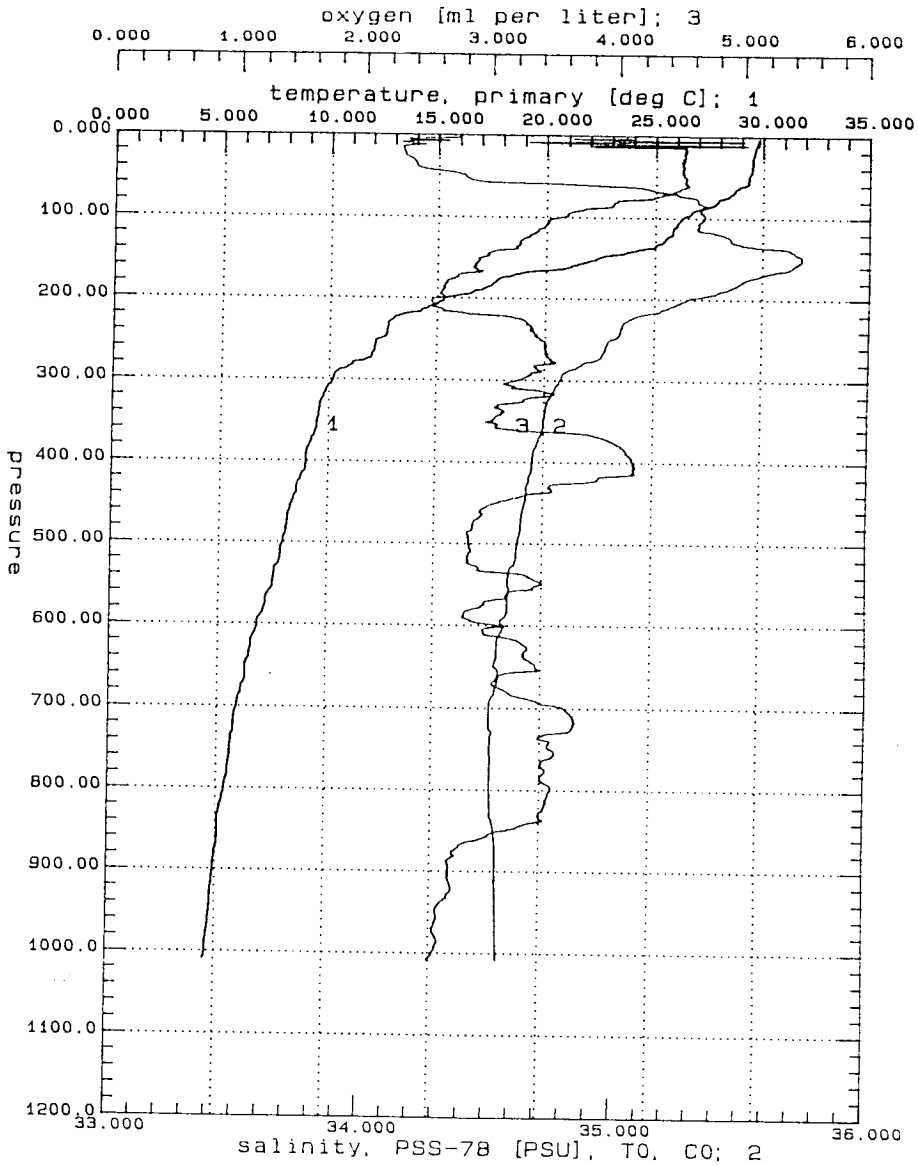

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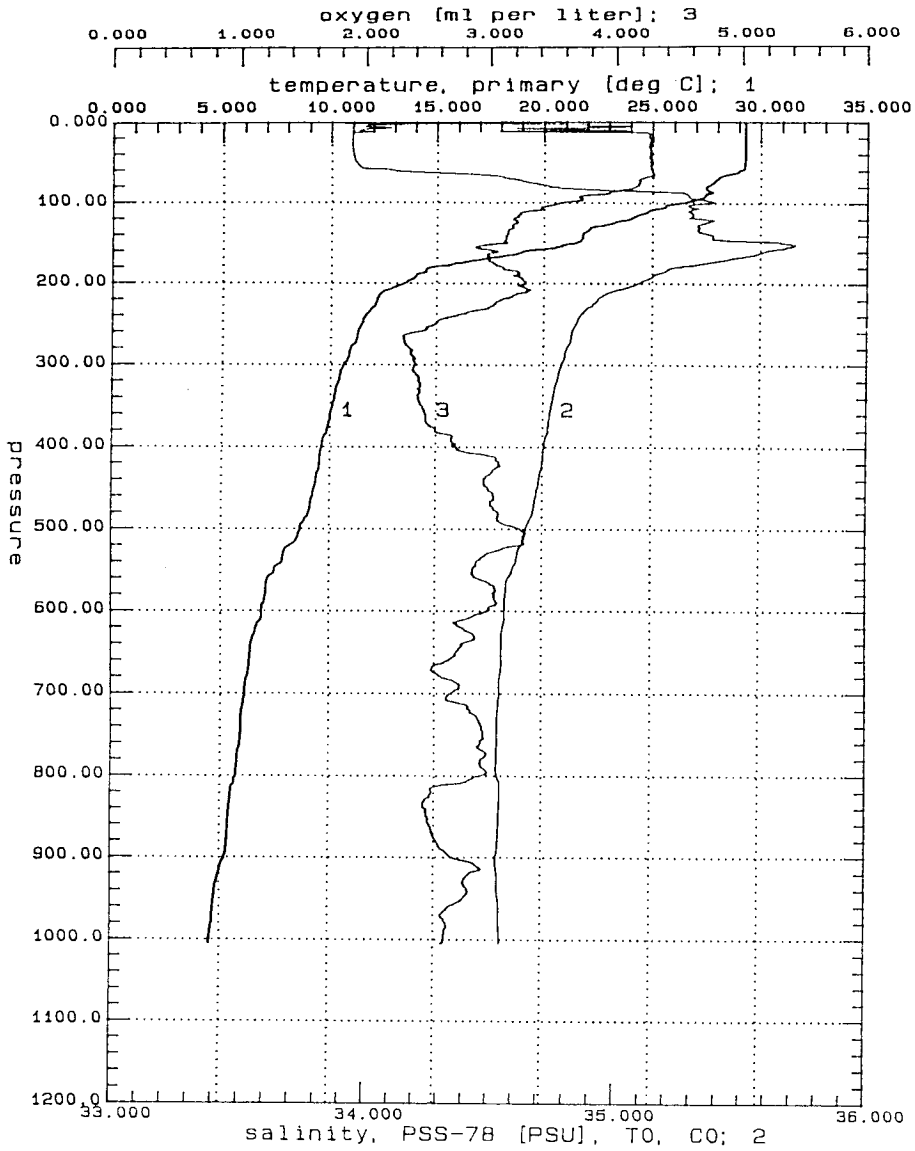

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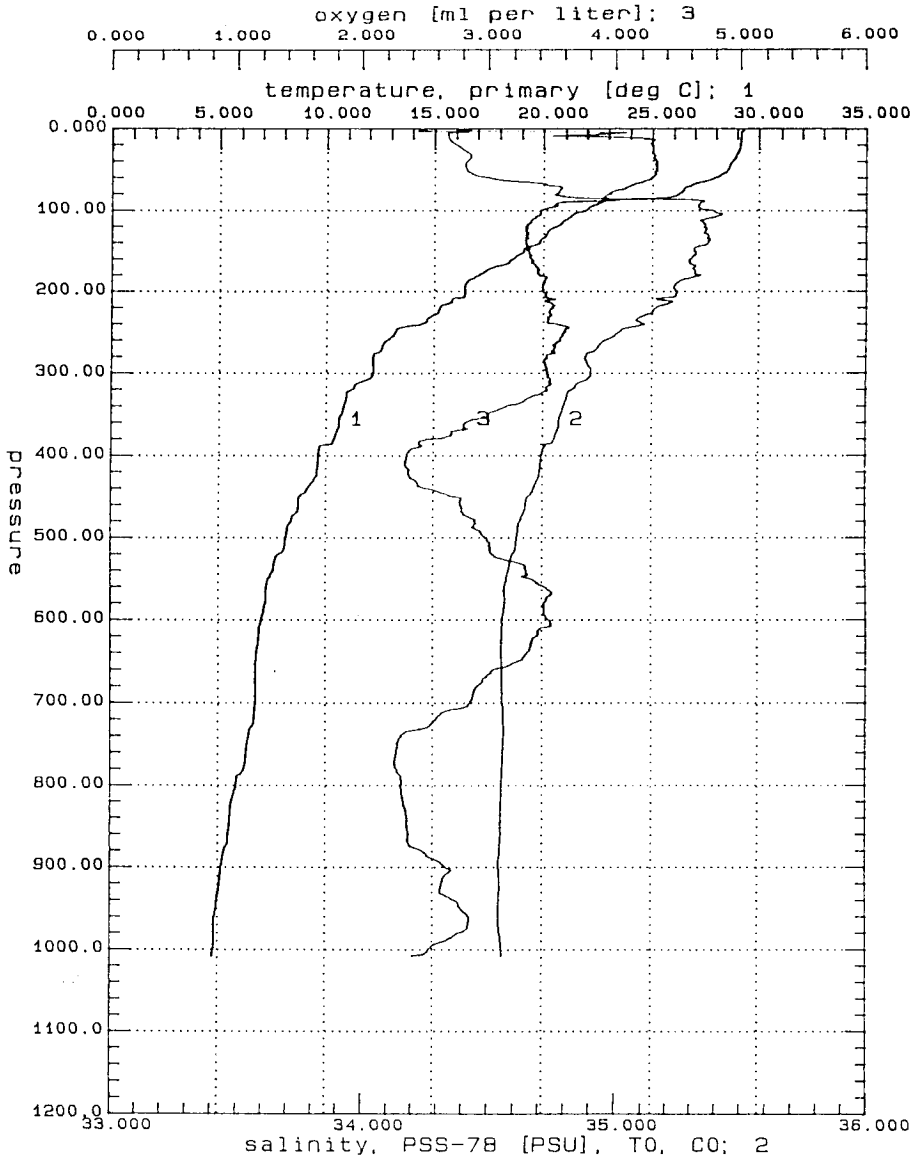

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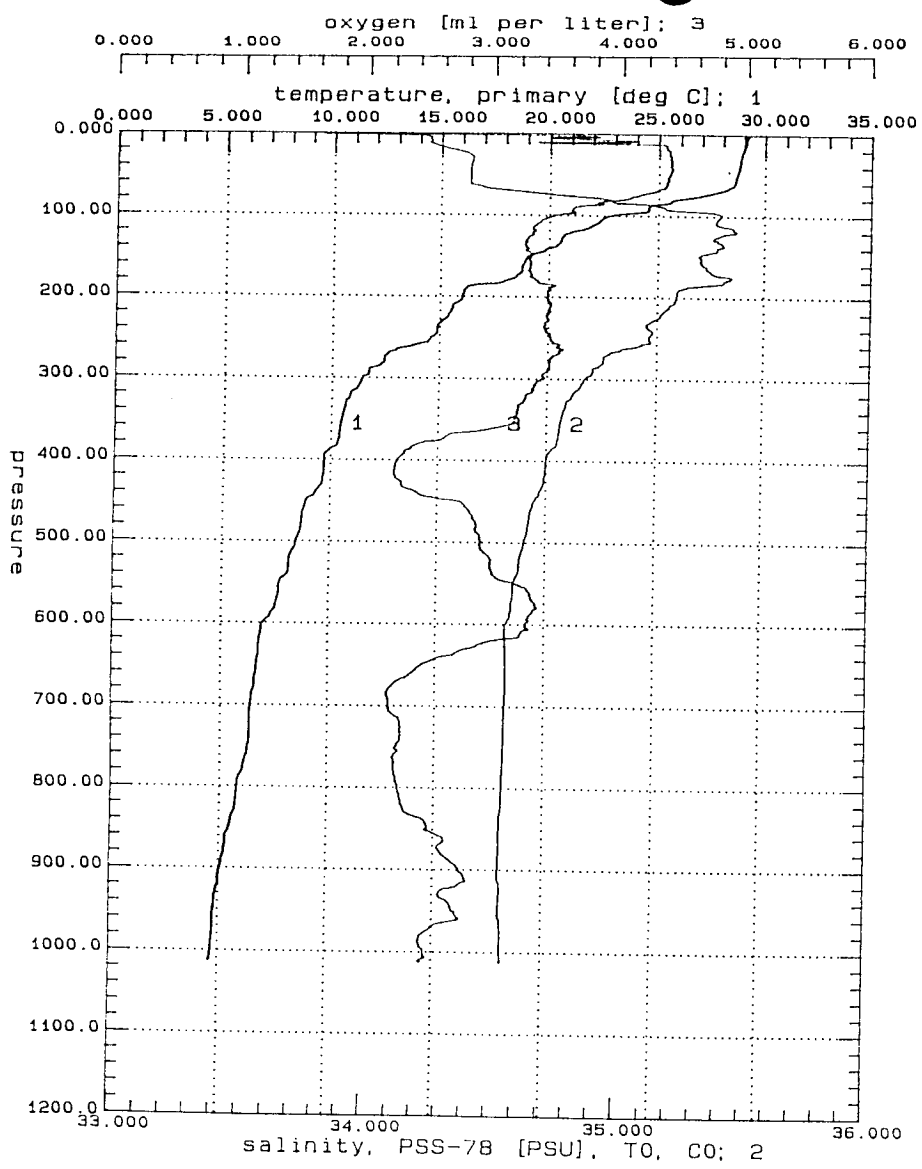

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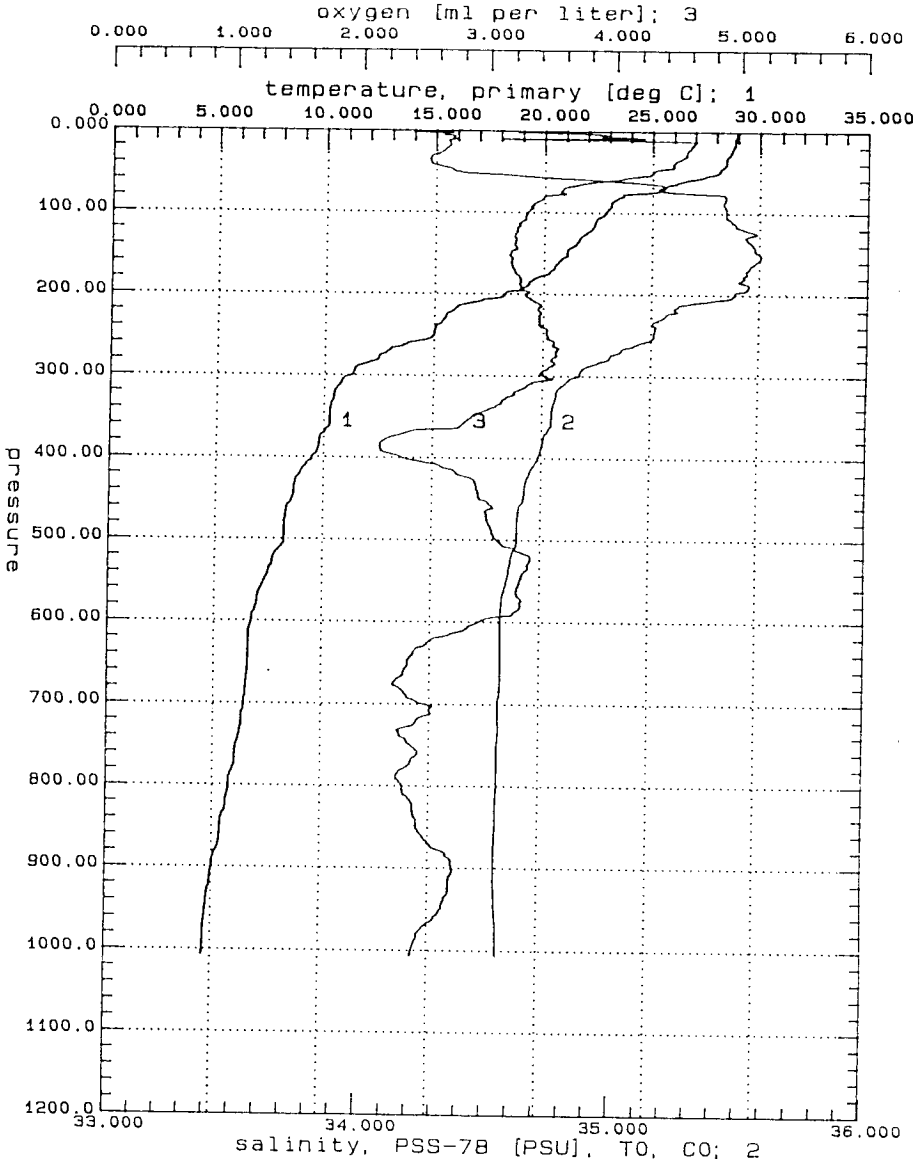

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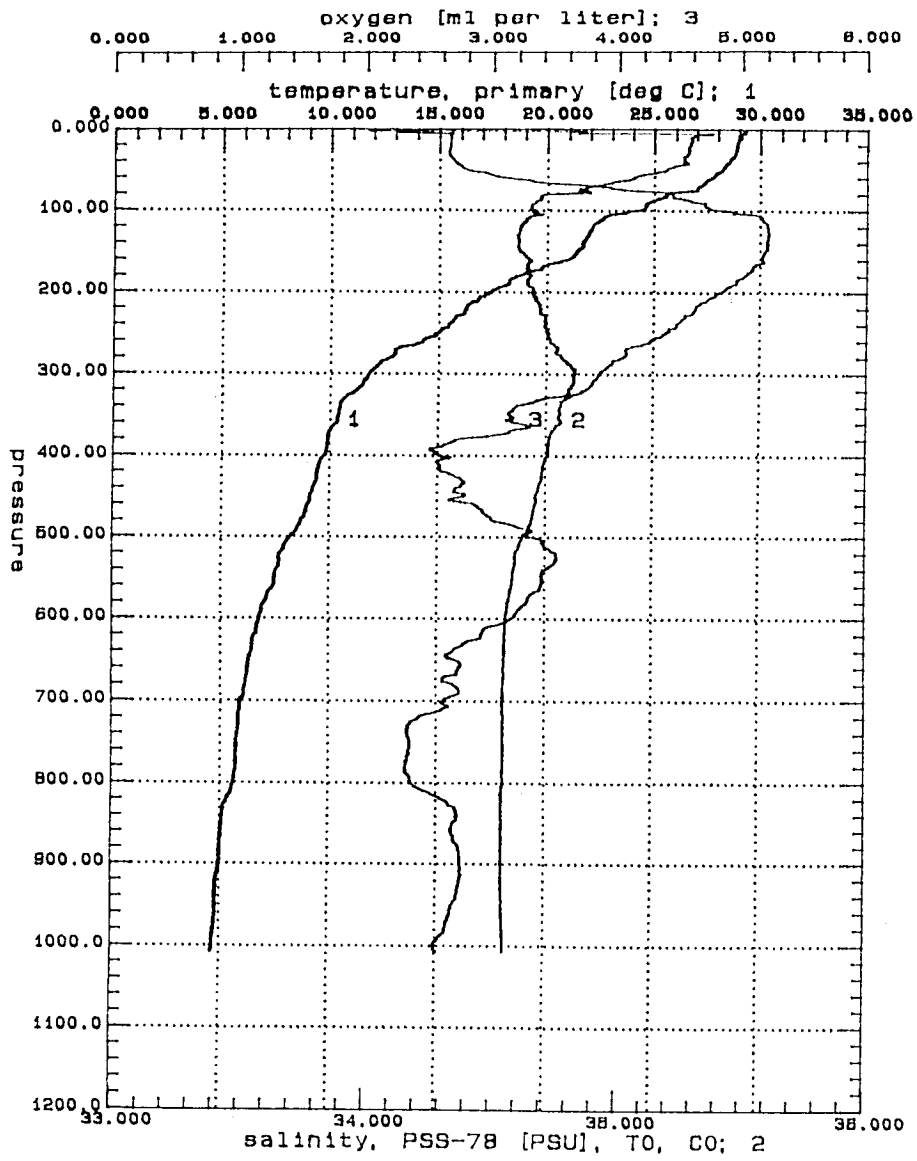

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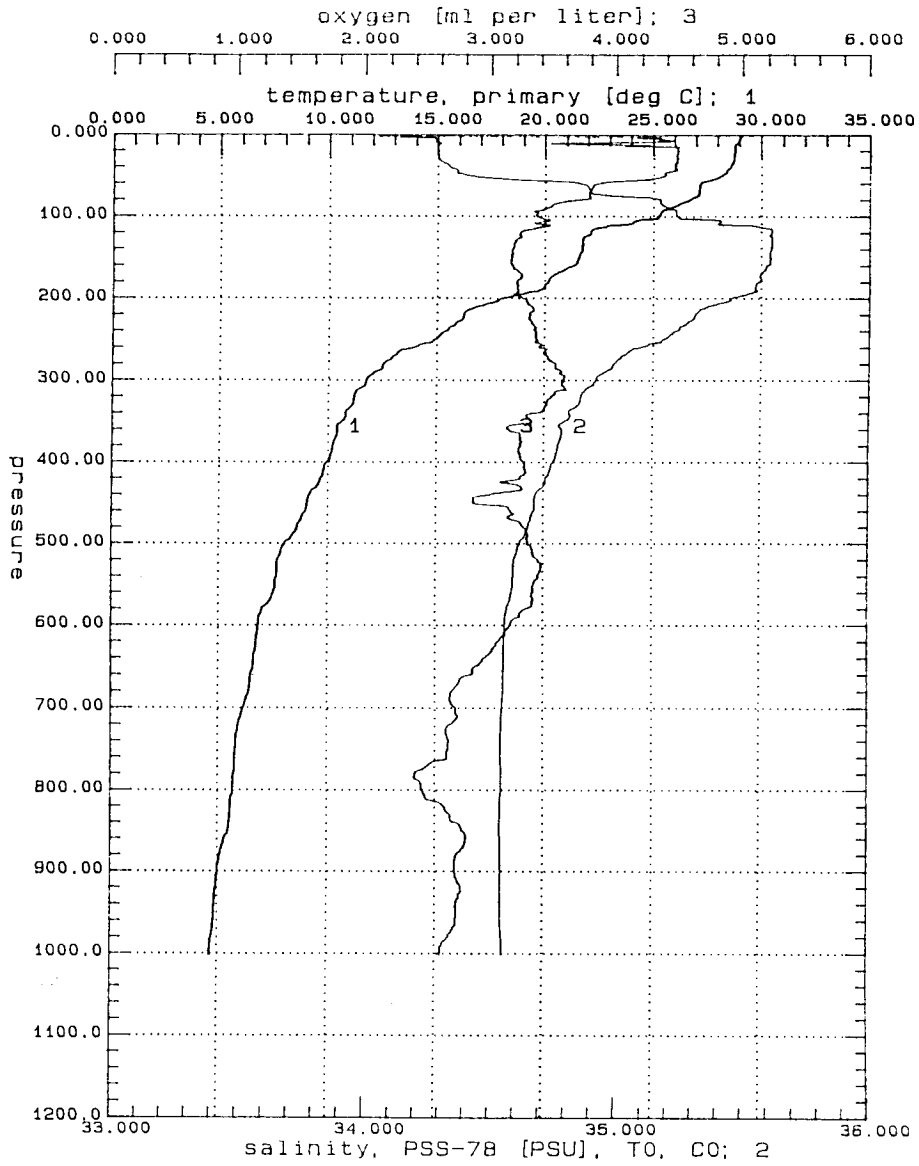

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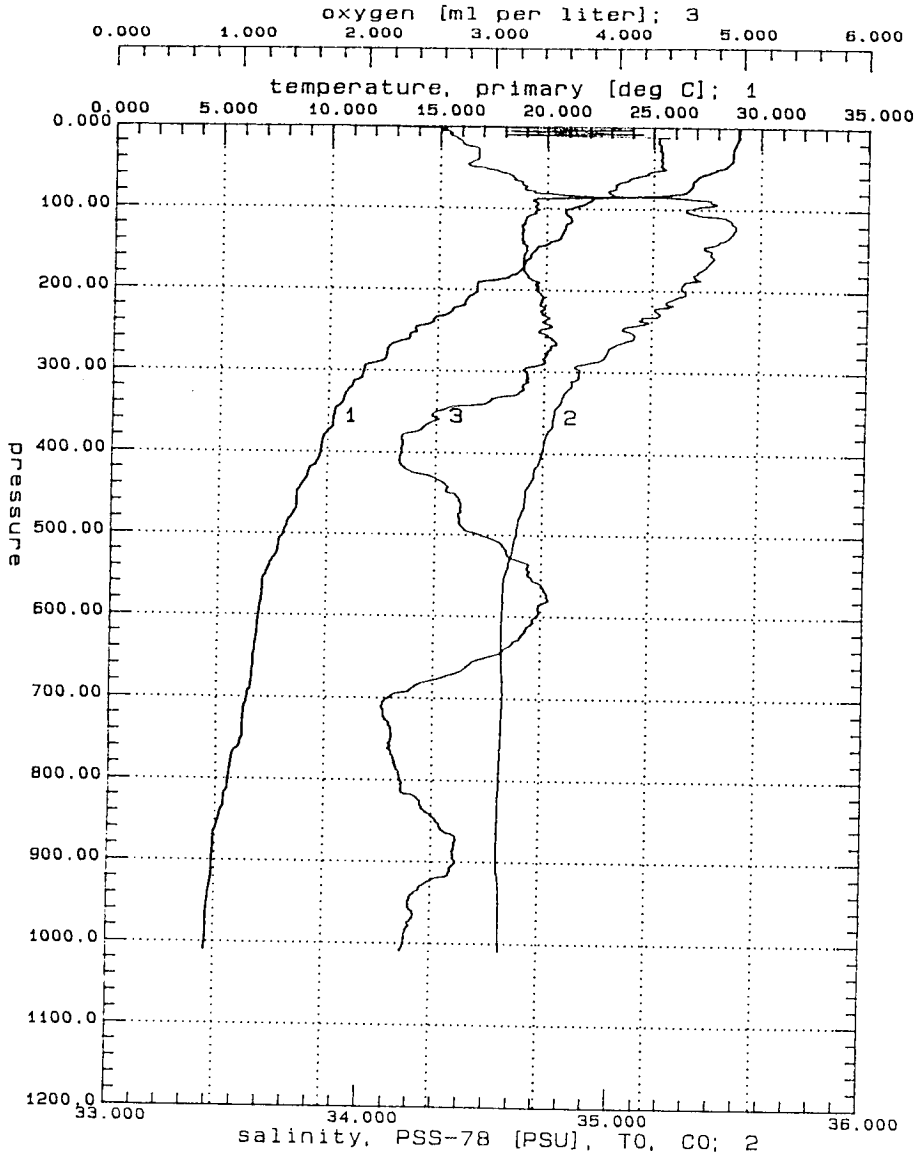

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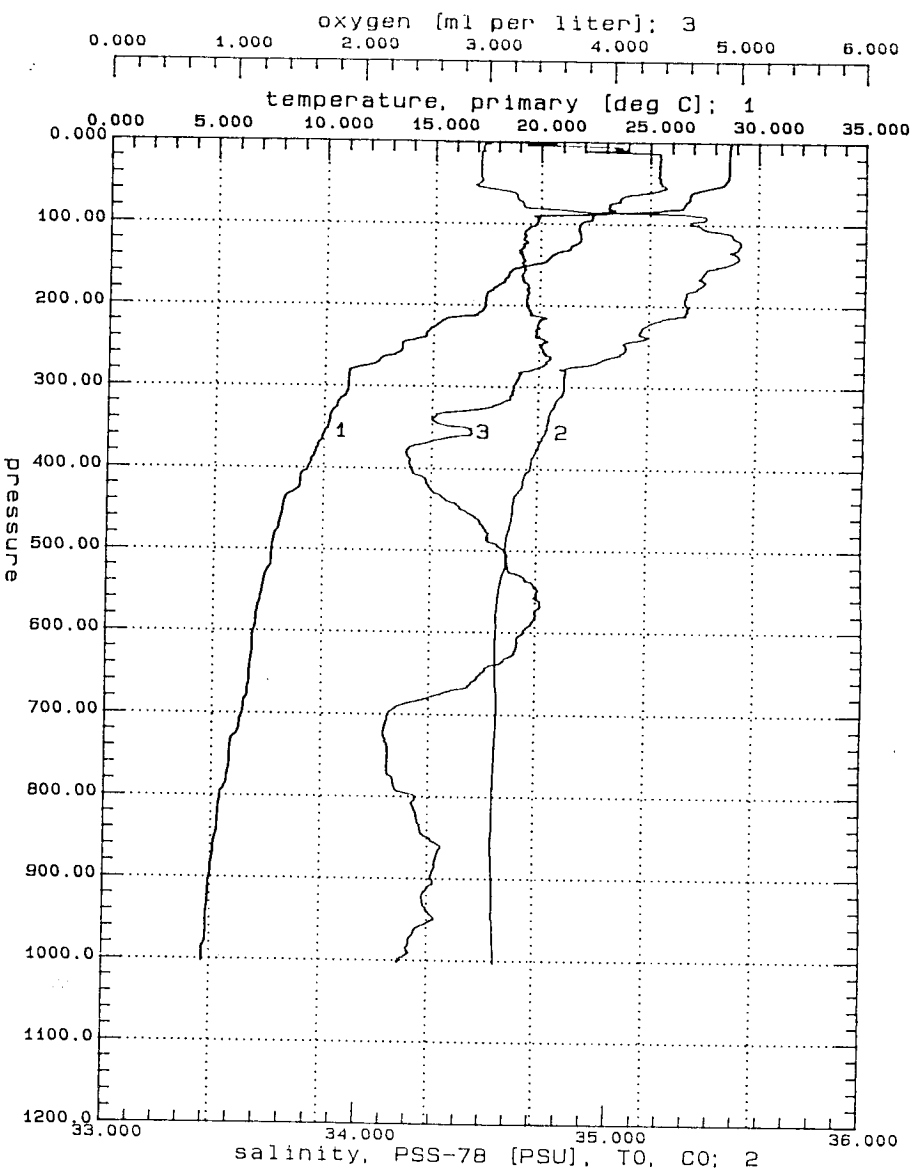

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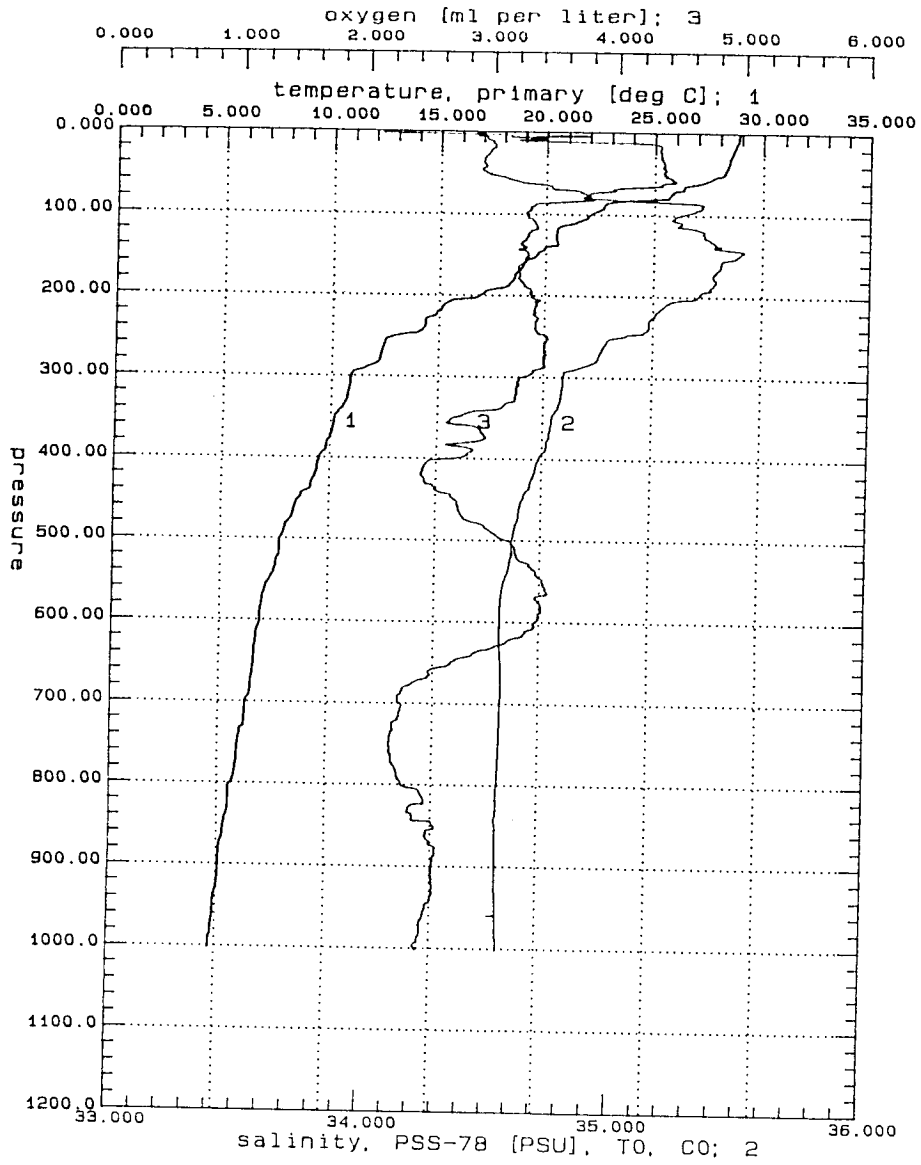

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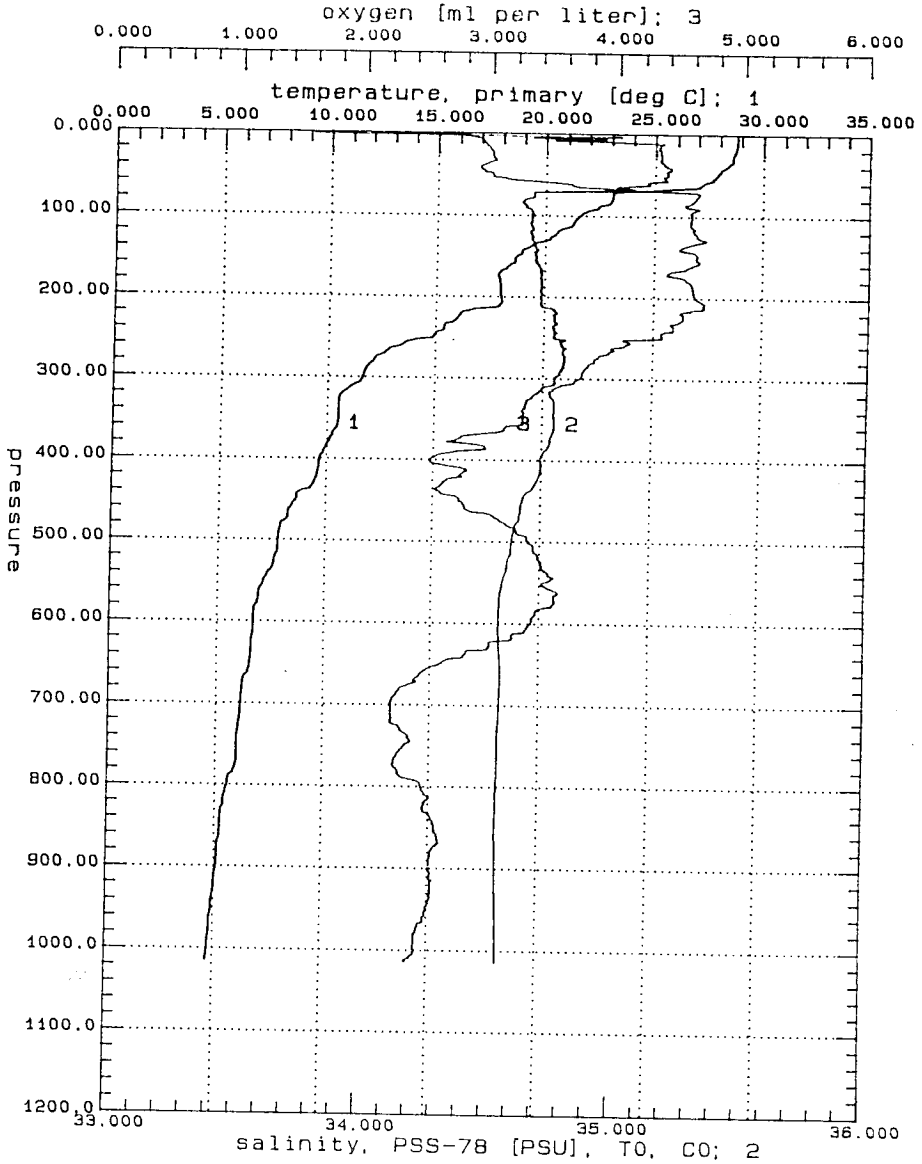

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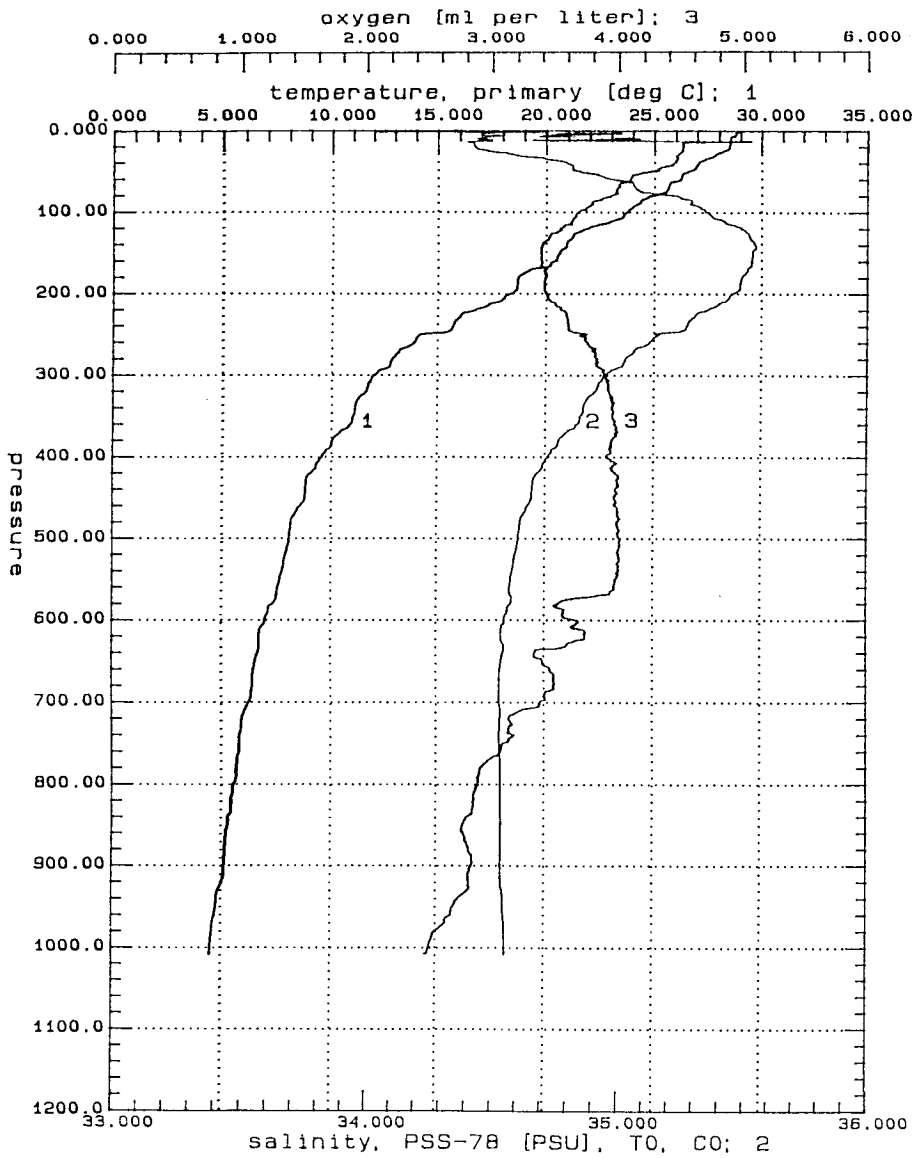

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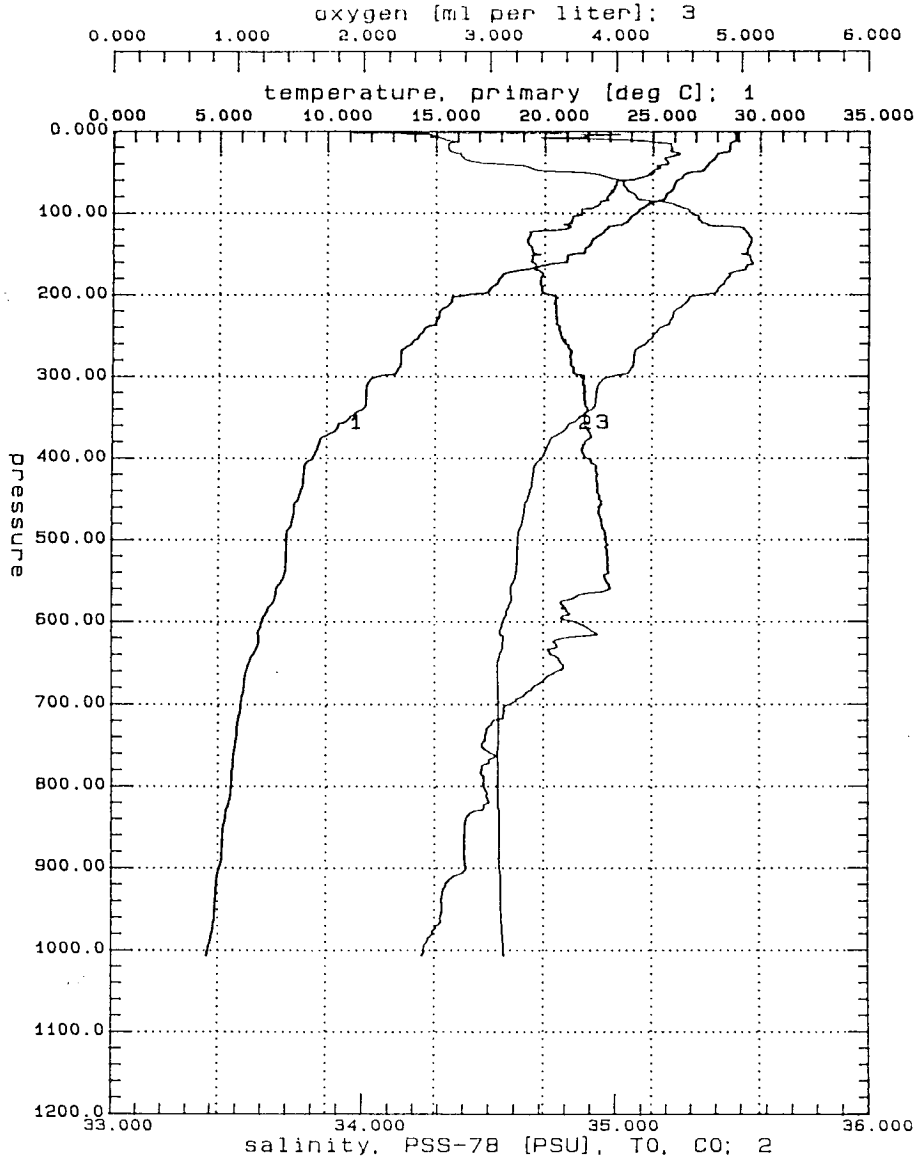

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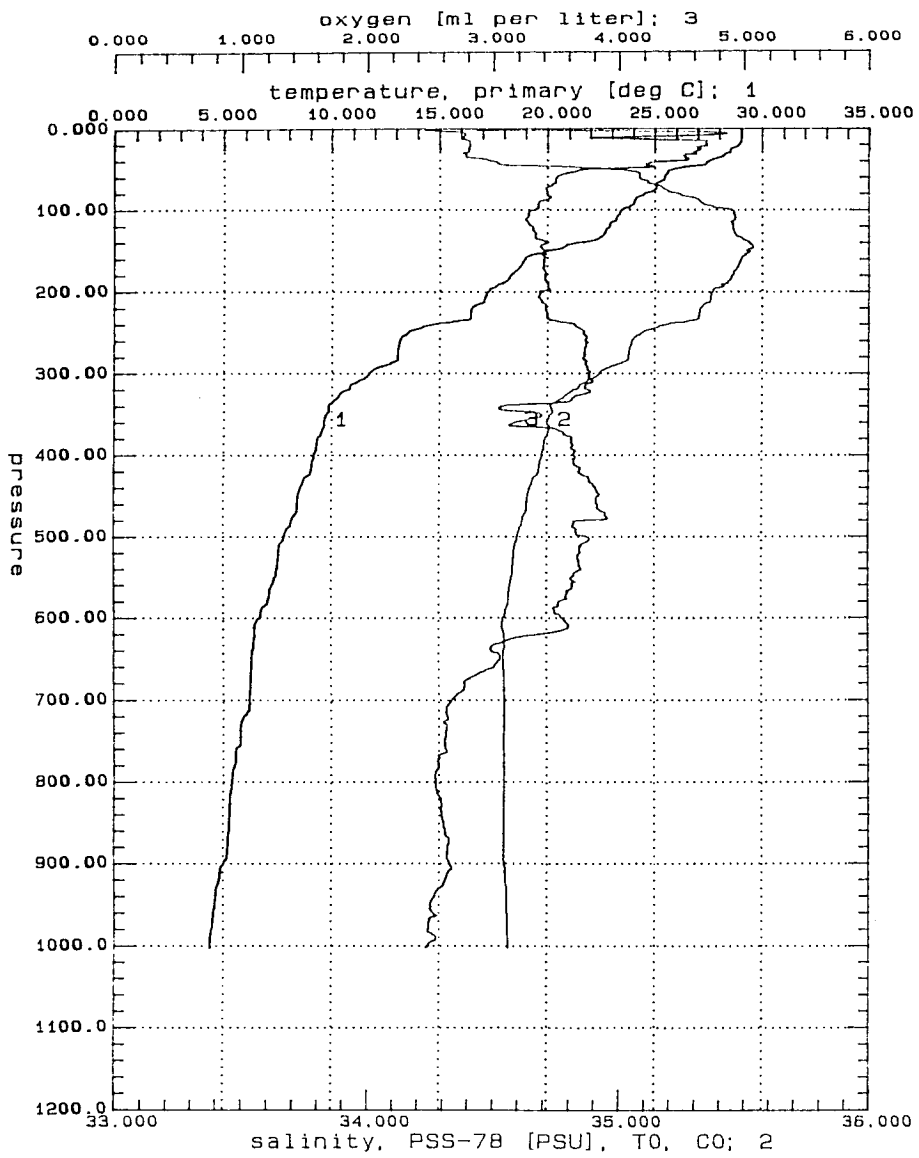

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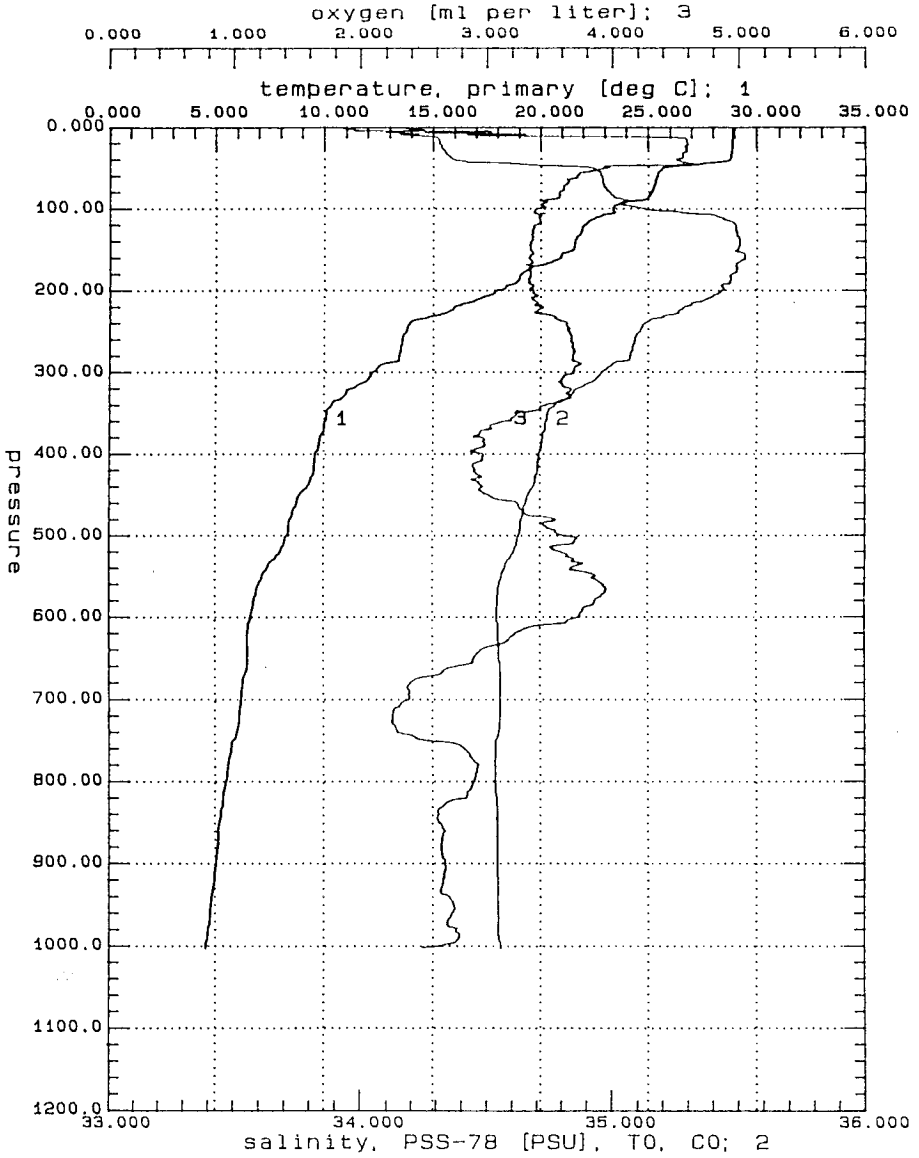

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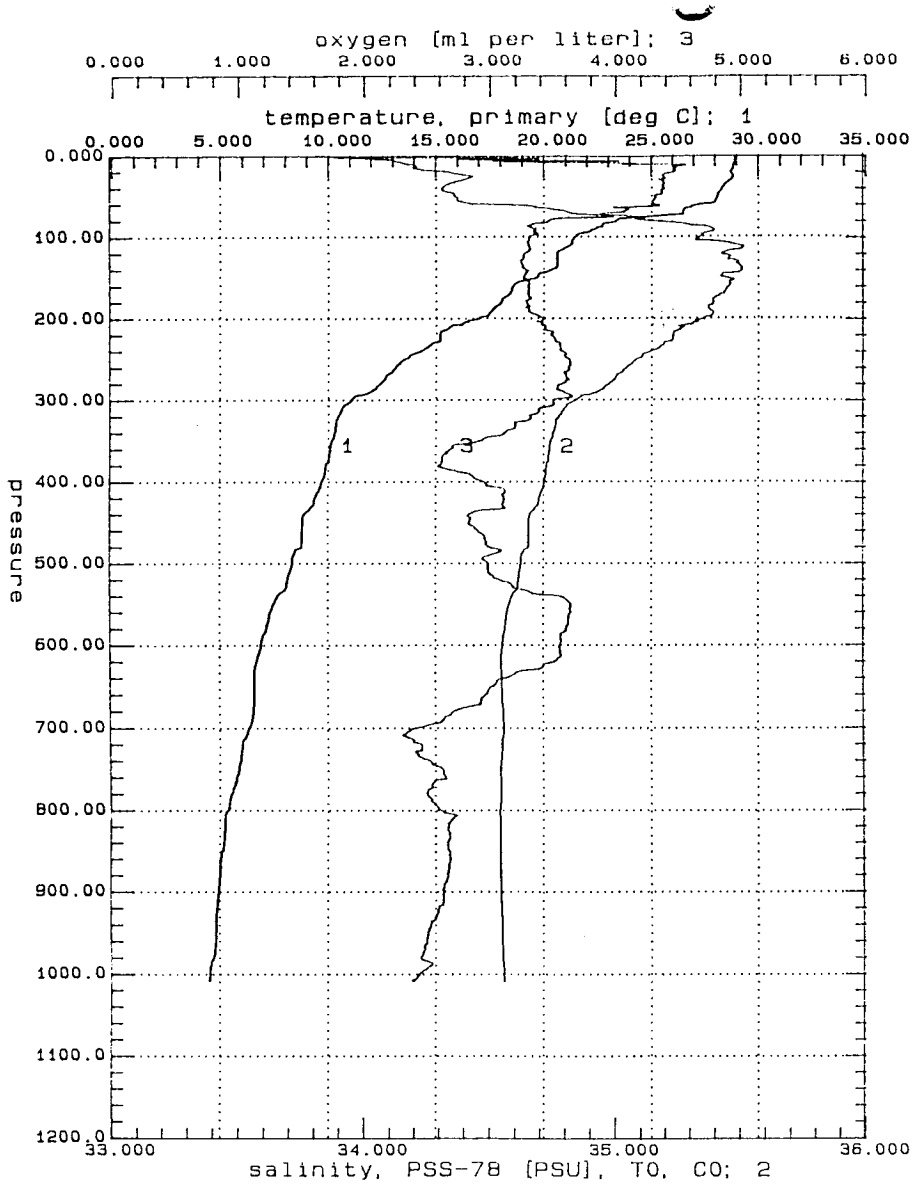

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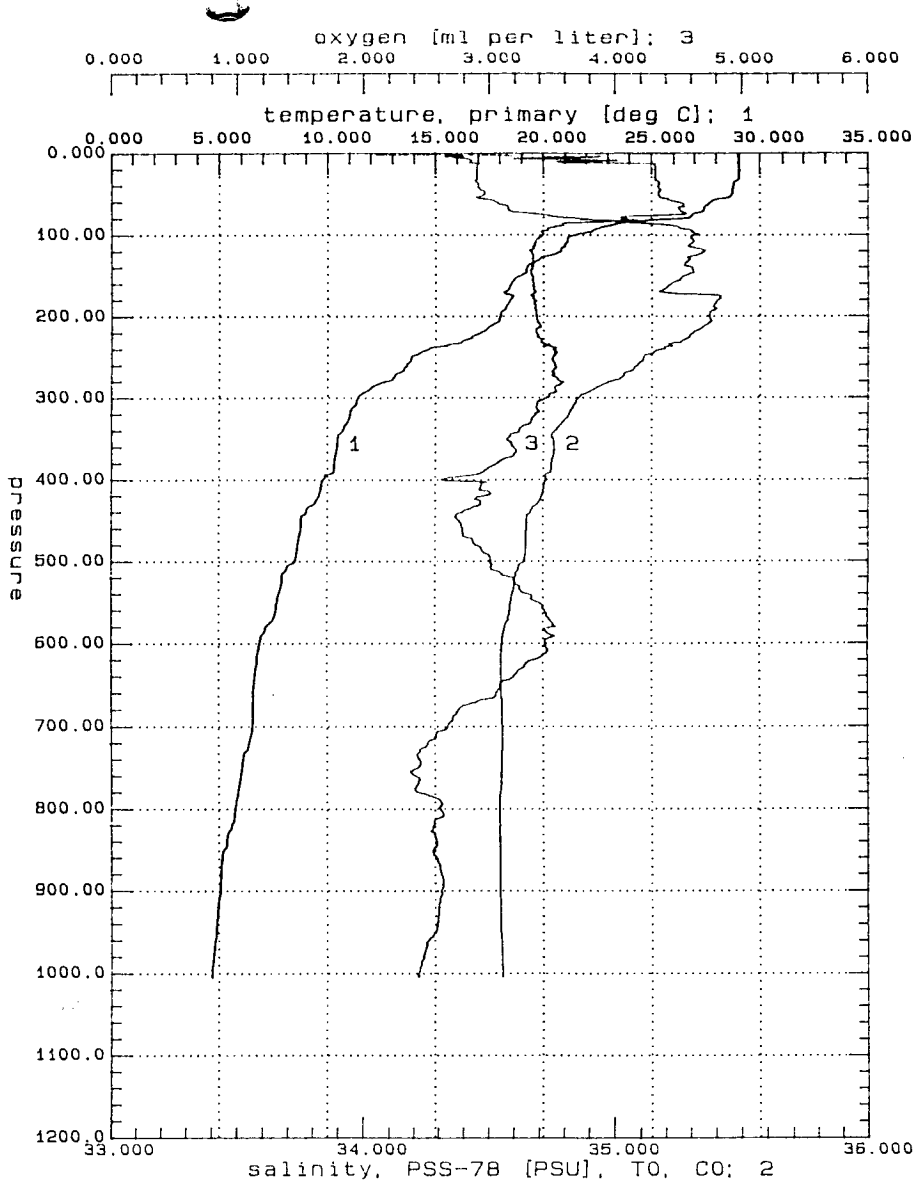

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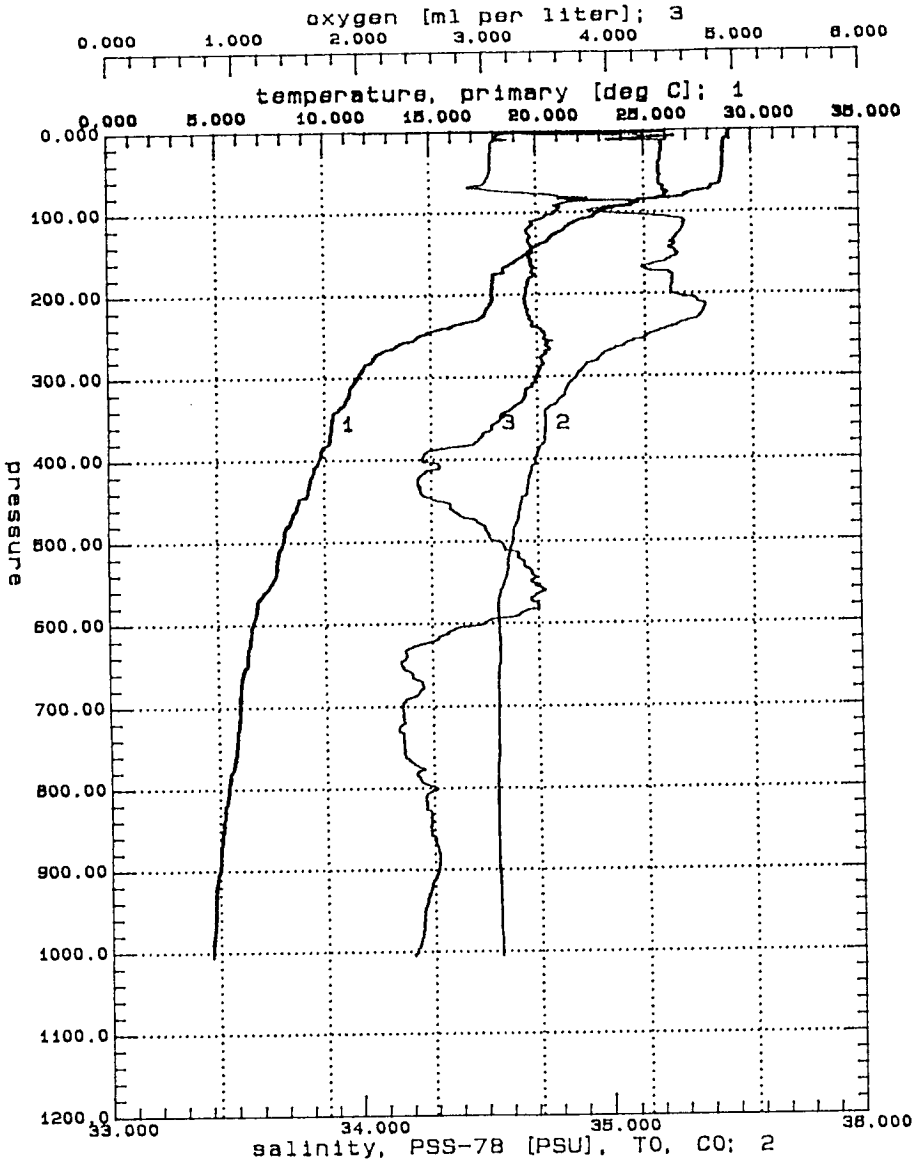

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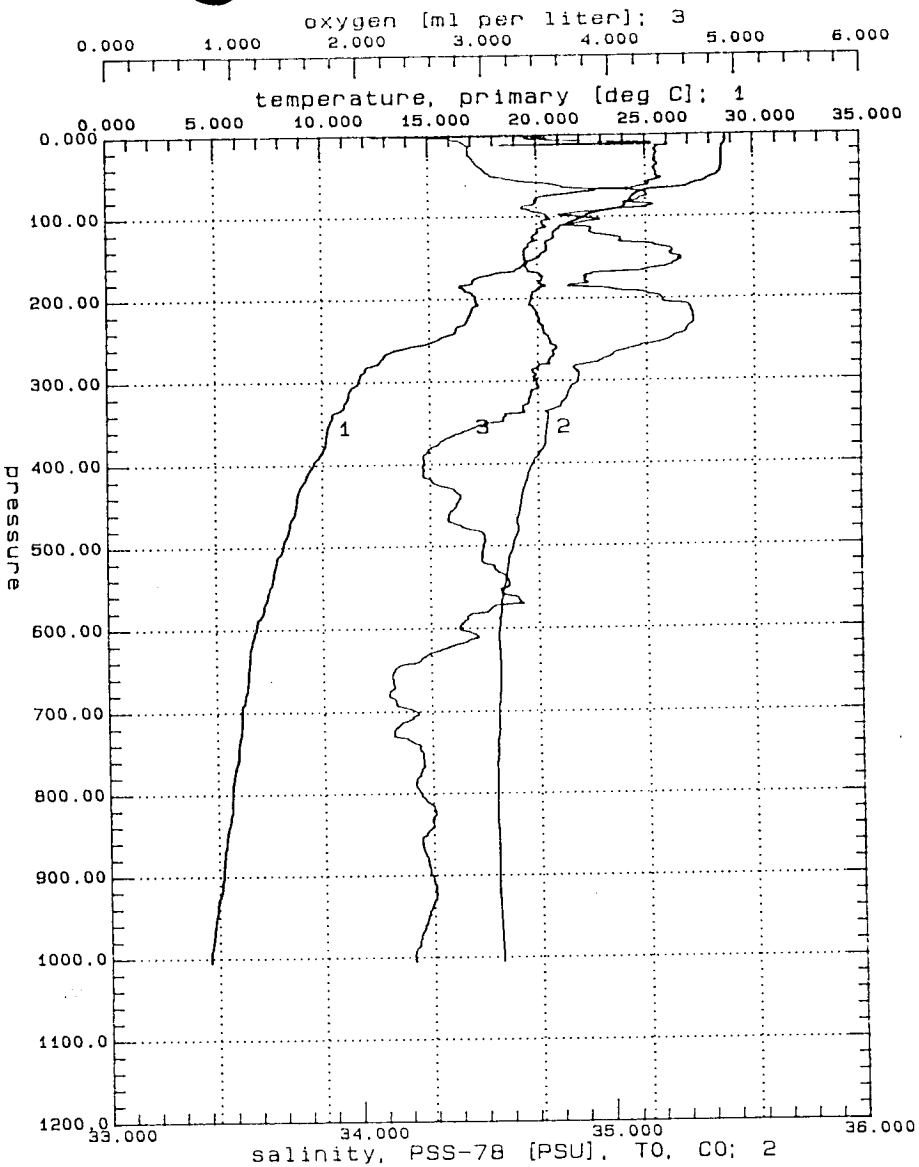

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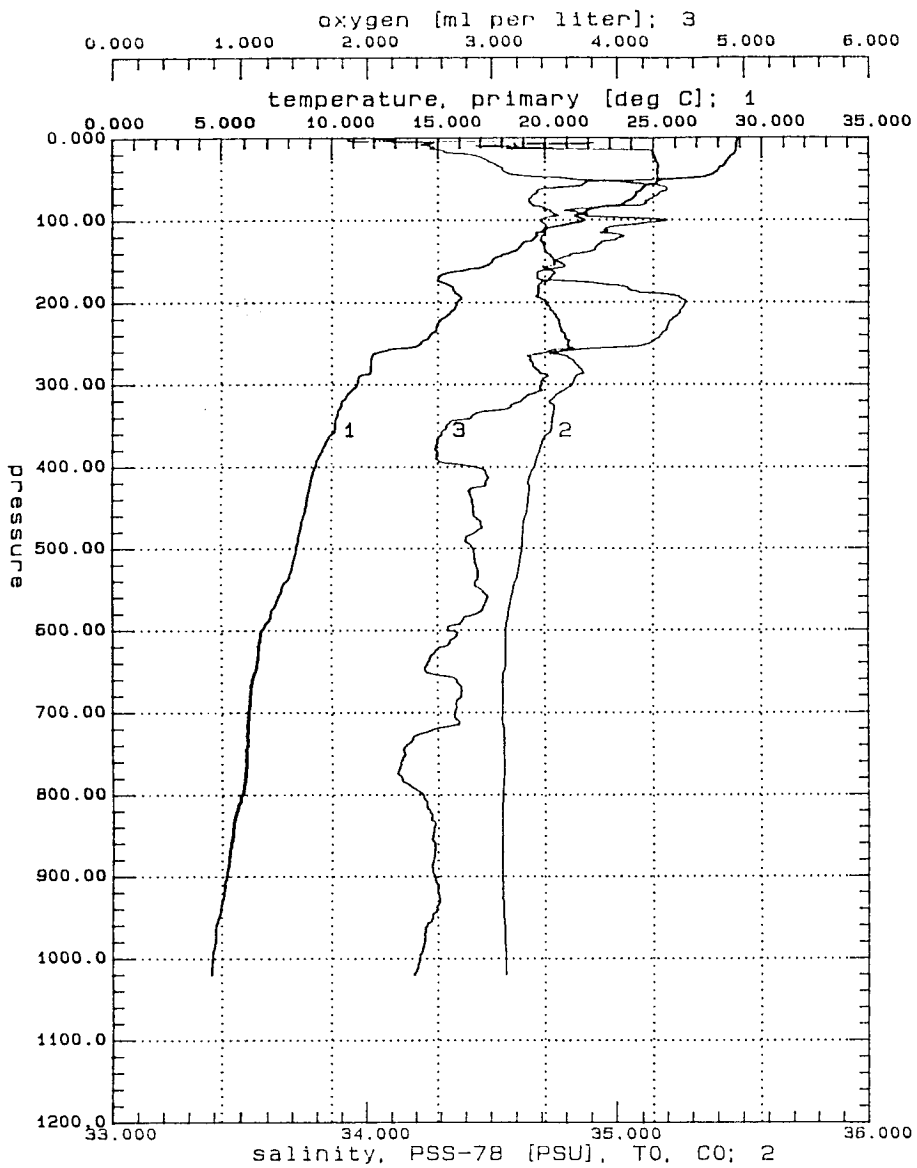
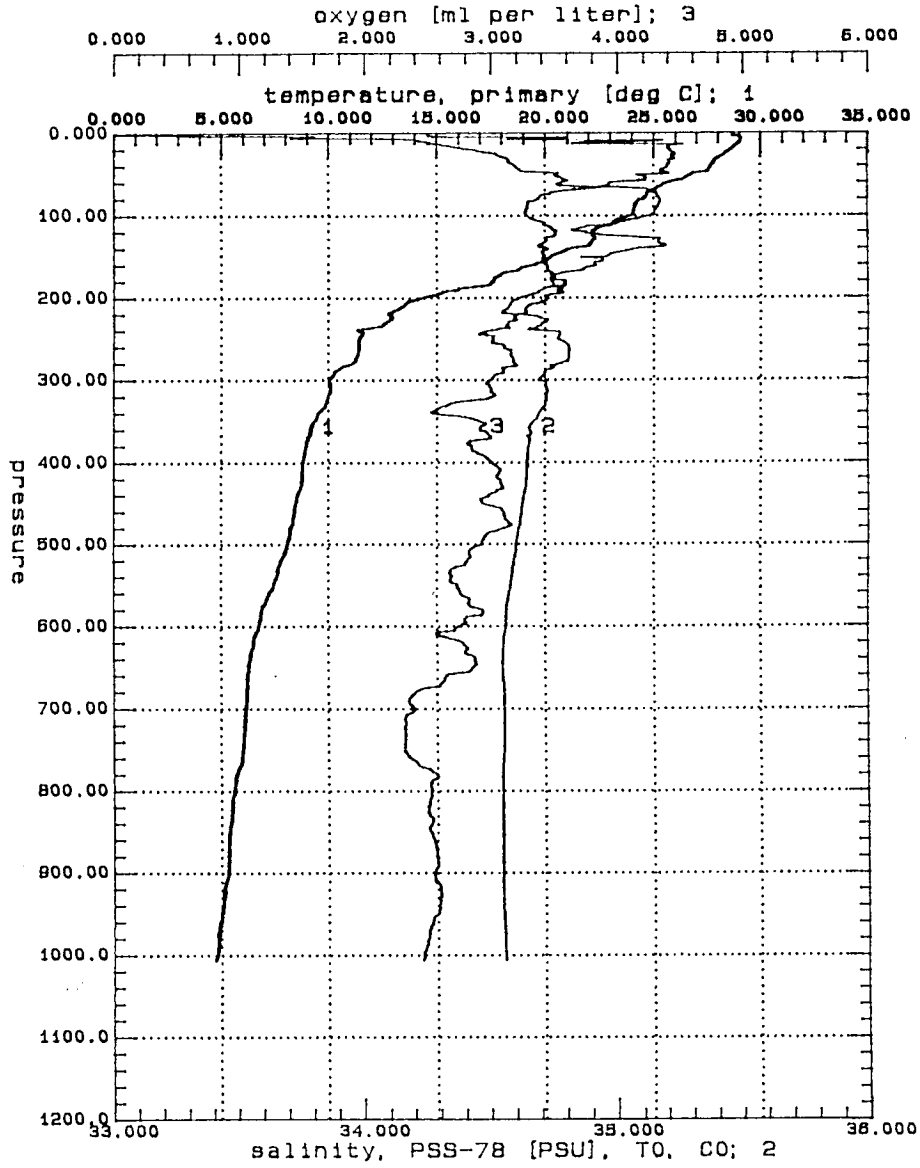


DTOCSC29.CNV: TOCS K9406 CTD-29 (01-00N, 142-00E) 95010715



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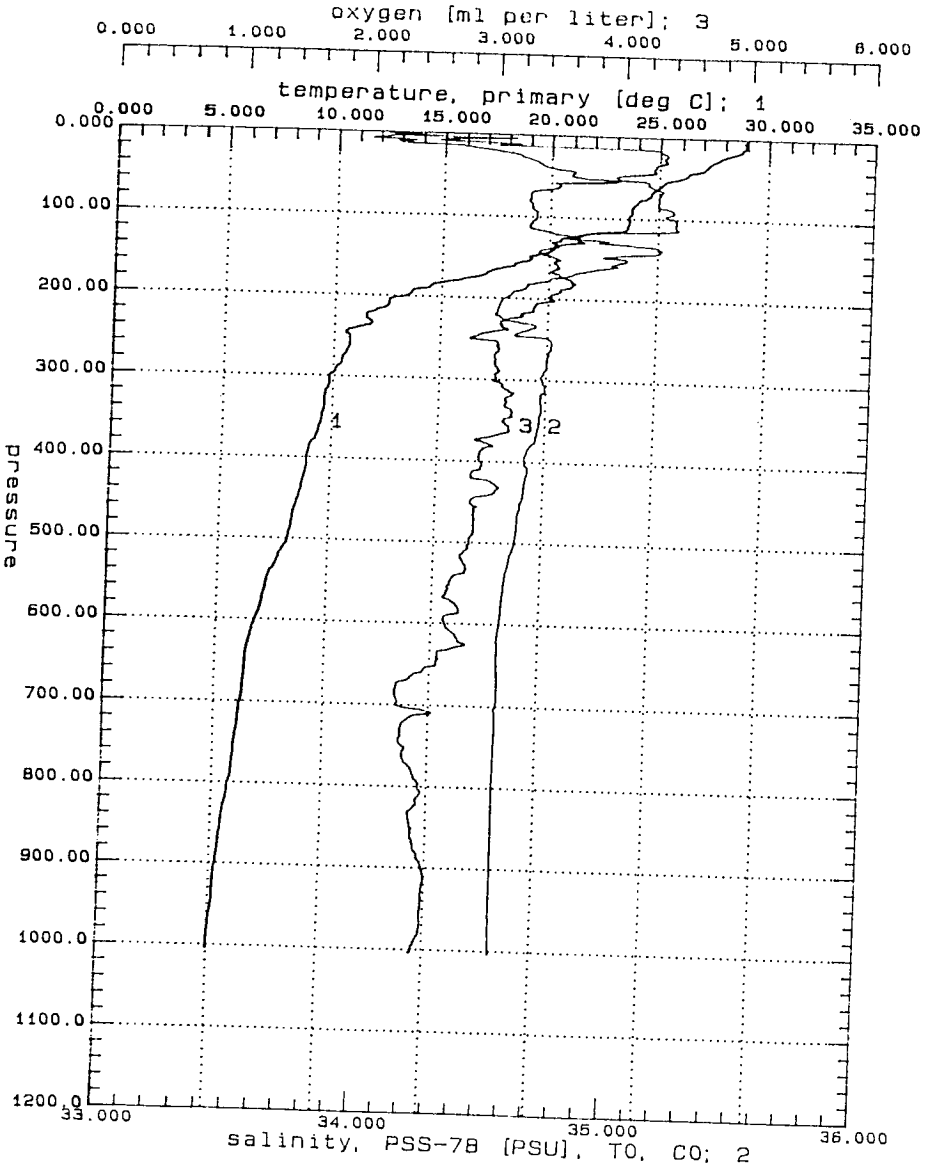

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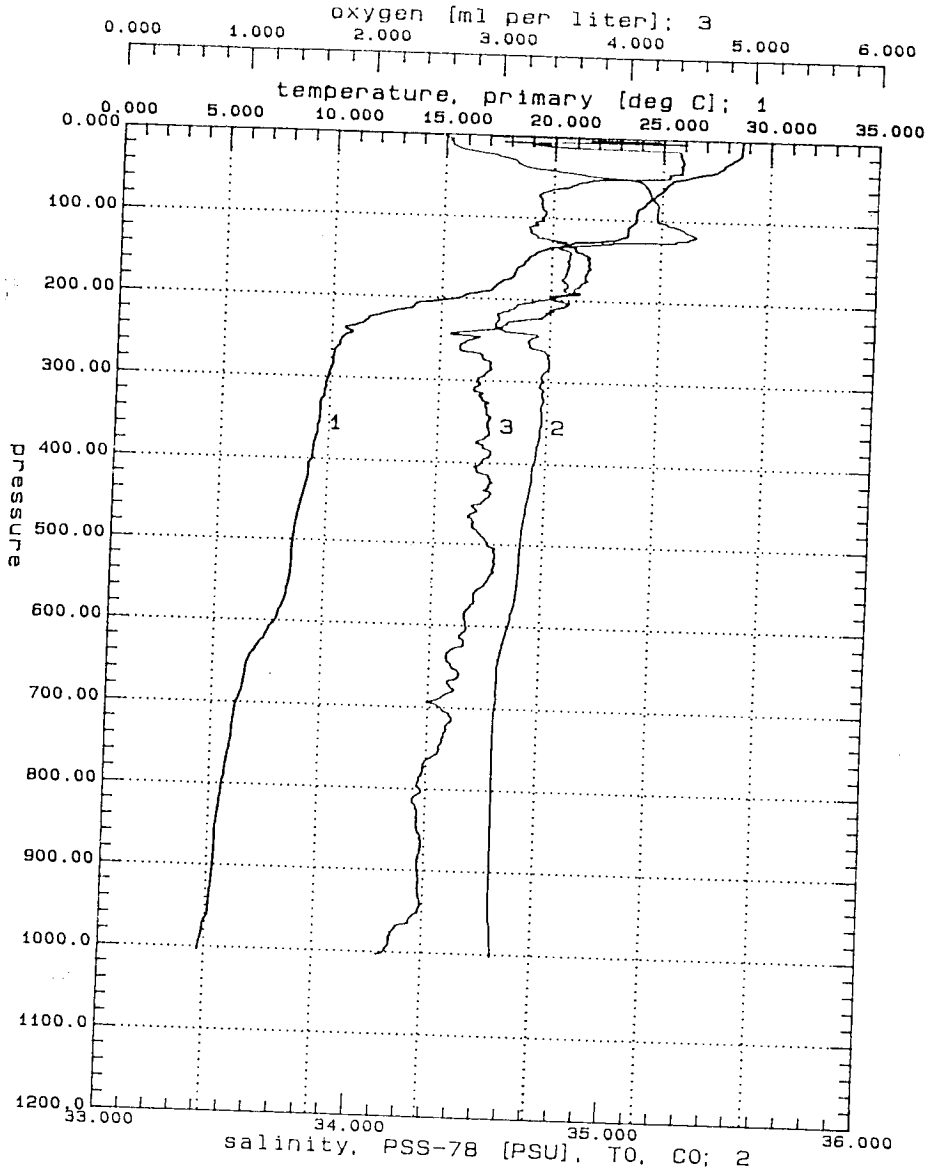

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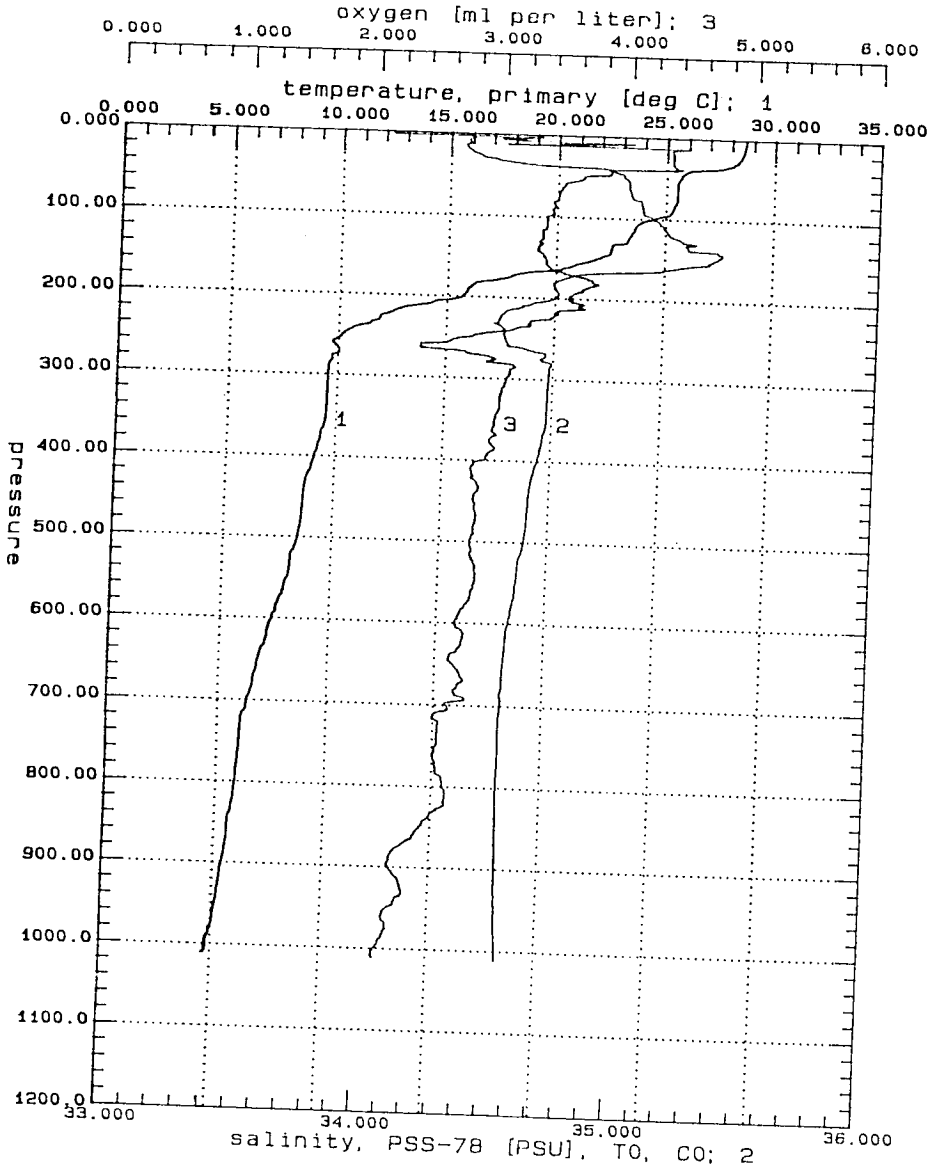
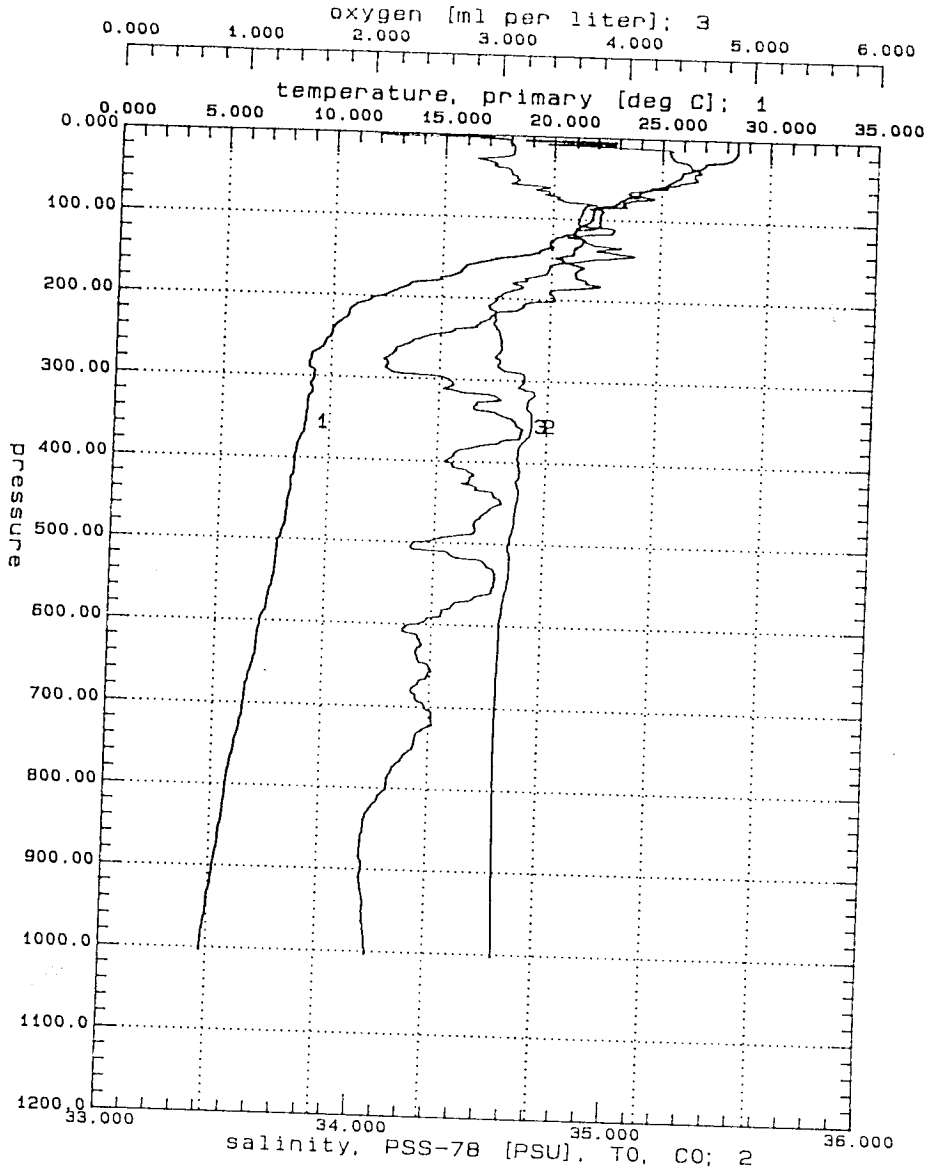
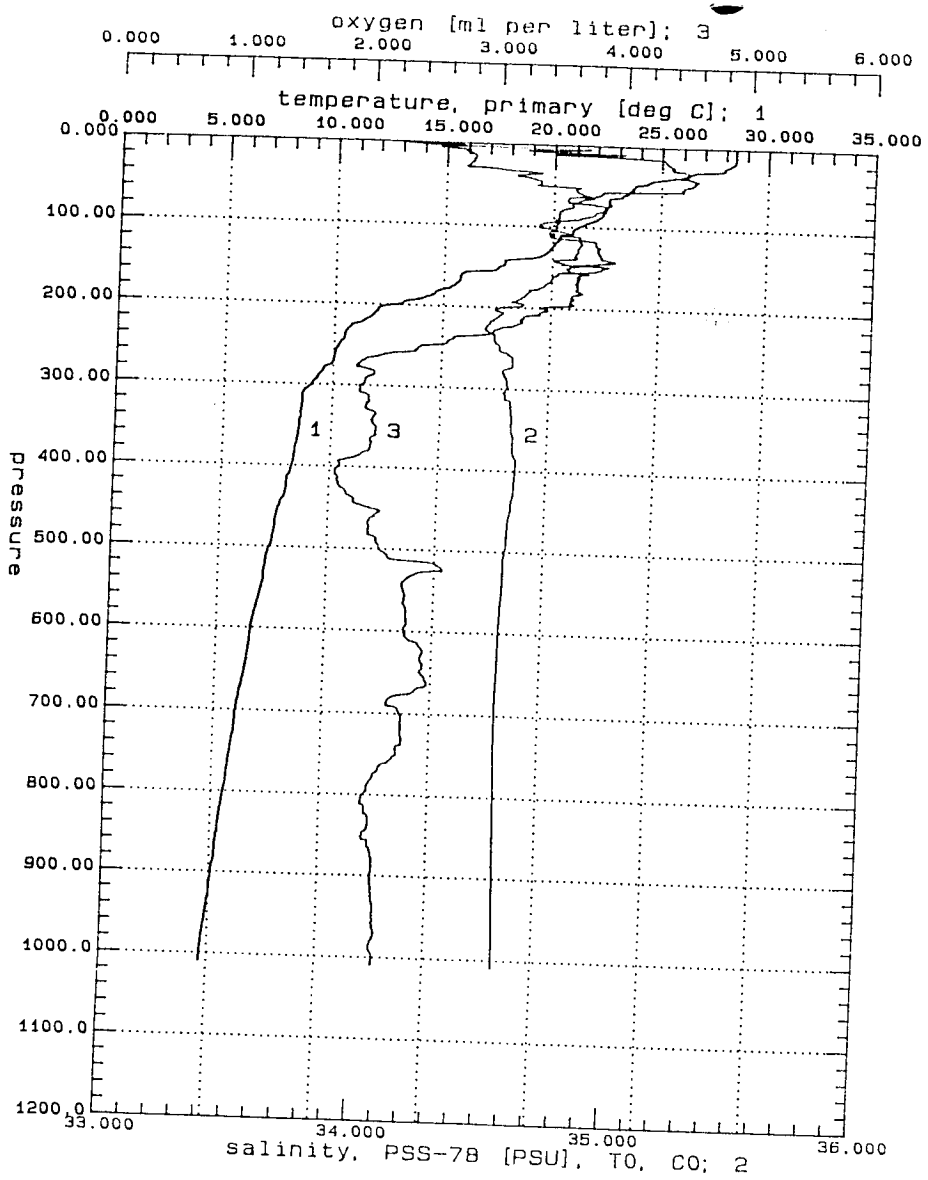


DTOCSC33.CNV: TOCS K9406 CTD-33 (03-00N, 142-00E) 95010804



DTOCSC34.CNV: TOCS K9406 CTD-34 (03-22N, 141-00E) 95010811



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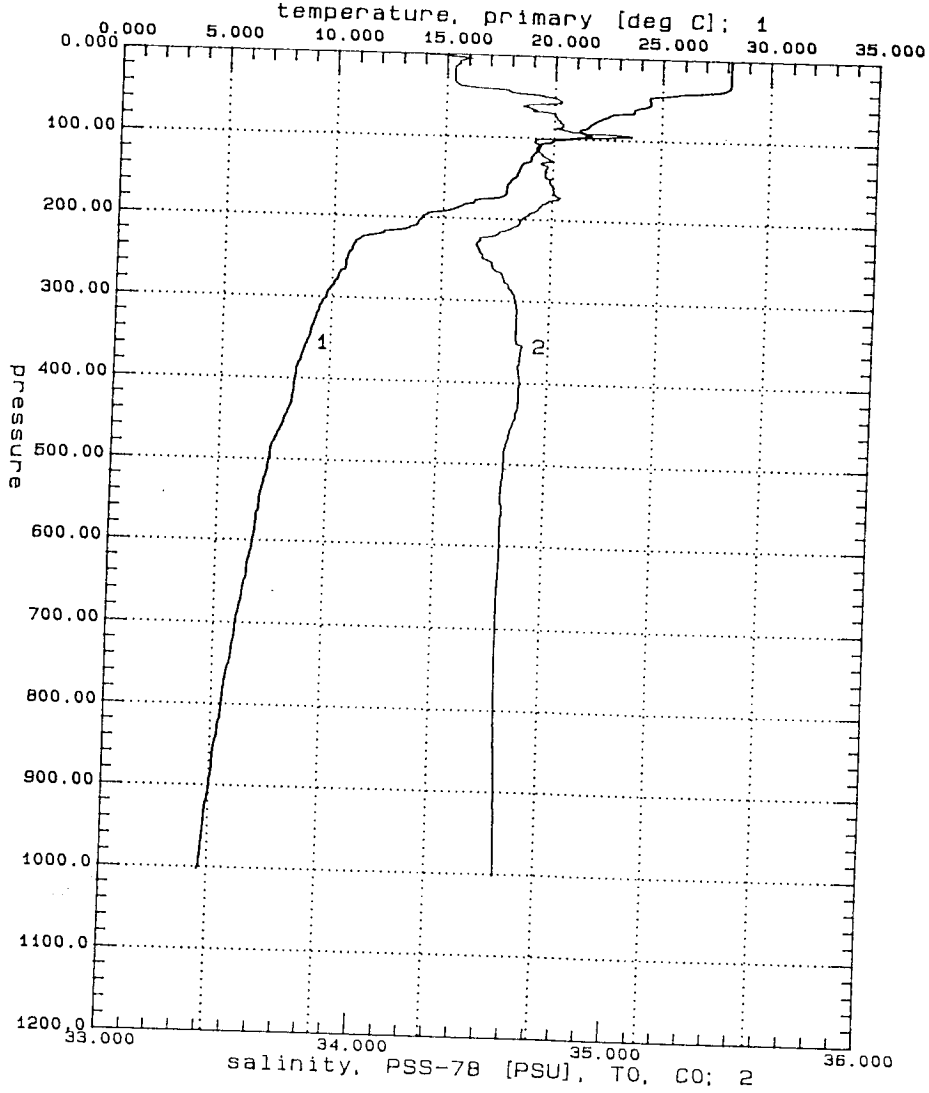
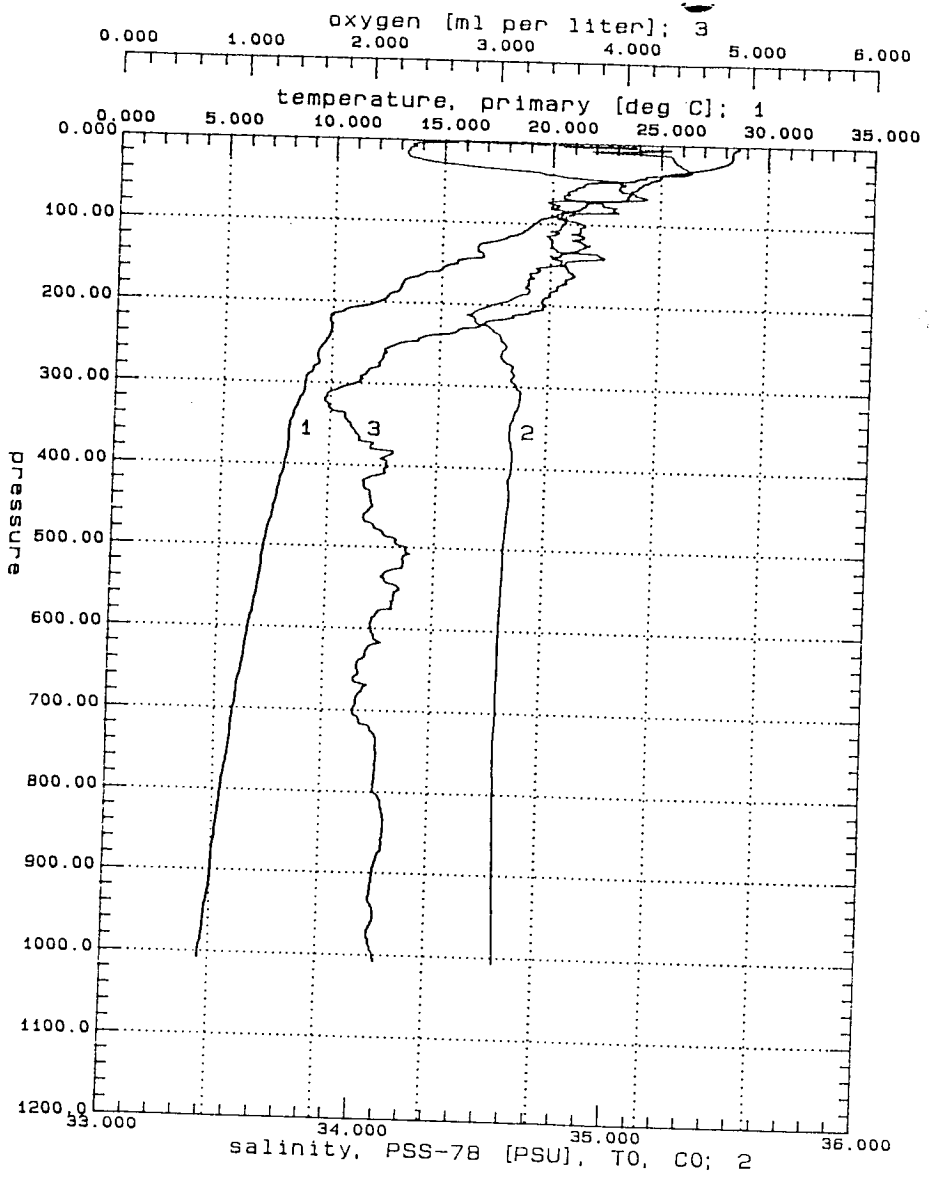
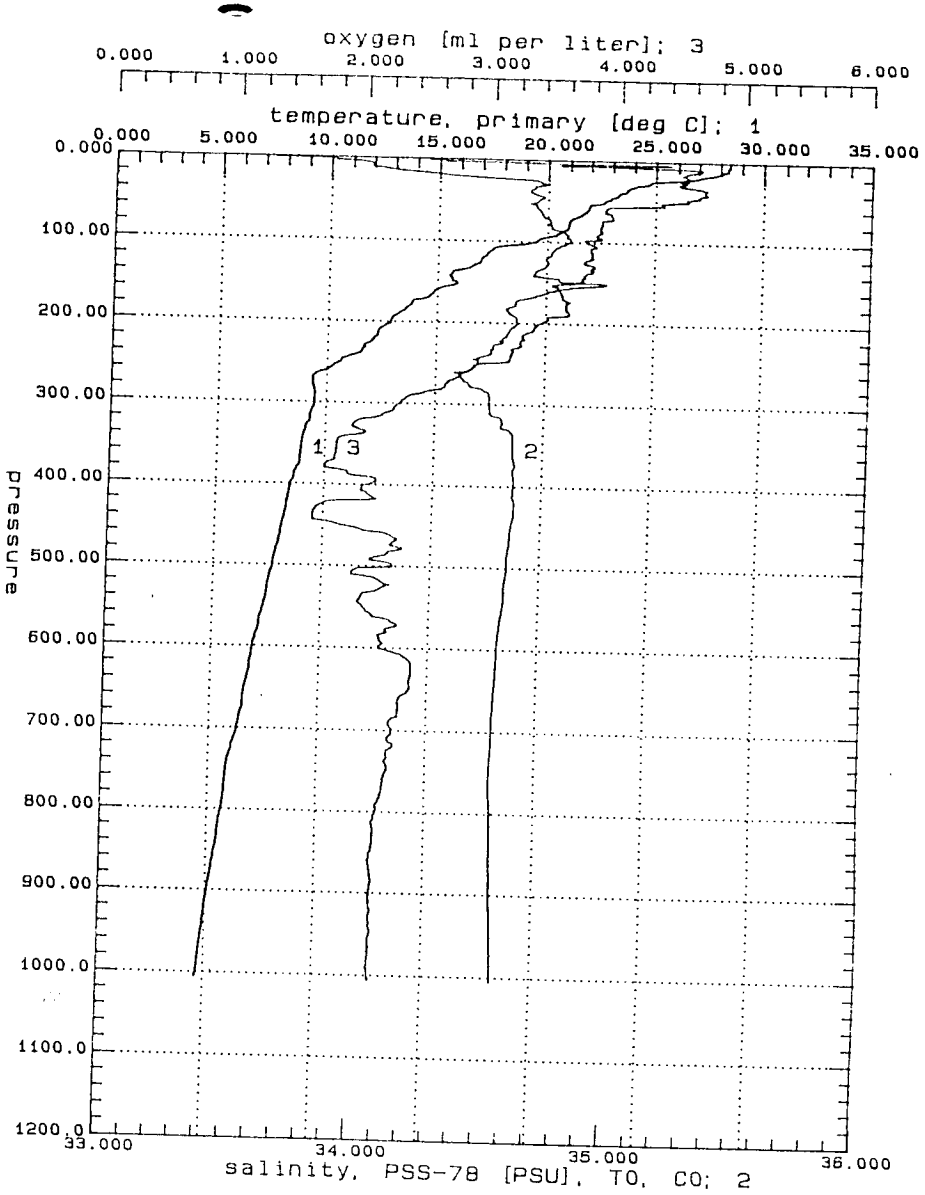


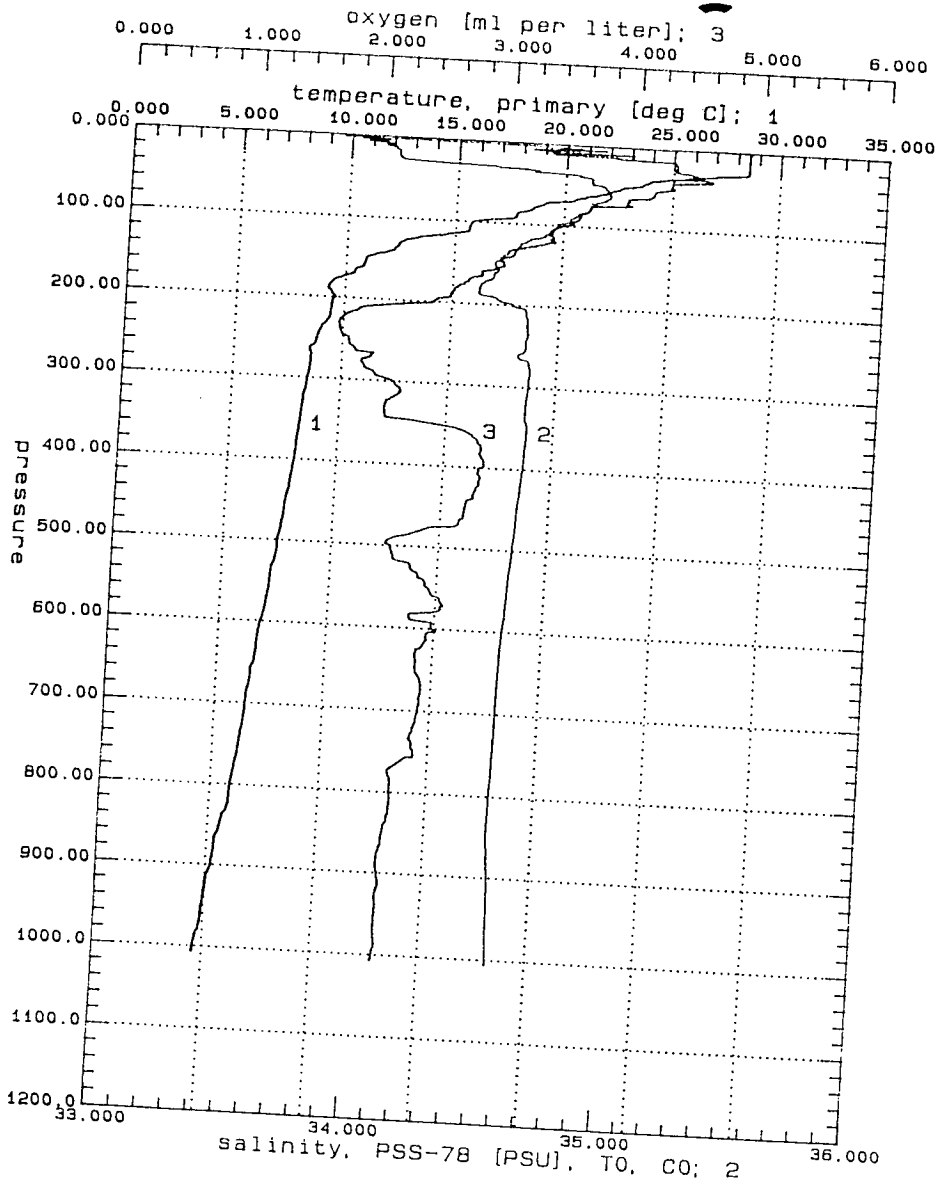
DTOCSC36.CNV: TOCS K9406 CTD-36 (04-06N, 139-00E) 95010823



DTOCSC37.CNV: TOCS K9406 CTD-37 (04-28N, 138-00E) 95010906



DTOCSC38.CNV: TOCS K9406 CTD-38 (04-50N, 137-00E) 95010913



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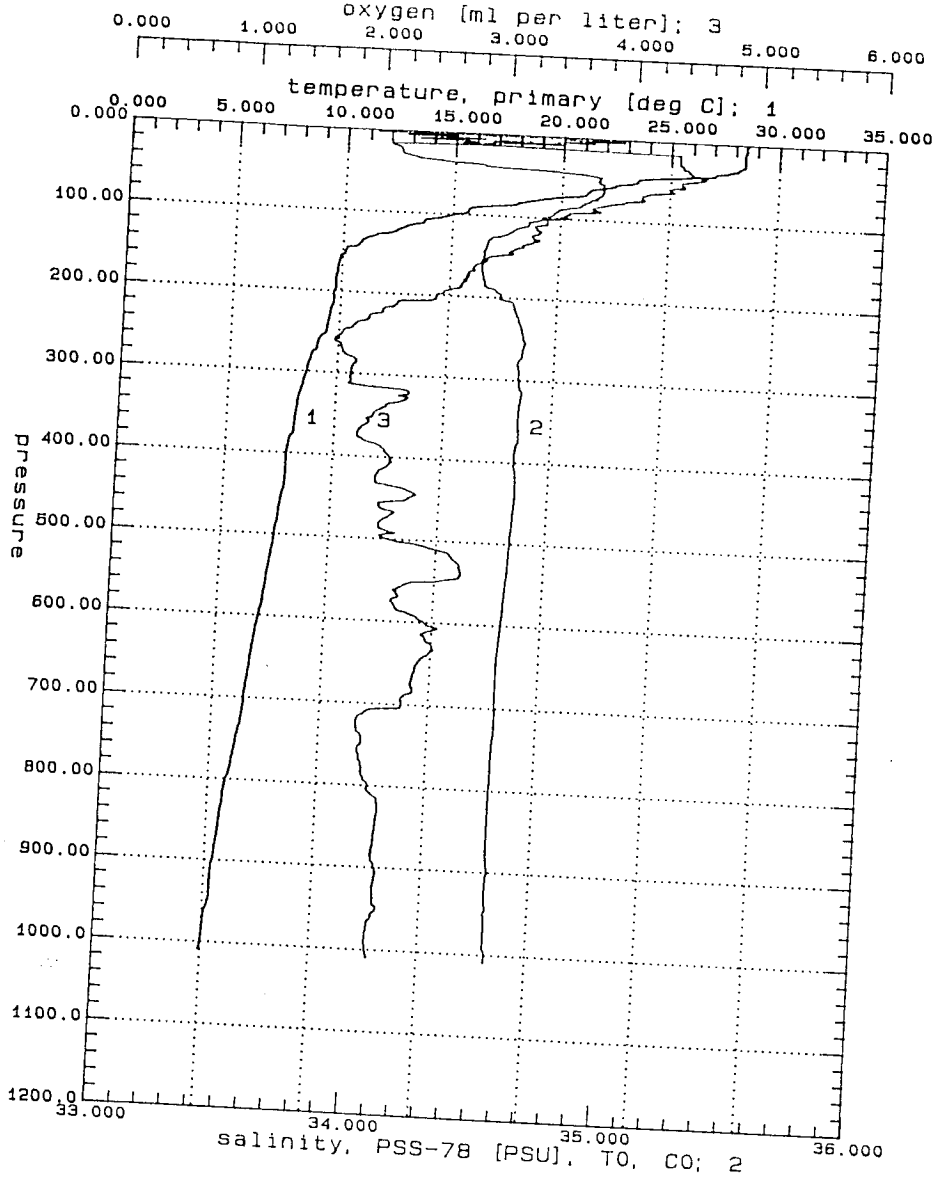
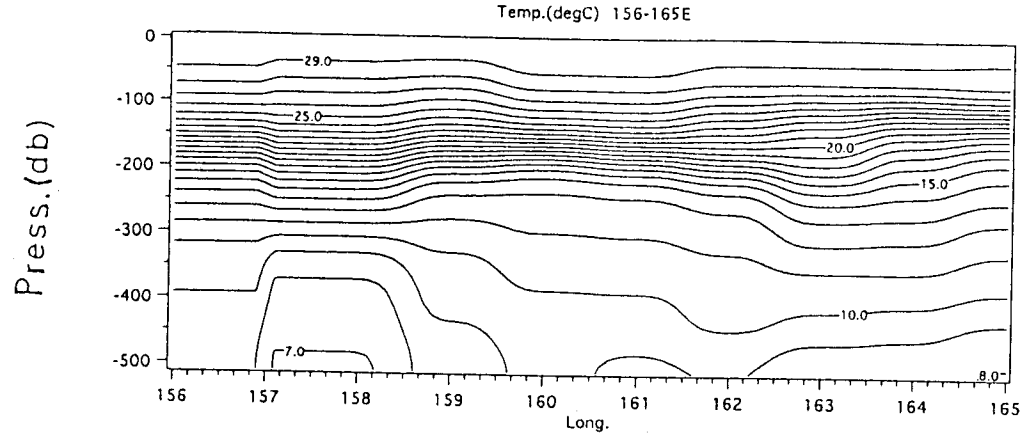
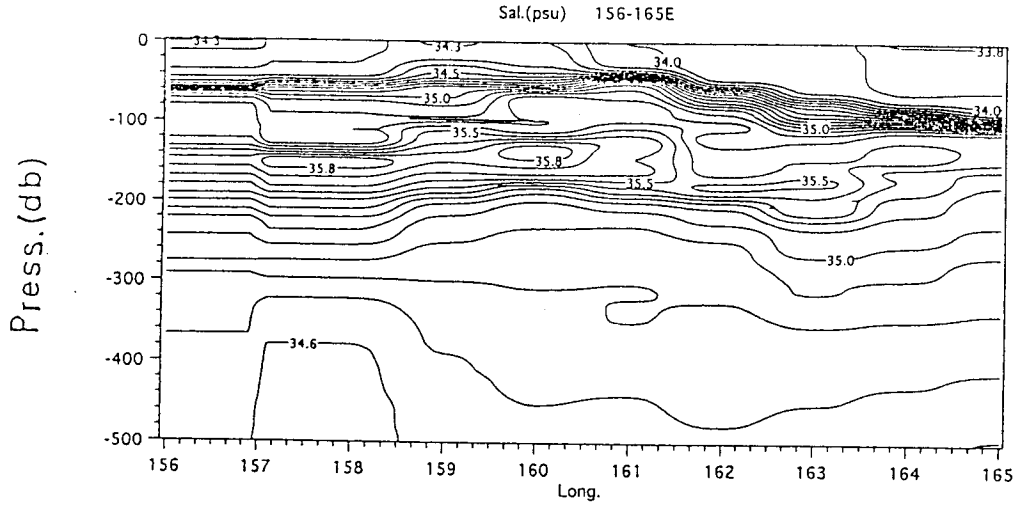
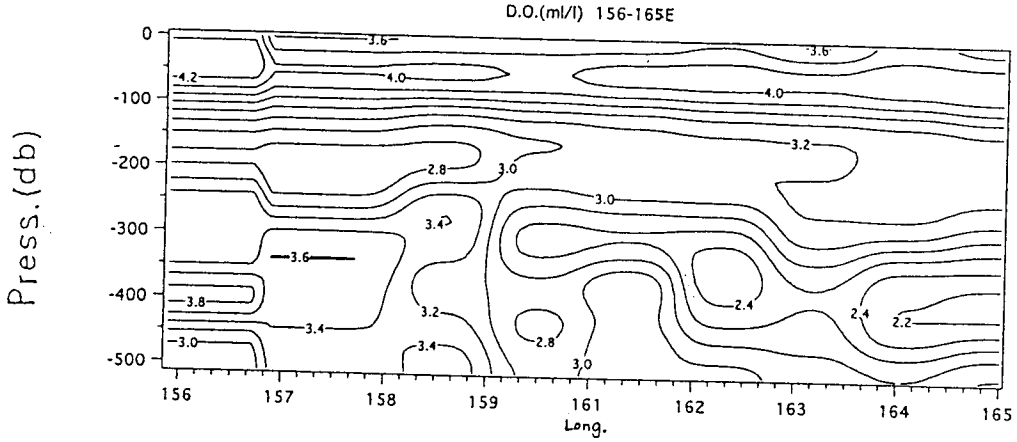
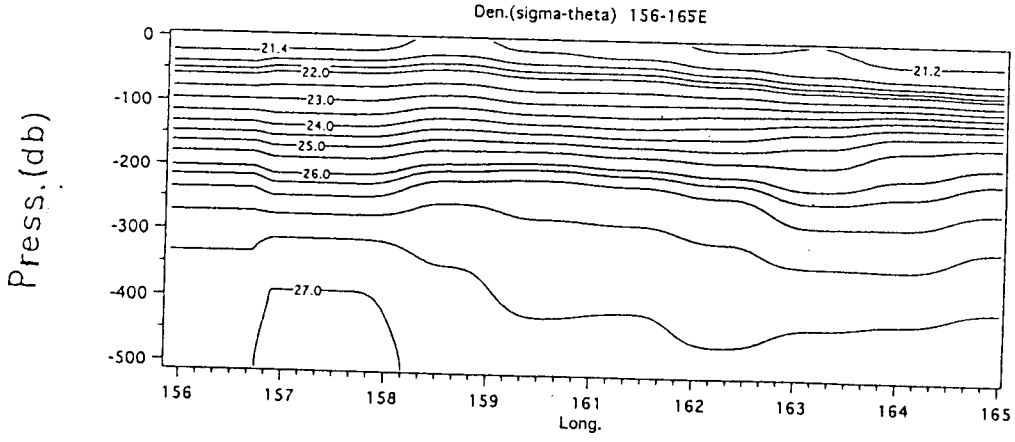


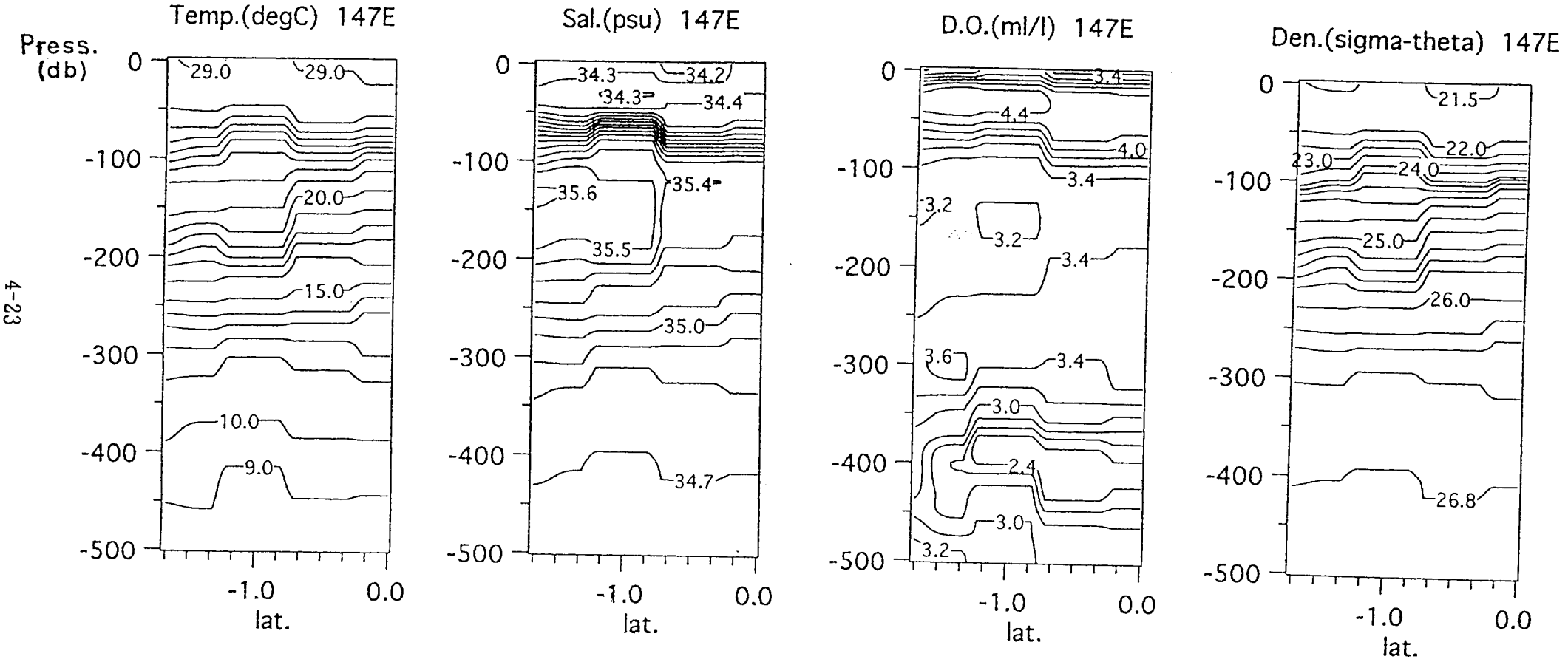
DTOCSC40.CNV: TOCS K9406 CTD-40 (06-20N, 135-00E) 95011003

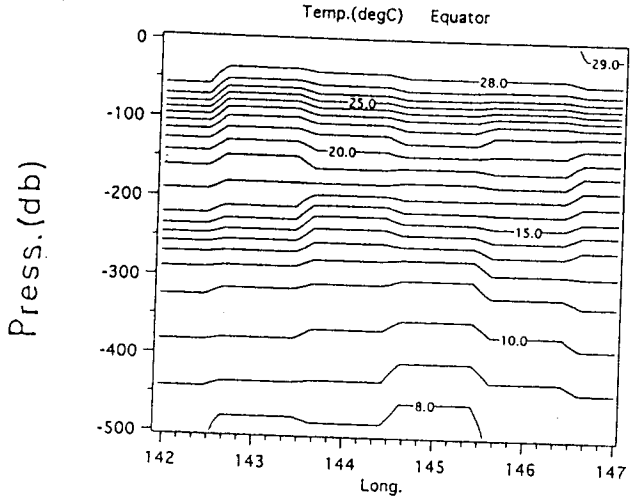

Temp.(degC) 156-165E
Press.(db)
0
-100
-200
-300
-400
-500
29.0
25.0
20.0
15.0
10.0
7.0
8.0
156
157
158
159
160
161
162
163
164
165
Long.

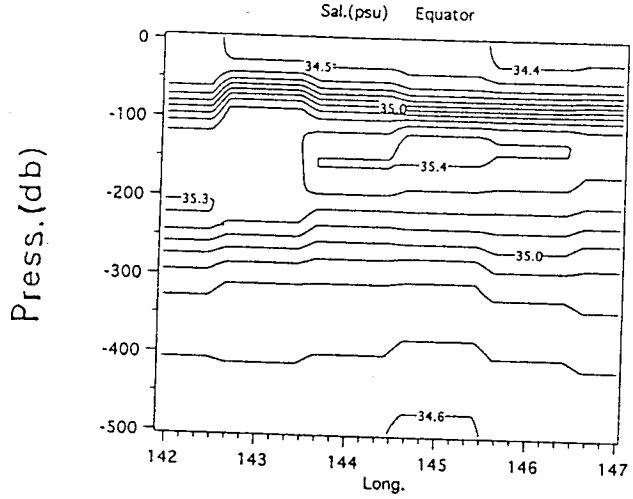

Sal.(psu) 156-165E
Press.(db)
0
-100
-200
-300
-400
-500
34.3
34.5
34.0
33.8
35.0
35.5
35.8
34.6
156
157
158
159
160
161
162
163
164
165
Long.

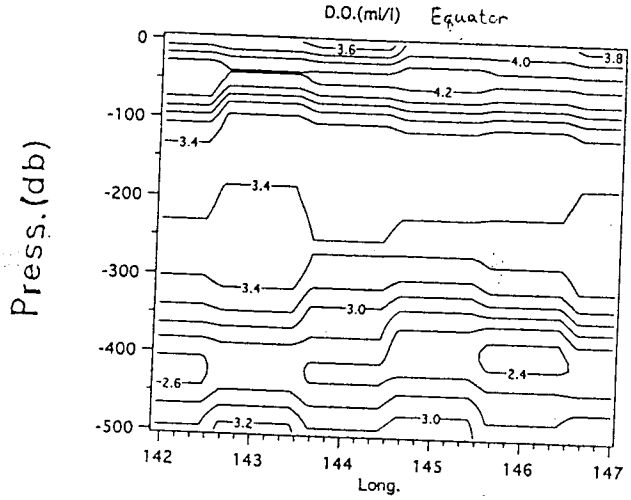

D.O.(ml/l) 156-165E
Press.(db)
0
-100
-200
-300
-400
-500
4.2
4.0
3.6
3.2
3.0
2.8
3.4
3.8
2.4
2.2
156
157
158
159
161
162
163
164
165
Long.

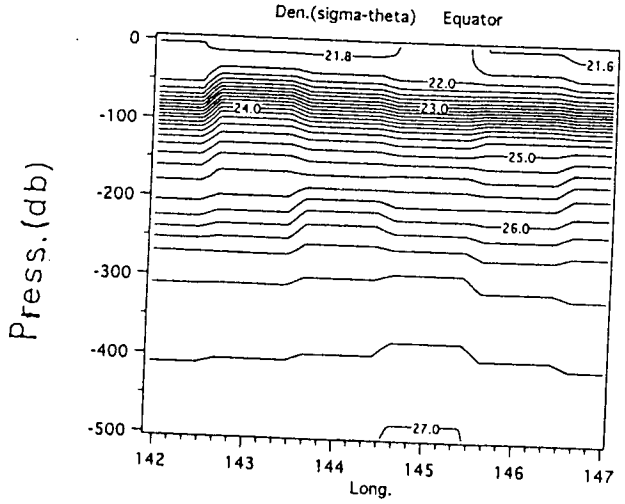

Den.(sigma-theta) 156-165E
Press.(db)
0
-100
-200
-300
-400
-500
21.4
22.0
23.0
24.0
25.0
26.0
21.2
27.0
156
157
158
159
161
162
163
164
165
Long.

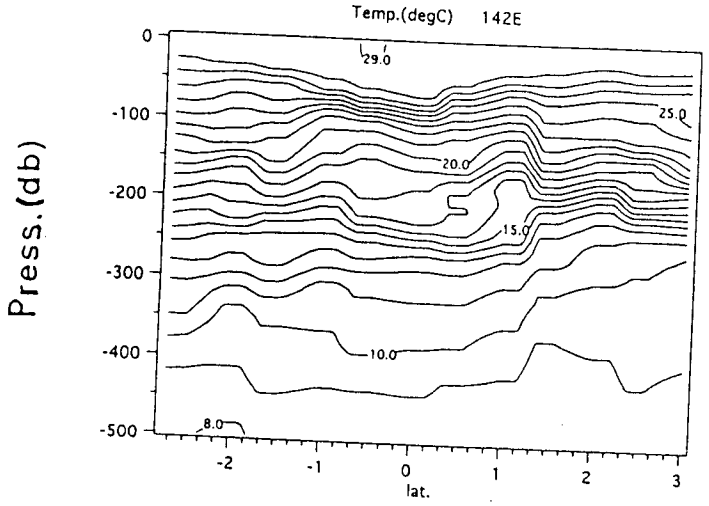

Temp.(degC) 147E
Press.
(db)
0
-100
-200
-300
-400
-500
29.0
29.0
20.0
15.0
10.0
9.0
-1.0
0.0
lat.
Sal.(psu) 147E
34.3
34.2
34.3
34.4
35.6
35.4
35.5
35.0
34.7
D.O.(ml/l) 147E
3.4
4.4
4.0
3.4
3.2
3.2
3.4
3.6
3.4
3.0
2.4
3.0
3.2
Den.(sigma-theta) 147E
21.5
22.0
23.0
24.0
25.0
26.0
26.8

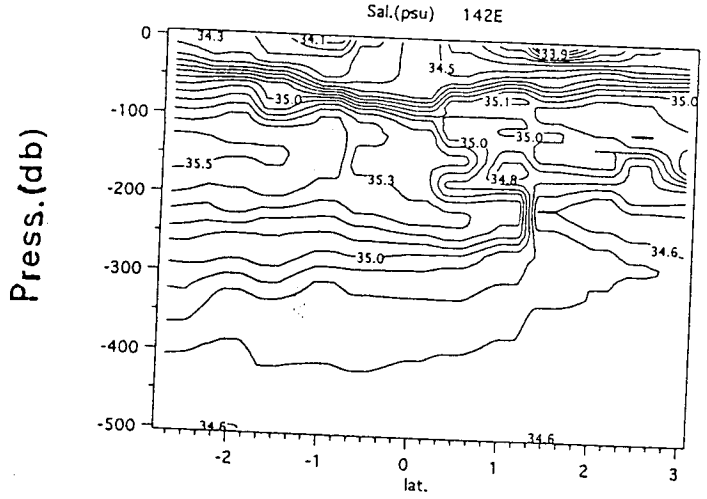

Temp.(degC) Equator
Press.(db)
0
-100
-200
-300
-400
-500
29.0
28.0
25.0
20.0
15.0
10.0
8.0
142
143
144
145
146
147
Long.

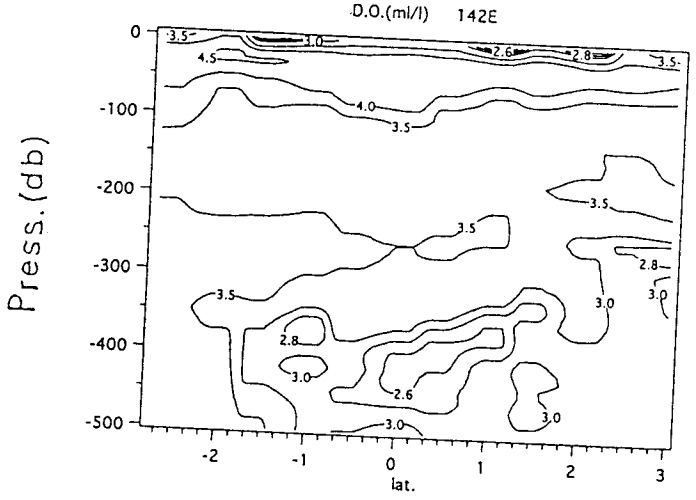

Sal.(psu) Equator
Press.(db)
0
-100
-200
-300
-400
-500
34.5
34.4
35.0
35.4
35.3
35.0
34.6
142
143
144
145
146
147
Long.

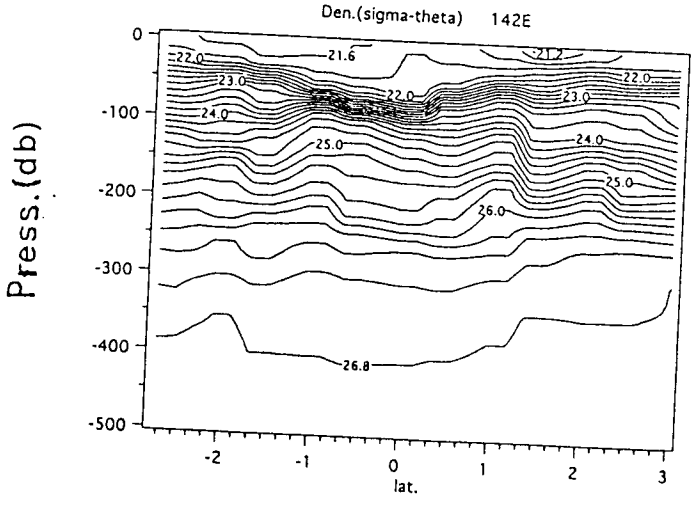

D.O.(ml/l) Equator
Press.(db)
0
-100
-200
-300
-400
-500
3.6
4.0
3.8
4.2
3.4
3.4
3.4
3.0
2.6
2.4
3.2
3.0
142
143
144
145
146
147
Long.

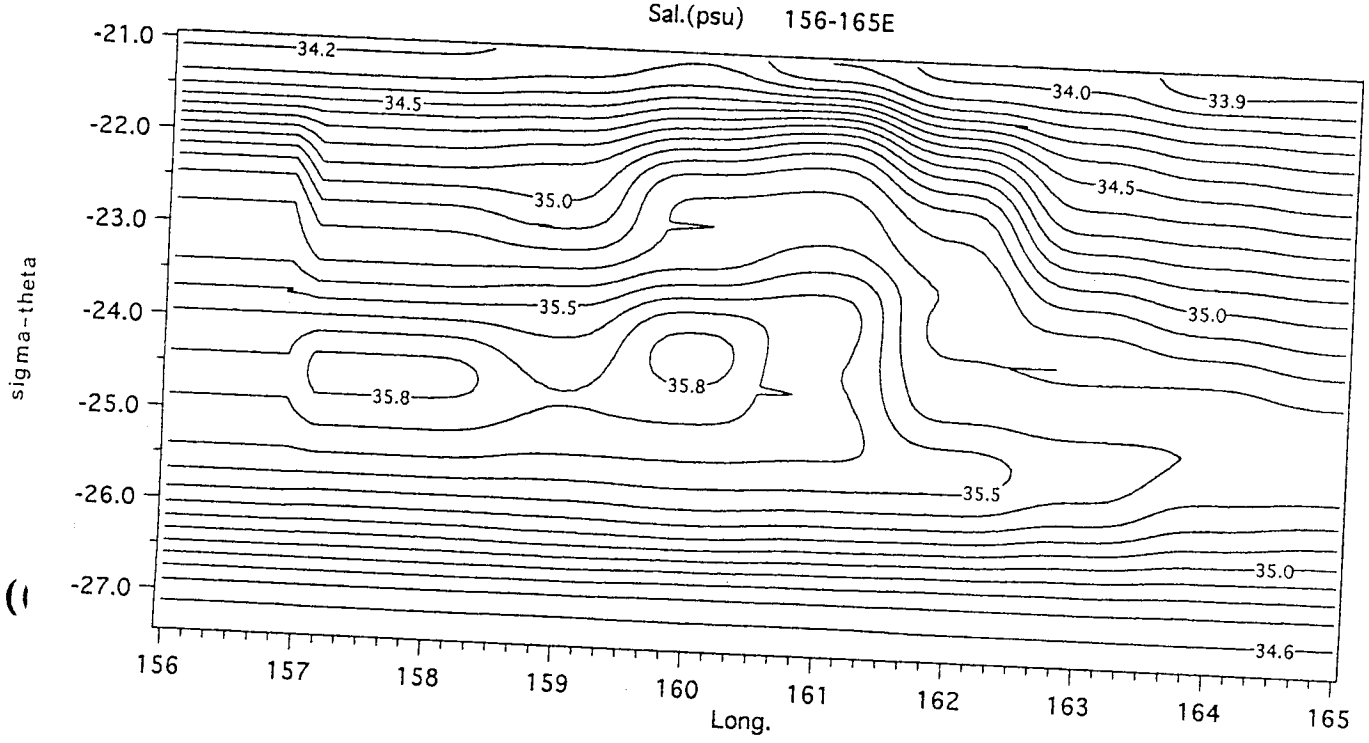

Den.(sigma-theta) Equator
Press.(db)
0
-100
-200
-300
-400
-500
21.8
21.6
22.0
24.0
23.0
25.0
26.0
27.0
142
143
144
145
146
147
Long.


Temp.(degC) 142E
Press.(db)
lat.

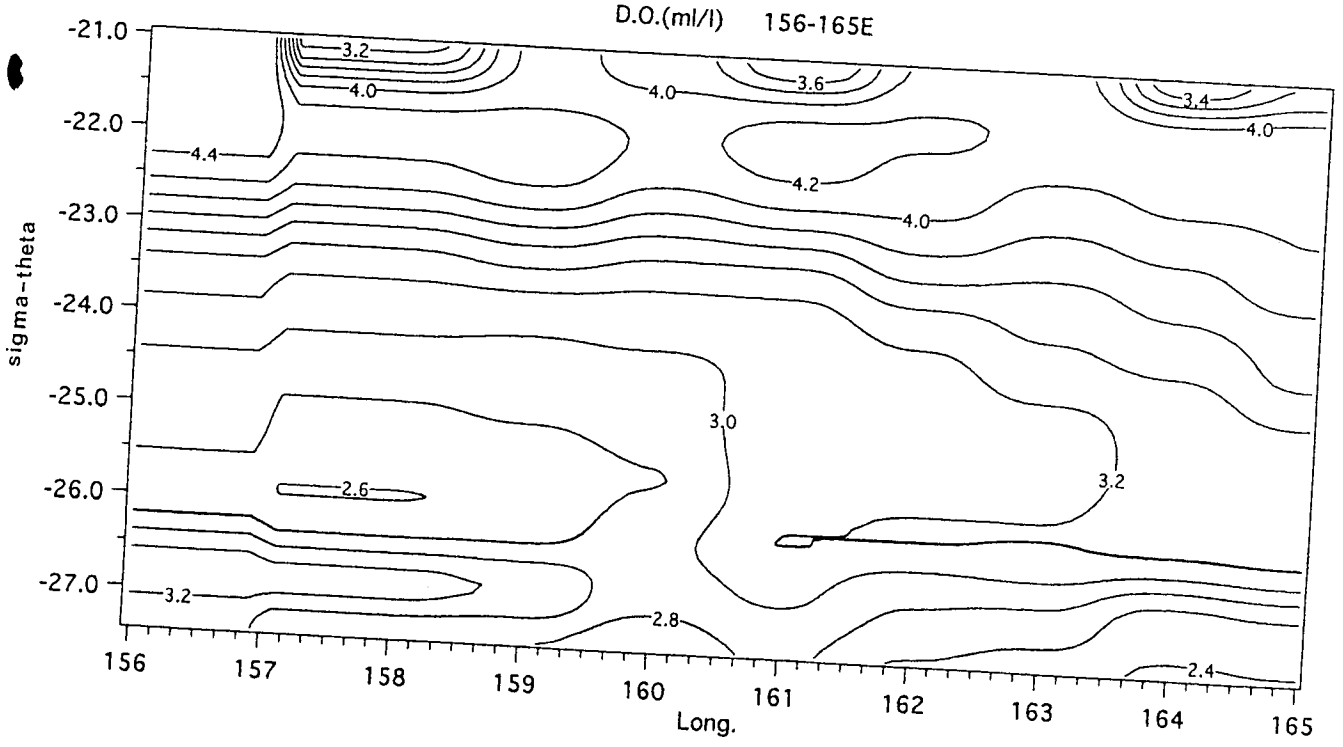

Sal.(psu) 142E
Press.(db)
lat.


D.O.(ml/l) 142E
Press.(db)
lat.

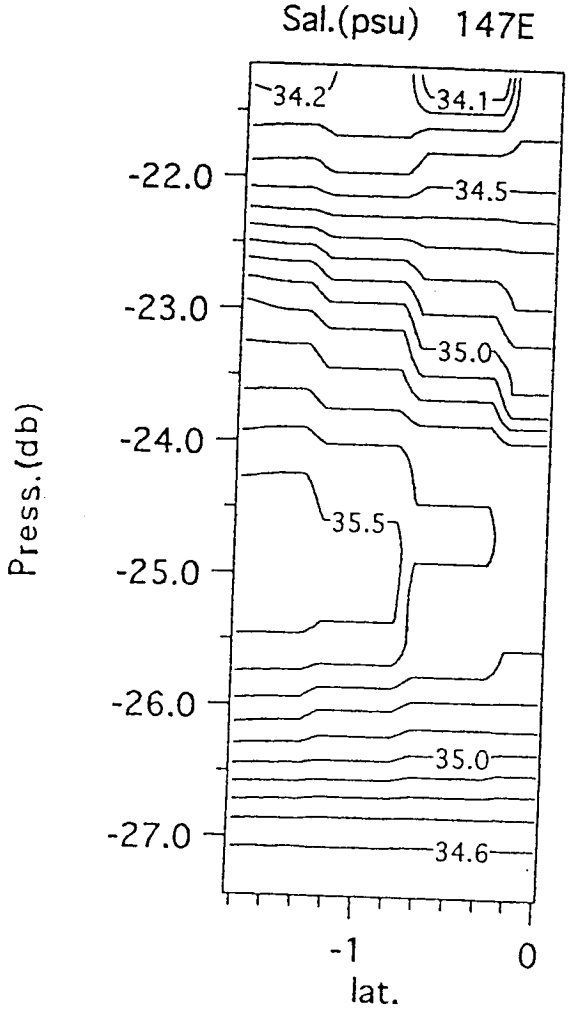

Den.(sigma-theta) 142E
Press.(db)
lat.



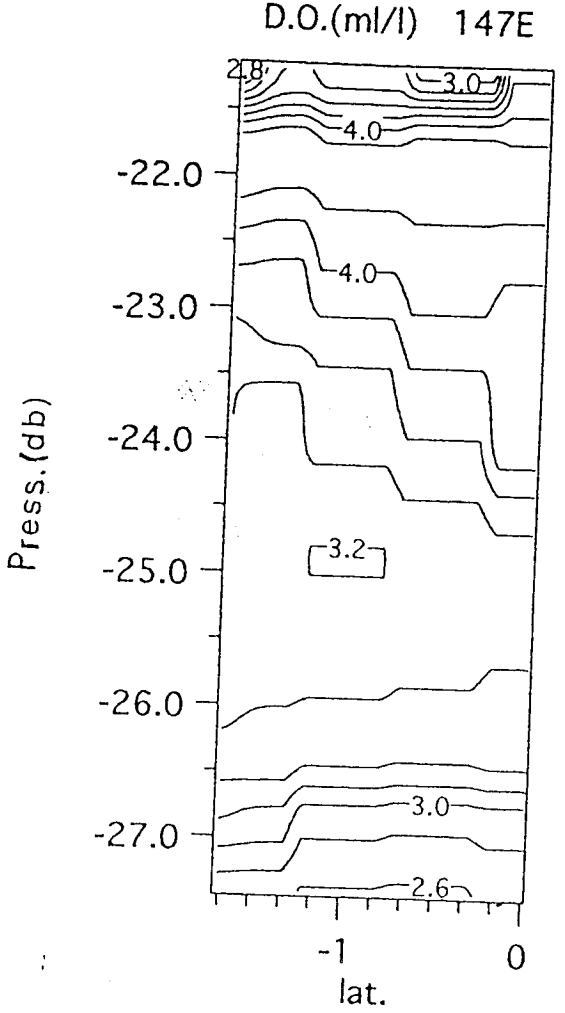
AL_md vs. (row, col)



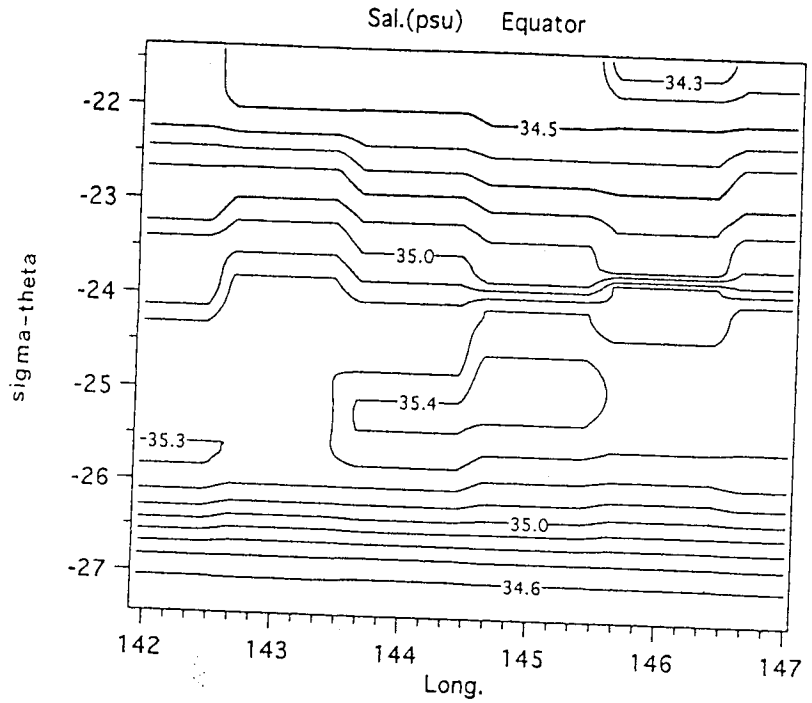
md vs. (row, col)



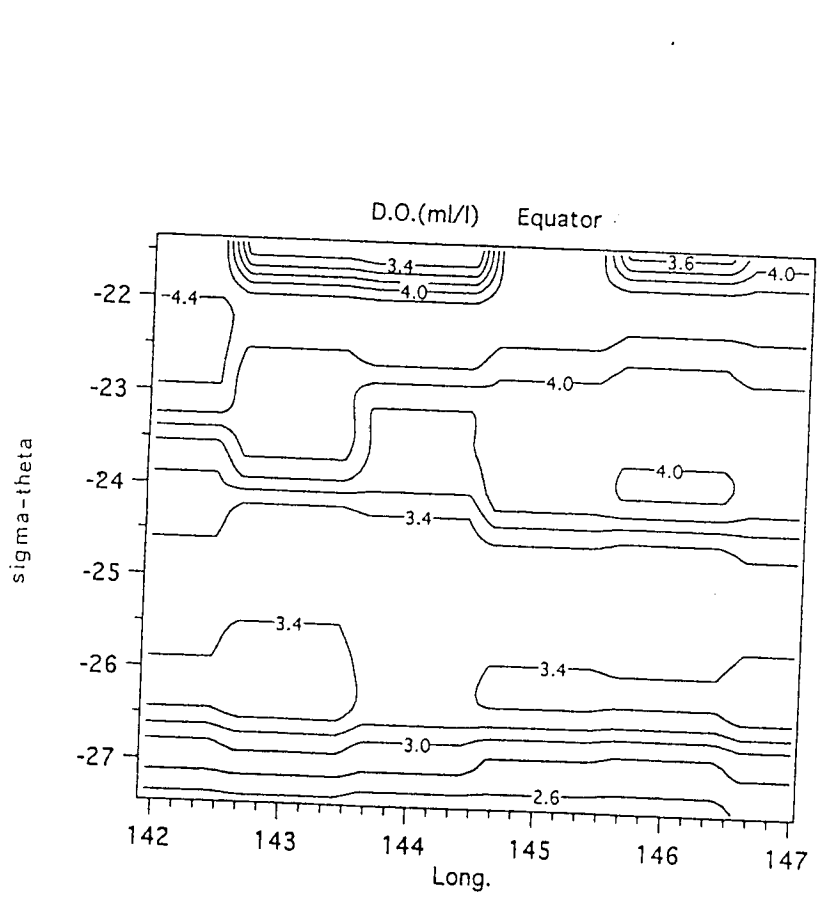
SAL_md vs. (row, col)



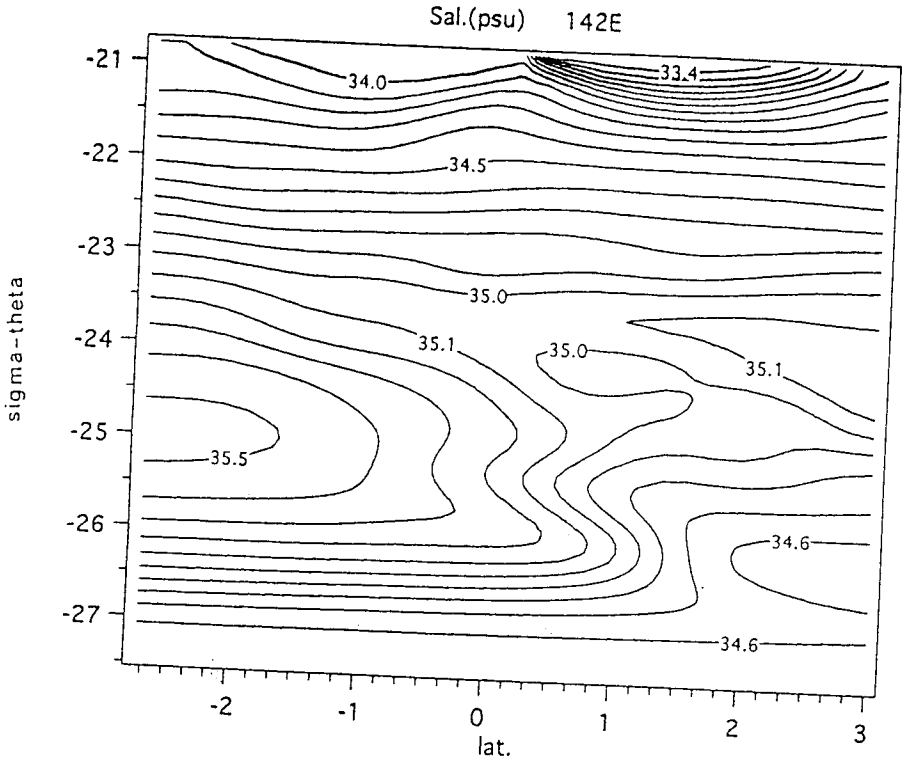
DOX_md vs. (row, col)



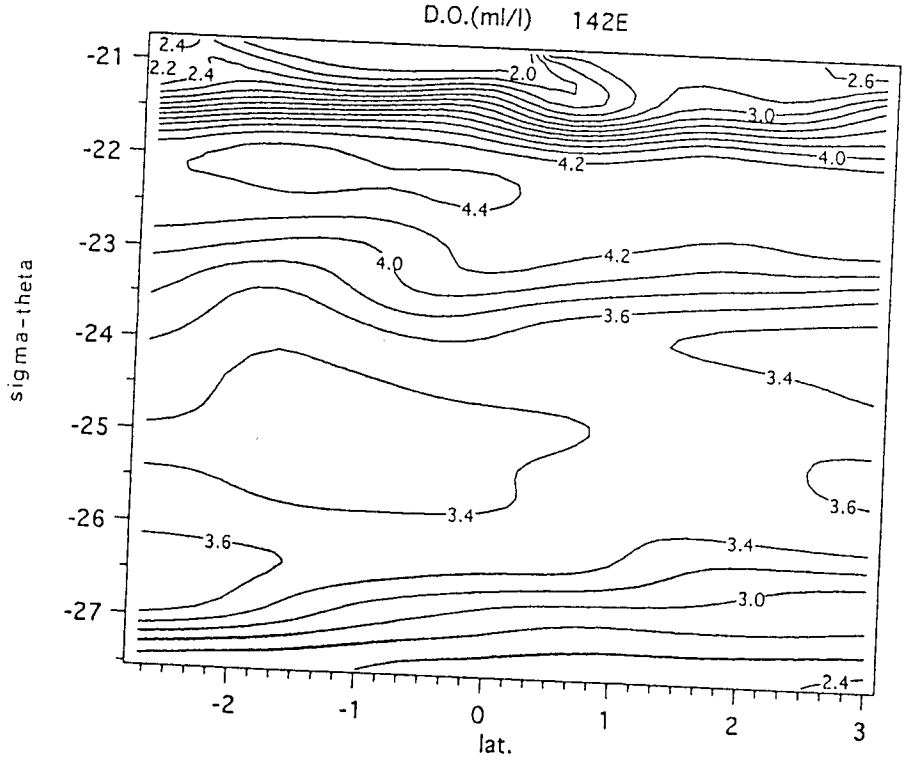
SAL_md vs. (row, col)



DOX_md vs. (row, col)



SAL_md vs. (row, col)



DOX_md vs. (row, col)

4.4 Bottle Salinity

BOTTLE No.	SALINITY (PSU)		AVE.
49	34.5525	34.5527	34.5526
50	34.5492	34.5492	34.5492
51	34.5514	34.5514	34.5514
52	34.5482	34.5482	34.5482
53	34.5506	34.5504	34.5505
54	34.549	34.5494	34.5492
55	34.55	34.5502	34.5501
56	34.5463	34.5464	34.54635
57	34.549	34.549	34.549
SUB	34.727	34.7268	34.7269
58	34.5468	34.5466	34.5467
59	34.5478	34.548	34.5479
67	34.5463	34.5463	34.5463
61	34.5461	34.5457	34.5459
68	34.5516	34.5519	34.55175
66	34.5494	34.5494	34.5494
63	34.5464	34.5466	34.5465
62	34.5486	34.5488	34.5487
65	34.5543	34.5547	34.5545
SUB	34.7268	34.7272	34.727
64	34.5553	34.5572	34.55625
71	34.5482	34.5486	34.5484
69	34.5502	34.5504	34.5503
72	34.5486	34.5482	34.5484
70	34.5512	34.5514	34.5513
99	34.5514	34.5516	34.5515
98	34.55	34.5502	34.5501
97	34.5488	34.5492	34.549
101	34.5488	34.5478	34.5483
105	34.5408	34.5408	34.5408
SUB	34.725	34.725	34.725
100	34.549	34.5488	34.5489
103	34.549	34.5492	34.5491
104	34.5512	34.551	34.5511
102	34.55	34.5504	34.5502
108	34.551	34.551	34.551
107	34.5545	34.5545	34.5545
106	34.5514	34.5518	34.5516
110	34.5423	34.5423	34.5423
109	34.5459	34.5455	34.5457
SUB	34.725	34.725	34.725

4.5 Dissolved Oxygen Measurement

Takehiko SHIRIBIKI
Sanyo Techno Marine, Inc., Japan

Objective :

Measurement of dissolved oxygen using D.O. meter with correct of the Winkler titration.
Comparison of D.O. meter data and CTD-DO data with titration data.

Instrument:

Titrator ; Metrohm Model 716 DMS Titrino/10ml of titration vessel
Detector ; Photometry : Metrohm Model 662 Photometer
D.O. Meter ; TOA Portable Dissolved Oxygen Meter Model DO-25A

Methods:

The samples for D.O. Meter were collected from a 12-liter Niskin water sampler into 100ml D.O. glass bottle Several samples for the Winkler titration were collected into a calibrated BOD flask (ca, 180ml) (see Green and Carritt1966). When the samples were collected, 3-bottle-volume of sample water was overflowed and sampling water temperature was measured during sampling.

After the sampling, samples were immediately measured by D.O. Meter with salinity correction. Before the measurement, the D.O. meter was adjusted 0-100%.

The samples for the titration method were analyzed within several hours. The DO values were obtained by Metrohm piston buret of 10ml with photometer using whole bottle titration in the laboratory controlled temperature (ca, 22℃).

I corrected the values of the D.O. meter with calibration factors. The factors were a linear regression line based on the Winkler titration vs DO meter.
In the same way, the CTD-D.O. data were corrected.

The standardizations have been done everyday before the sample titration. An analytical method was done according to the WHP Operations and Methods (Culberson, 1991).

Preliminary result:

Dissolved Oxygen concentrations were ranged from 1.99 to 4.78 ml/l. Fig. 1 and Fig. 2 were indicated existence of high-oxygen layer (50-100m). And below it, (see Fig2) at 2° S 142° E 3.00 ml/l oxygen concentration contor deepened to 700m depth but north from 2° S, this concentration contor was in 300m depth.

In this cruise, the standard deviation of photometric titration data was 0.009 ml/l (0.02% of D.O. maximun in the cruise), which was derived from 10-pair of samples.

In this same way, the standard deviation of DO meter data was 0.02 ml/l (0.4% of D.O. maximum in this cruise), which was derived from 88-pair of samples.

FIG. 1

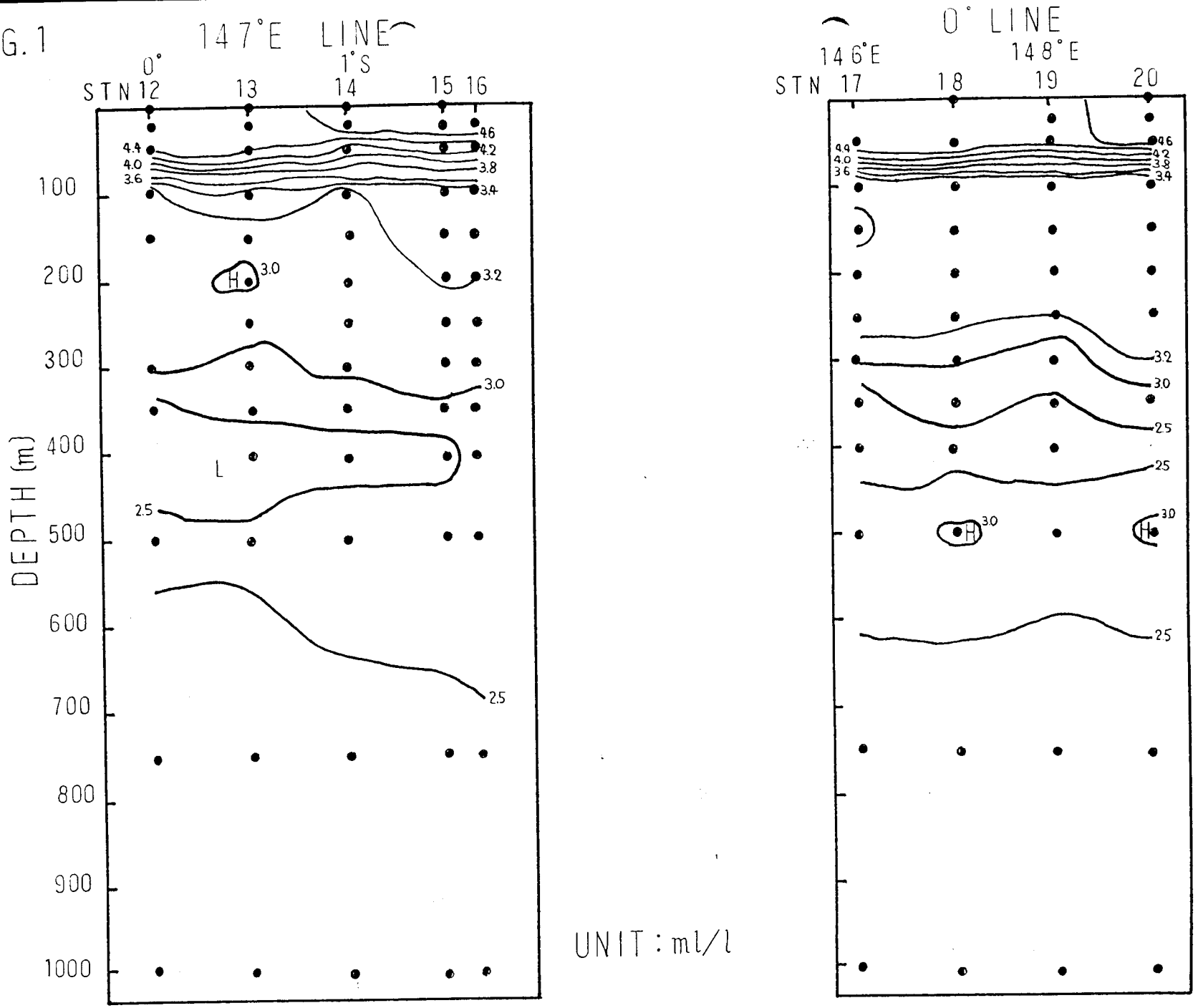

147°E LINE
0° LINE
0°
1°S
146°E
148°E
STN 12
13
14
15 16
17
18
19
20
DEPTH (m)
100
200
300
400
500
600
700
800
900
1000
4.6
4.4
4.2
4.0
3.8
3.6
3.4
3.2
3.0
2.5
H
L
UNIT : ml/l

FIG. 2

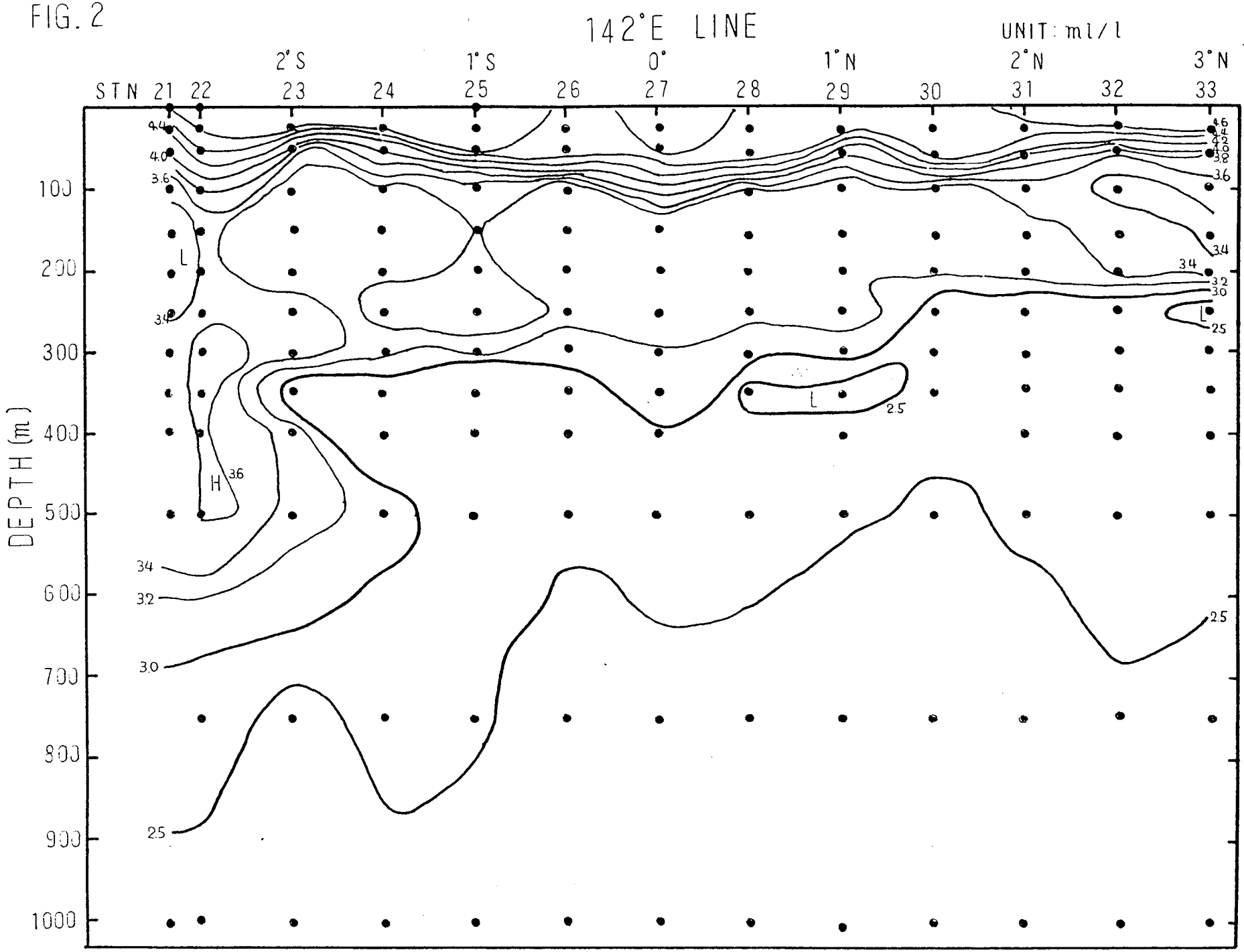

142°E LINE
UNIT: ml/l
2°S
1°S
0°
1°N
2°N
3°N
STN 21 22 23 24 25 26 27 28 29 30 31 32 33
DEPTH (m)
100
200
300
400
500
600
700
800
900
1000
4.4
4.0
3.6
3.4
3.2
3.0
2.5
L
H
4.6
4.4
4.2
4.0
3.8
3.6
3.4
3.2
3.0
2.5

FIG.3

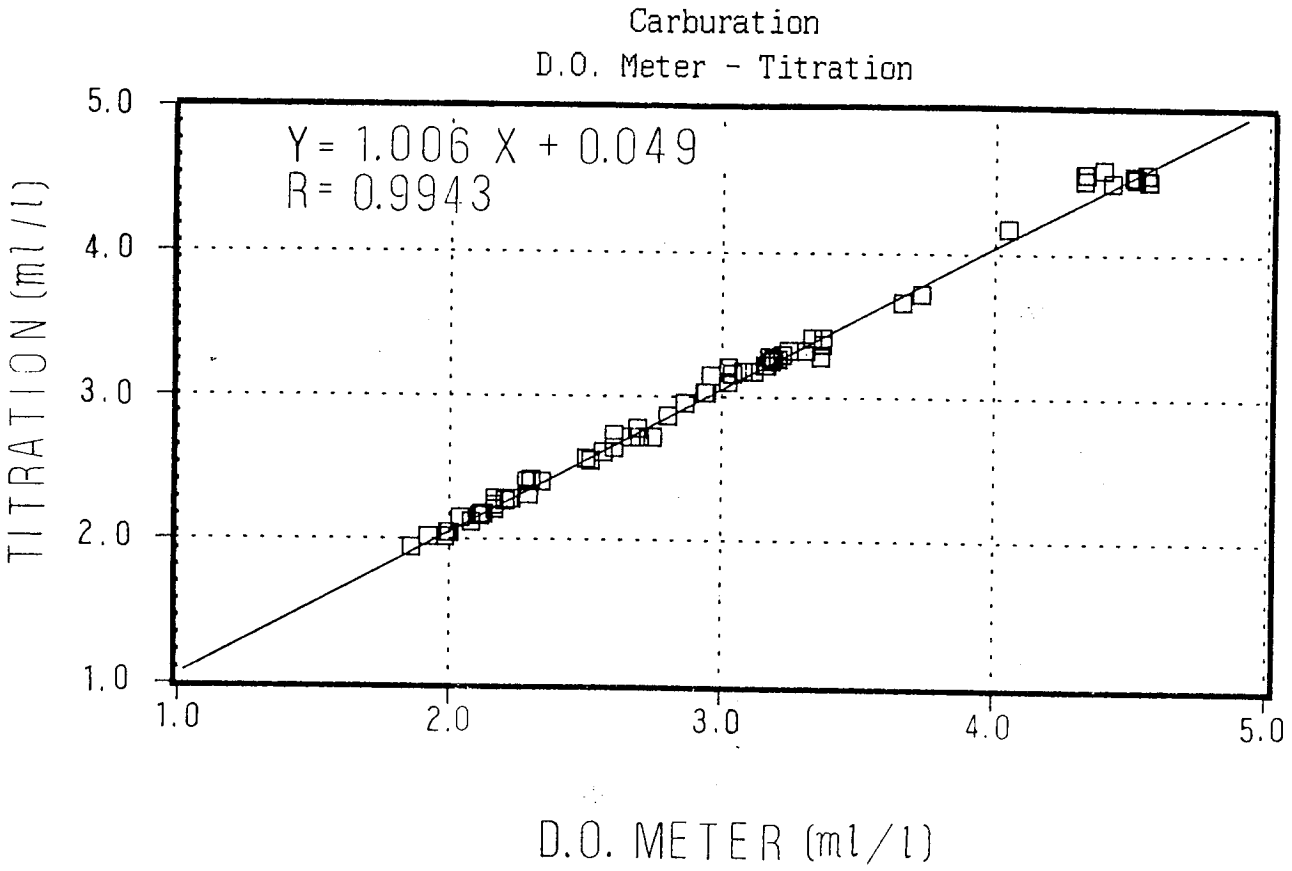
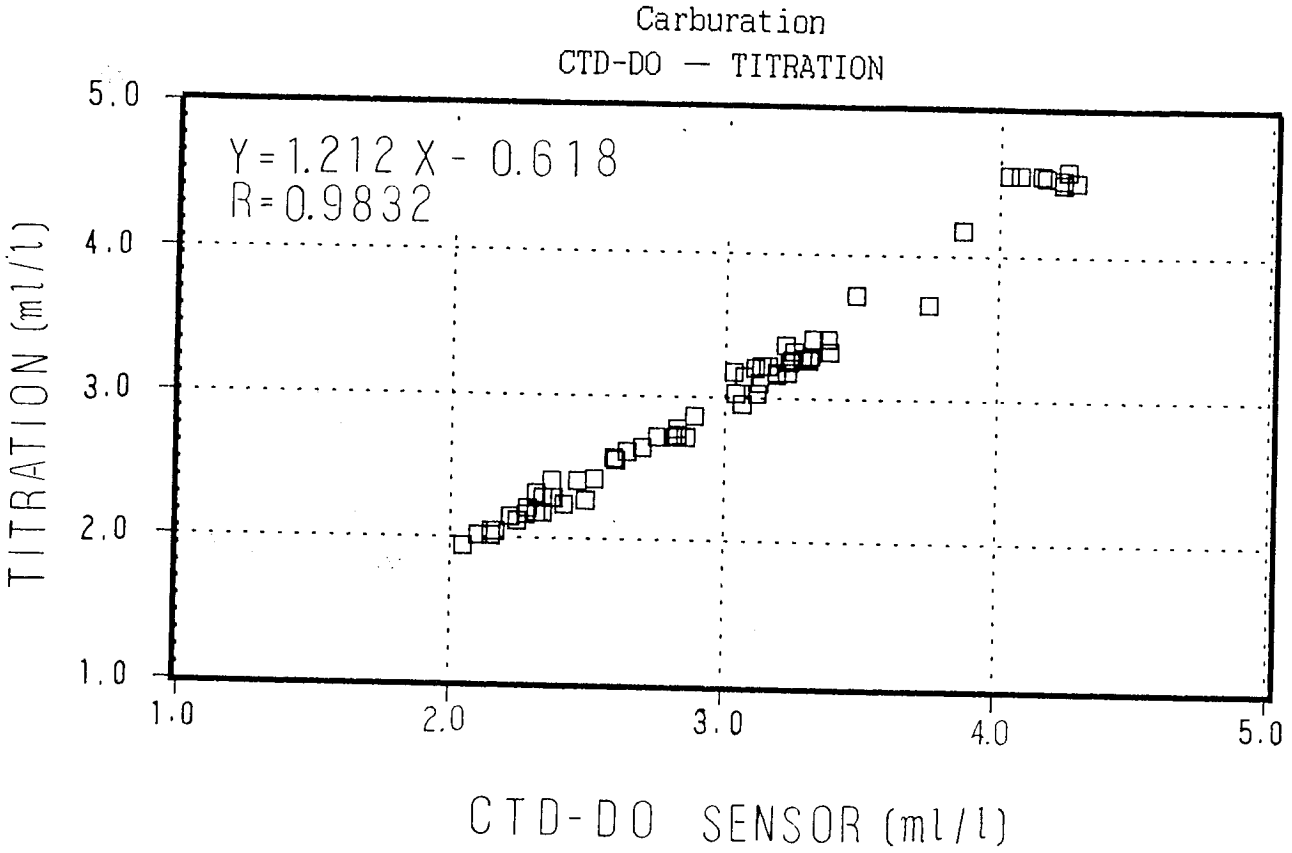

Carburation
D.O. Meter - Titration
Y= 1.006 X + 0.049
R= 0.9943
TITRATION (ml/l)
5.0
4.0
3.0
2.0
1.0
1.0
2.0
3.0
4.0
5.0
D.O. METER (ml/l)

FIG. 4


Carburation
CTD-DO — TITRATION
Y=1.212 X - 0.618
R=0.9832
TITRATION (ml/l)
5.0
4.0
3.0
2.0
1.0
1.0
2.0
3.0
4.0
5.0
CTD-DO SENSOR (ml/l)

5. Meteorological Measurements

5.1 Atmospheric Sounding

Using Omega sonde(Vaisala,RS-80N), we have started to measure the atmospheric sounding to promote our understanding about the air-sea interaction over the "warm pool" area from this TOCS K9406 cruise. We launched the balloon every 6 hours (00:00,06:00,12:00,18:00 UTC) during two weeks (1994.12.22-12.28, 1995.01.03-09).

The data obtained from Omega sonde consists of pressure, temperature, humidity, and wind speed/direction. We classified these 57 sounding data into 4 groups according to their period and position. The brief results are the follows :

1. Period : 94.12.22-12.26
   Position : (02°N,168°E) - (04°S,157°E)
   Features : The moist strong westerly wind (>10m/s) is dominant in the lower layer (0-4km) due to mainly the typhoon located around 15°N, 150E and the deep convective area (super cloud cluster and/or intraseasonal variation) located around 5°S, 175°E.
   (cf. EMA* ①,② ; GMS** 1-5)
2. Period : 94.12.27-12.28
   Position : (05°S,156°E) - (02°S,153°E)
   Features : The relatively weak westerly wind flows in the low level layer. Especially, the dry easterly wind intrude into the deep convection which developed over the New Guinea at the mid level(5km).
   (cf. EMA ③,④ ; GMS 6-8)
3. Period : 95.01.03-01.07
   Position : (00°, 147°E) - (00°, 142°E)
   Features : There are no dominant wind and it is very weak(<5m/s), while the surface is fully moist.
   (cf. EMA ⑤,⑥ ; GMS 9-13)
4. Period : 95.01.08-01.09
   Position : (03°N,142°E) - (06°S,135°E)
   Features : It shows the typical profile under the trade wind i.e. the low level high potential temperature wind create the inversion layer at 2-3km high and the air becomes very dry above that level.
   (cf. EMA ⑦,⑧ ; GMS 14-16)

* EMA -- See the EMAGRAM and Wind Profile Page 5-04 ~ 5-07
** GMS -- See the appendices GMS IR Images

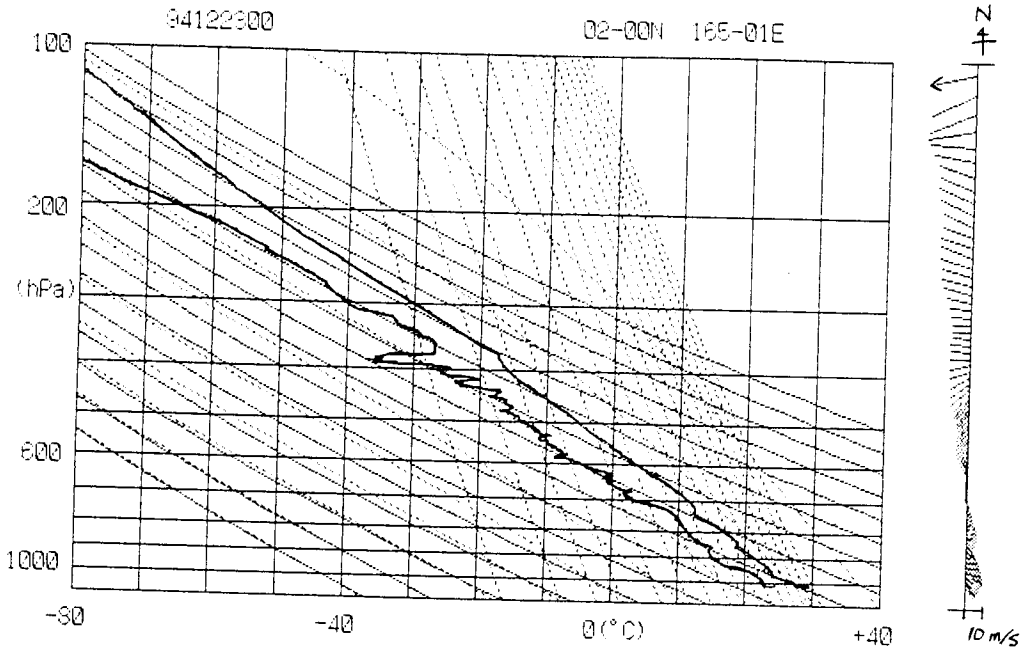
Radio Sonde Launch Sites

No.	Time(GMT) YYMMDDHH	Position Lat.	Lon.	Surface Pres hPa	Temp °C	RH %	WD deg	WS m/s	Max Altitude hPa (m)	Cloud Amount, Type
01	94122104	04°42N,	168°51E	1007.8	30.2	85	24	6.8	28.3(24,133)	7, 5
02	94122200	02°02N,	167°41E	1010.8	31.5	72	26	9.8	41.6(21,721)	7, 7
03	94122206	01°59N,	166°40E	1009.2	29.4	82	30	7.8	39.6(21,999)	6, 3
04	94122213	02°00N,	165°30E	1012.2	28.2	85	351	7.8	42.3(21,619)	8,
05	94122218	02°00N,	165°00E	1010.2	27.1	84	306	7.5	52.8(20,250)	7, Sc,Cc,Ci
06	94122300	02°00N,	165°01E	1010.8	29.6	74	330	9.0	37.4(22,327)	1, Ci
07	94122304	02°00N,	165°02E	1009.9	29.0	78	330	9.1	39.2(23,096)	2, Cc
08	94122312	01°21N,	165°02E	1011.8	28.2	82	321	9.3	33.8(23,002)	0
09	94122318	00°16N,	165°00E	1009.3	28.4	77	319	10.5	32.4(23,251)	2,
10	94122400	00°00S,	164°52E	1010.7	29.3	78	308	9.8	58.9(19,626)	3, Cu
11	94122406	00°00S,	164°56E	1007.5	29.0	77	300	10.5	33.2(23,092)	8, Cb
12	94122412	00°17S,	164°32E	1009.3	28.2	81	250	10.0	------	-------
13	94122418	00°41S,	163°47E	1007.5	28.4	85	259	7.5	38.9(22,087)	9, Sc,Cu
14	94122500	01°11S,	162°55E	1009.1	31.4	68	268	10.6	326.4(9,104)	4, Cu,As,Cs
15	94122506	01°37S,	162°04E	1007.2	29.2	82	290	10.5	26.8(24,464)	3, Cu
16	94122512	02°06S,	161°15E	1009.4	28.9	82	260	9.6	29.9(23,750)	1, Cu
17	94122518	02°33S,	160°26E	1008.3	28.6	82	245	4.1	33.1(23,094)	6, Cu,Cb
18	94122600	03°00S,	159°35E	1009.9	32.2	66	241	6.4	86.0(17,426)	4, Cu,Cb
19	94122606	03°29S,	158°44E	1007.2	31.0	70	235	7.3	28.0(24,165)	2, Cu
20	94122612	03°58S,	157°52E	1010.4	29.1	85	236	4.8	95.6(16,871)	1, Cu
21	94122618	04°34S,	156°47E	1009.2	28.2	82	250	3.0	29.9(23,711)	1, Cu
22	94122700	05°01S,	156°02E	1011.1	30.4	84	198	0.5	78.0(17,977)	3, Cu
23	94122706	05°00S,	156°02E	1007.5	30.3	70	129	1.1	25.6(24,730)	7, Sc,Cu
24	94122712	04°06S,	156°01E	1010.8	28.6	83	330	3.1	37.8(22,262)	0
25	94122800	02°00S,	156°01E	1010.9	30.9	73	254	5.7	120.7(15,528)	4, Cu
26	94122812	02°20S,	154°51E	1010.3	28.4	82	261	9.5	36.8(22,429)	3, Cu,Cb,Sc
27	94122900	02°20S,	153°04E	1010.2	30.2	73	295	8.8	49.5(20,618)	3, Cu
28	95010300	00°13S,	147°19E	1009.1	30.6	67	195	2.6	94.6(16,891)	7, As,Ac
29	95010306	00°00S,	147°05E	1007.3	28.1	82	0	8.0	37.9(22,263)	9, Sc,Cu
30	95010312	00°01S,	146°57E	1008.2	27.4	85	203	1.9	44.8(21,245)	3, Cu

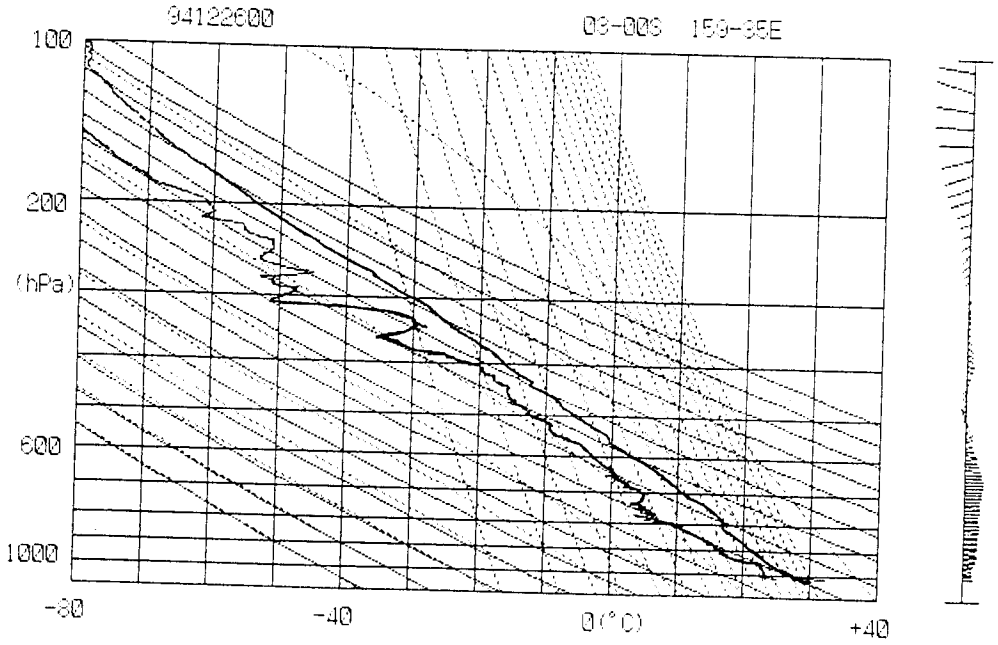
Surface

No.	Time(GMT) YYMMDDHH	Position Lat.	Lon.	Pres hPa	Temp °C	RH %	WD deg	WS m/s	Max Altitude hPa (m)	Cloud Amount, Type
31	95010318	00°00S,	146°58E	1006.4	27.2	82	10	0.5	160.0(13,861)	1, Cu
32	95010400	00°00S,	146°58E	1009.1	29.3	83	244	2.8	32.7(23,171)	4, Cu, As
33	95010406	00°52S,	147°00E	1006.7	29.2	80	5	1.4	31.8(23,306)	9, Sc, Cu
34	95010412	01°40S,	147°00E	1008.4	28.3	79	253	4.2	42.5(21,525)	3, Cu
35	95010418	00°37S,	146°23E	1006.9	27.4	88	320	2.1	38.4(22,143)	2, Sc
36	95010500	00°00S,	145°51E	1009.5	27.3	90	33	2.9	133.7(14,963)	9, Sc, Ns
37	95010506	00°00N,	144°52E	1006.9	28.5	81	293	3.4	21.5(25,818)	7, As, Ac, Cu
38	95010512	00°00N,	143°54E	1009.1	27.6	85	356	4.9	97.2(16,772)	3, Sc
39	95010518	00°03S,	142°58E	1008.8	26.9	84	203	2.8	37.1(22,357)	2, Cu, Cb
40	95010600	01°12S,	142°34E	1010.8	29.0	79	253	7.9	64.7(19,022)	4, Ac, Cu
41	95010606	02°25S,	142°05E	1007.0	30.0	74	57	13.0	57.0(19,777)	3, Cu, Sc
42	95010612	02°05S,	142°00E	1010.8	27.4	90	302	7.5	65.2(19,007)	3, Cu, Ac
43	95010618	01°14S,	142°00E	1009.2	27.4	83	301	7.4	380.5(7,955)	7, Ns, Cu
44	95010700	00°23S,	141°59E	1010.8	28.4	80	321	7.0	27.8(24,410)	7, Cu
45	95010706	00°00N,	141°59E	1008.7	30.4	75	223	6.9	34.7(22,789)	9, Cu, Sc
46	95010712	00°23N,	142°00E	1009.9	27.2	89	325	5.5	75.0(18,226)	7, Cu, Sc
47	95010718	01°12N,	142°00E	1008.3	25.2	96	295	3.0	559.1(4,963)	10, Ns, Cb
48	95010800	02°07N,	142°00E	1010.4	28.9	79	2	6.7	28.9(23,968)	9, Cu
49	95010806	03°00N,	142°00E	1007.2	30.0	68	233	3.7	27.3(24,300)	8, Cu, Sc, Ac
50	95010812	03°22N,	141°00E	1009.8	26.4	88	44	6.6	49.8(20,541)	2, Cu
51	95010818	03°44N,	140°00E	1007.4	27.0	79	47	6.5	26.2(24,575)	0
52	95010900	04°04N,	139°05E	1009.8	29.2	65	60	5.7	33.4(23,022)	2, Sc
53	95010906	04°25N,	138°08E	1006.1	30.5	65	196	2.5	31.0(23,510)	6, Cu, As
54	95010912	04°44N,	137°17E	1008.6	27.0	78	349	7.7	31.8(23,354)	4, Sc
55	95010918	05°13N,	136°29E	1006.8	26.8	84	152	2.6	33.9(22,952)	2, Cu
56	95011000	05°50N,	135°39E	1009.5	27.7	82	11	9.1	53.4(20,149)	5, Cb, Cu
57	95011006	06°30N,	134°47E	1006.0	29.3	72	57	3.3	30.5(23,634)	2, Cu, Ac

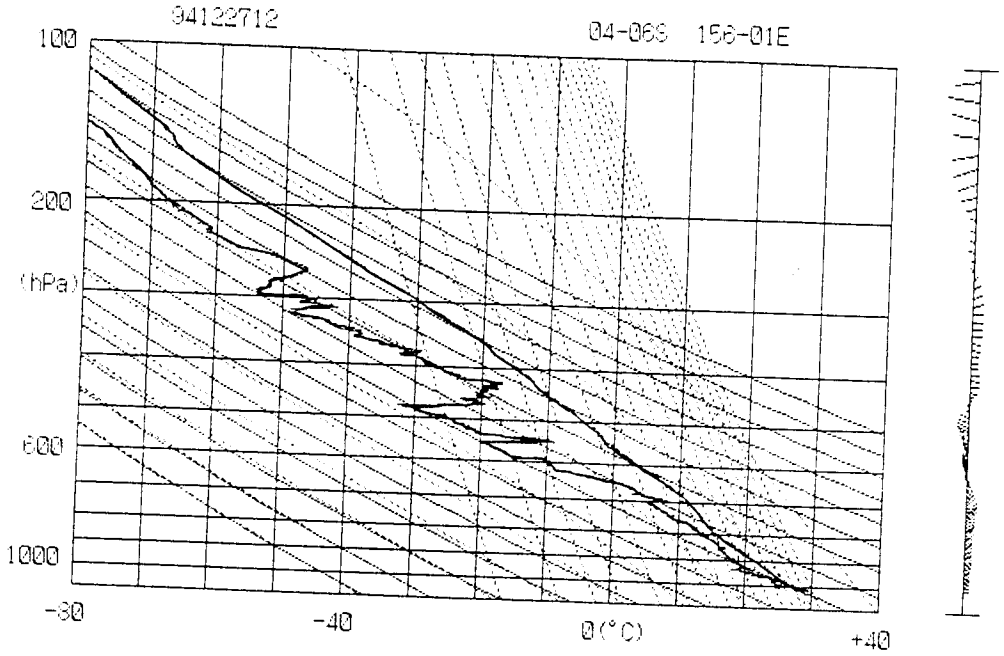
①


94122300
02-00N 165-01E
100
200
(hPa)
600
1000
-80
-40
0(°C)
+40
N
10 m/s

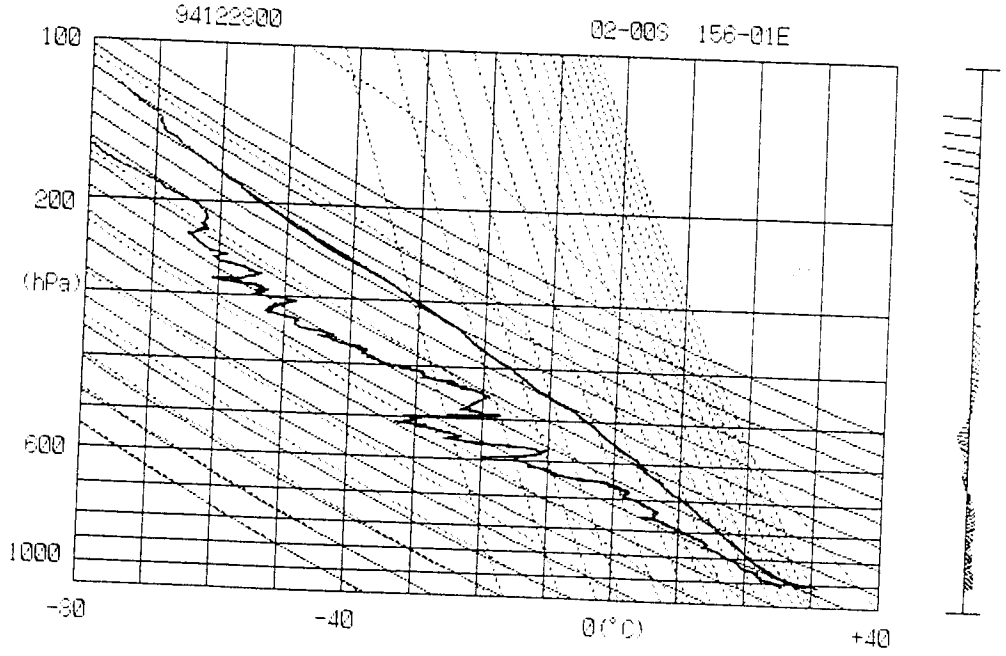
②


94122600
03-00S 159-35E
100
200
(hPa)
600
1000
-80
-40
0(°C)
+40

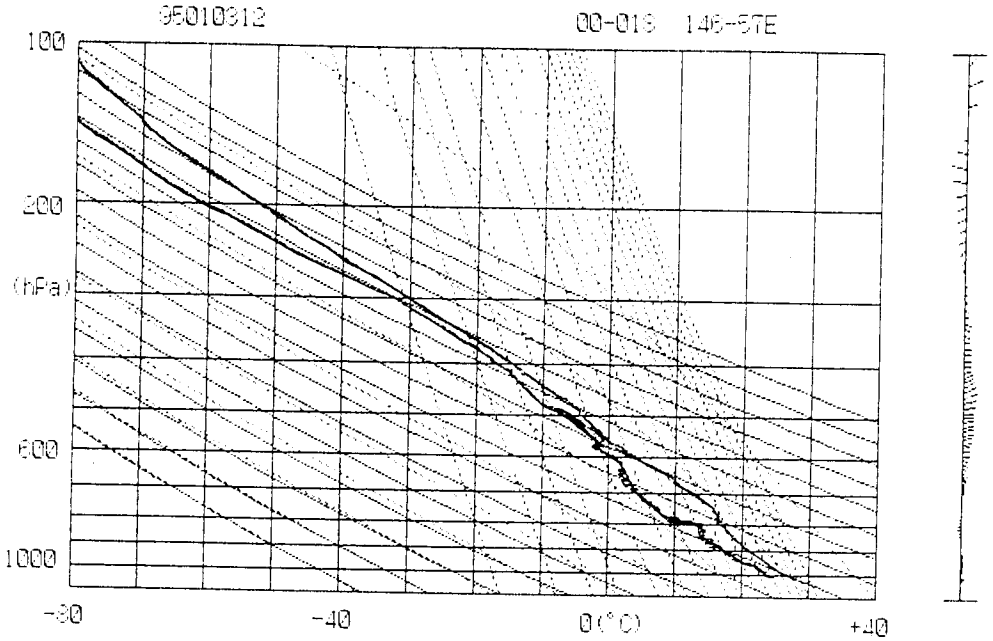
③


94122712
04-06S 156-01E
100
200
(hPa)
600
1000
-80
-40
0(°C)
+40

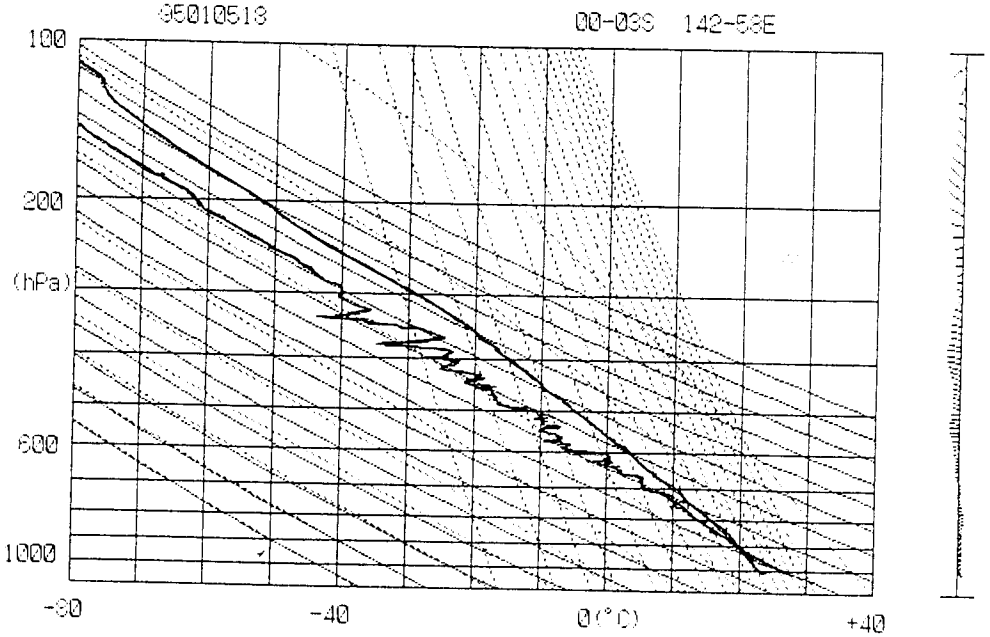
④


94122800
02-00S 156-01E
100
200
(hPa)
600
1000
-80
-40
0(°C)
+40

⑤


95010312
00-01S 146-57E
100
200
(hPa)
600
1000
-80
-40
0(°C)
+40

⑥


95010513
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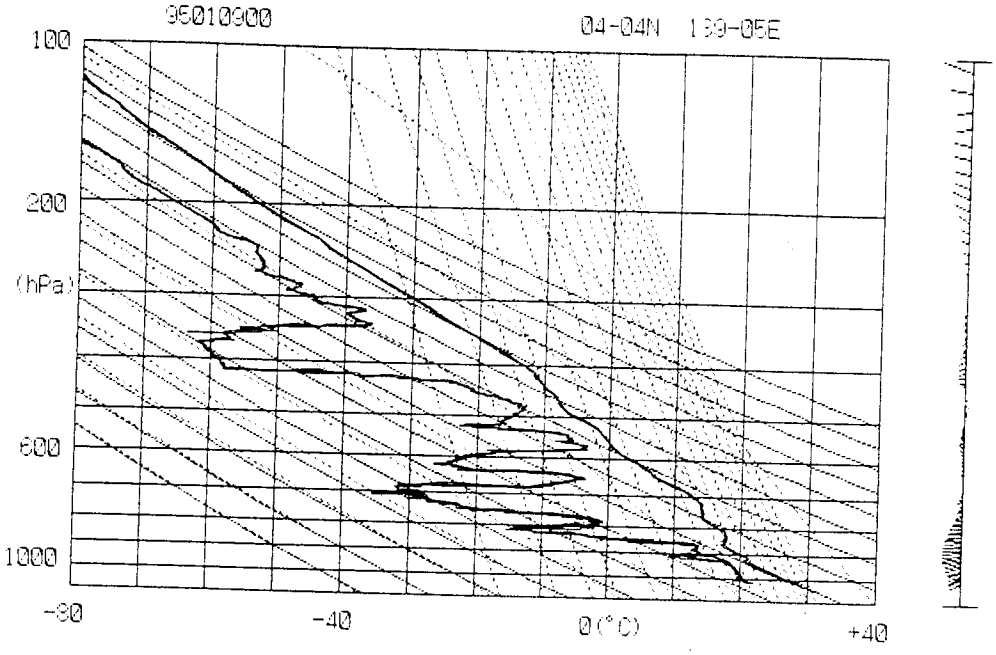
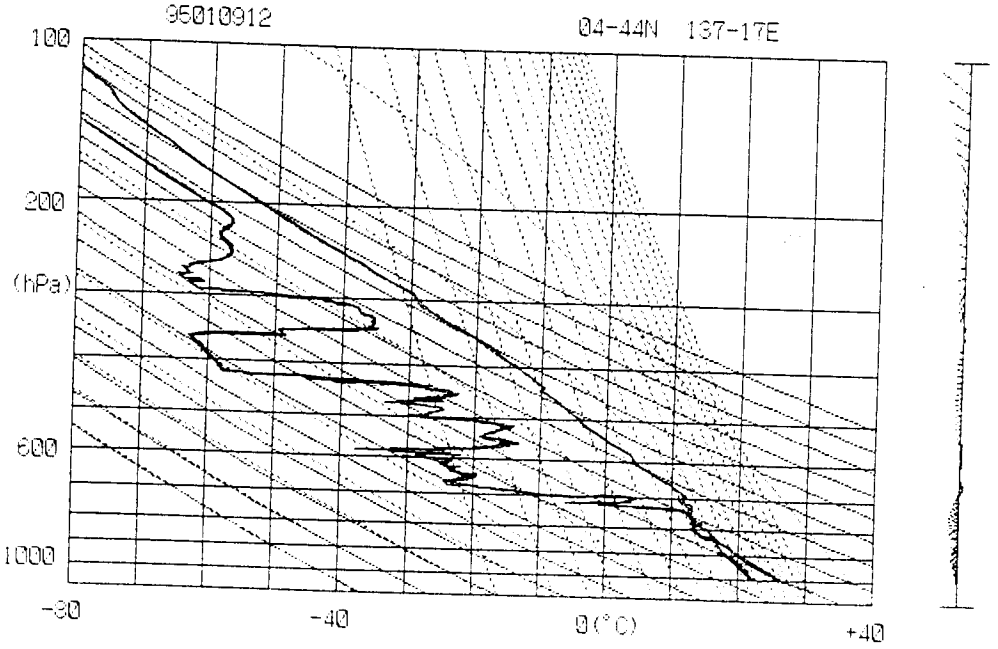
200
(hPa)
600
1000
-80
-40
0(°C)
+40

⑦


95010900
04-04N 139-05E
100
200
(hPa)
600
1000
-80
-40
0(°C)
+40

⑧


95010912
04-44N 137-17E
100
200
(hPa)
600
1000
-80
-40
0(°C)
+40

GMT	Lat.	Long.	WD(16)	WF(m/s)	Weather	Atm.P(hPa)	Air T.(°C)	***
941220/03	06° 05' N	170° 45' E	SSW	2.8	o	1009.2	27.2	
941220/06	06° 30' N	170° 22' E	NNE	1.0	o	1008.4	27.8	
941220/09	06° 07' N	169° 56' E	SW	10.3	o	1010.8	24.8	
941220/12	06° 10' N	169° 44' E	SW	8.7	o	1010.9	25.4	
941220/15	06° 10' N	169° 43' E	SW	9.5	o	1010.6	26.0	
941220/18	05° 41' N	169° 37' E	NNE	3.8	o	1009.3	27.0	
941220/21	05° 18' N	169° 21' E	SW	5.0	c	1011.3	28.2	
941221/00	04° 53' N	169° 06' E	SW	1.0	c	1010.4	29.0	
941221/03	04° 42' N	168° 50' E	NE	3.0	bc	1008.7	28.2	
941221/06	04° 43' N	168° 51' E	NNE	6.9	c	1008.3	28.6	
941221/09	04° 29' N	168° 32' E	NE	8.4	c	1010.6	27.9	
941221/12	03° 55' N	168° 20' E	NNE	6.7	c	1011.7	27.4	
941221/15	03° 28' N	168° 07' E	NNE	8.4	o	1010.8	27.6	
941221/18	02° 50' N	167° 55' E	NNE	8.2	c	1009.8	28.2	
941221/21	02° 18' N	167° 45' E	NNE	8.4	c	1010.3	29.0	
941222/00	02° 01' N	167° 35' E	NNE	9.0	c	1011.0	30.4	
941222/03	02° 00' N	167° 04' E	NNE	7.0	c	1009.7	29.4	
941222/06	01° 59' N	166° 34' E	NNE	7.8	bc	1009.2	29.4	
941222/09	01° 59' N	166° 04' E	NNE	7.1	bc	1011.4	28.4	
941222/12	01° 60' N	165° 34' E	N	7.8	bc	1012.3	28.0	SHIPTIME=GMT+11h
941222/15	01° 60' N	165° 08' E	NNW	8.0	c	1011.3	28.0	
941222/18	02° 00' N	165° 05' E	NW	7.5	c	1010.2	26.5	
941222/21	02° 00' N	165° 01' E	NW	6.2	bc	1011.1	27.9	
941223/00	02° 01' N	165° 01' E	NW	10.5	bc	1011.1	28.5	
941223/03	02° 60' N	165° 01' E	NW	9.5	bc	1009.3	29.2	
941223/06	02° 00' N	165° 02' E	NNW	9.0	bc	1007.8	28.2	
941223/09	01° 50' N	165° 03' E	NW	2.6	bc	1011.9	28.0	
941223/12	01° 12' N	165° 02' E	NW	8.5	bc	1012.2	28.1	
941223/15	00° 38' N	165° 01' E	NNW	7.6	bc	1010.5	28.0	
941223/18	00° 07' N	164° 60' E	NW	8.6	bc	1009.5	28.1	
941223/21	00° 00' S	165° 02' E	NW	11.3	bc	1010.3	29.4	
941224/00	00° 00' S	164° 53' E	NW	9.5	bc	1010.6	30.9	
941224/03	00° 00' N	164° 55' E	WSW	7.0	o	1009.2	27.0	
941224/06	00° 00'	164° 56' E	WNW	9.2	bc	1006.8	27.5	
941224/09	00° 01' S	164° 50' E	WNW	9.1	bc	1010.8	26.4	
941224/12	00° 22' S	164° 25' E	WSW	8.5	o	1011.1	27.5	
941224/15	00° 33' S	164° 00' E	WSW	9.6	o	1010.3	28.0	
941224/18	00° 45' S	163° 37' E	WNW	8.8	o	1008.7	28.2	
941224/21	01° 02' S	163° 10' E	WSW	8.6	bc	1010.2	28.5	
941225/00	01° 14' S	162° 49' E	WSW	9.8	bc	1010.1	31.0	
941225/03	01° 28' S	162° 21' E	W	9.5	bc	1008.7	29.6	
941225/06	01° 40' S	161° 60' E	WNW	11.0	bc	1008.0	30.2	
941225/09	01° 55' S	161° 33' E	W	10.8	bc	1009.3	29.0	

Ship Time	eawater TEMP.(°C	Wet bulb TEMP.(°C)	Dew point TEMP.(°C)
1220/15	28	24.6	24
1220/18	28	24.6	23.2
1220/21	28	23.9	23.5
1221/00	28	24.0	23.4
1221/03	28	24.6	24
1221/06	28	24.6	24
1221/09	28	25.1	24.5
1221/12	28	27.0	26.4
1221/15	28	26.2	25.3
1221/18	28	26.2	25.6
1221/21	28	26.9	26.8
1222/00	28	26.4	26.1
1222/03	28	26.2	25.5
1222/06	28	26.3	26
1222/09	28	26.6	25.8
1222/12	29	27.1	26
1222/15	29	26.8	26.2
1222/18	29	26.4	25.6
1222/21	29	26.3	25.6
1222/23	29	26.6	26.1
1223/02	28	26.2	25.3
1223/05	28	25.3	24.2
1223/08	28	24.9	23.9
1223/11	28	25.5	24.4
1223/14	28	26.0	25
1223/17	28	26.0	25.4
1223/20	28	26.1	25.3
1223/23	28	25.5	24.6
1224/02	29	25.8	25.3
1224/05	29	25.9	25.2
1224/08	29	26.1	25.1
1224/11	29	27.1	25.9
1224/14	29	25.5	25
1224/17	29	25.4	24.7
1224/20	29	25.9	25.5
1224/23	29	25.2	24.4
1225/02	29	25.0	23
1225/05	29	26.7	26.2
1225/08	29	26.6	25.9
1225/11	29	26.4	24.9
1225/14	29	26.4	25.5
1225/17	29	26.7	25.5
1225/20	29	26.9	26

GMT	Lat.	Long.	WD(16)	WF(m/s)	Weather	Atm.P(hPa)	Air T.(°C)	***	Ship Time	eawater TEMP.(°C	Wet bulb TEMP.(°C)	Dew point TEMP.(°C)
941225/12	02° 11' S	161° 06' E	W	9.7	bc	1010.4	28.9		1225/23	29	26.1	25.4
941225/15	02° 23' S	160° 44' E	WSW	9.6	bc	1009.1	28.6		1226/02	29	26.0	25.1
941225/18	02° 38' S	160° 16' E	WSW	9.0	bc	1009.0	28.8		1226/05	29	26.2	25.3
941225/21	02° 50' S	159° 54' E	W	9.0	bc	1010.6	28.8		1226/08	29	25.8	24.7
941226/00	03° 06' S	159° 26' E	WSW	7.9	bc	1010.7	31.8		1226/11	29	26.9	25.4
941226/03	03° 20' S	158° 60' E	SW	7.0	bc	1008.8	31.6		1226/14	29	26.6	24.8
941226/06	03° 34' S	158° 35' E	SW	8.0	bc	1007.8	30.6		1226/17	29	26.3	24.9
941226/09	03° 50' S	158° 05' E	SW	5.9	bc	1010.3	28.7		1226/20	29	26.0	25.1
941226/12	04° 04' S	157° 42' E	SW	6.5	bc	1011.3	28.8		1226/23	29	25.8	24.8
941226/15	04° 11' S	157° 10' E	WSW	4.0	bc	1010.2	27.4	SHIPTIME=GMT+10h	1227/01	29	26.0	25.5
941226/18	04° 39' S	156° 38' E	SW	4.0	bc	1009.4	27.4		1227/04	29	25.8	25.5
941226/21	04° 57' S	156° 07' E	SSW	1.9	bc	1011.7	28.2		1227/07	29	25.6	24.6
941227/00	05° 02' S	156° 02' E	SSW	2.0	bc	1011.4	32.8		1227/10	29	27.1	25.3
941227/03	05° 00' S	156° 03' E	SE	2.5	bc	1009.3	31.8		1227/13	29	26.9	25.4
941227/06	04° 59' S	156° 01' E	WNW	2.0	bc	1008.3	30.0		1227/16	29	25.6	23.9
941227/09	04° 31' S	156° 01' E	NW	4.3	bc	1010.2	28.6		1227/19	29	26.2	25.3
941227/12	03° 55' S	156° 01' E	WNW	4.0	bc	1011.5	28.6		1227/22	29	26.1	25.3
941227/15	03° 18' S	156° 00' E	W	4.8	bc	1009.8	28.8		1228/01	29	26.0	25
941227/18	02° 39' S	156° 00' E	W	5.3	bc	1008.8	28.4		1228/04	29	25.7	24.6
941227/21	02° 05' S	156° 00' E	W	4.0	bc	1011.4	28.2		1228/07	29	26.0	25
941228/00	02° 00' S	156° 00' E	W	7.5	bc	1011.8	31.4		1228/10	29	26.7	25.1
941228/03	02° 03' S	155° 52' E	WSW	6.5	bc	1009.6	31.4		1228/13	29	26.8	25.5
941228/06	02° 08' S	155° 34' E	WSW	6.5	bc	1008.3	29.8		1228/16	29	26.4	25.3
941228/09	02° 17' S	155° 09' E	WSW	8.0	c	1010.2	28.2		1228/19	29	25.8	25
941228/12	02° 20' S	154° 44' E	WSW	8.9	bc	1011.0	28.4		1228/22	29	25.8	25
941228/15	02° 20' S	154° 17' E	SW	6.9	bc	1009.9	27.2		1229/01	29	25.0	24.3
941228/18	02° 20' S	153° 49' E	WSW	8.0	bc	1008.9	27.7		1229/04	29	25.3	24.6
941228/21	02° 20' S	153° 22' E	WSW	8.0	p	1010.3	26.8		1229/07	29	25.4	25
941229/00	02° 20' S	152° 55' E	WSW	9.0	bc	1011.1	29.9		1229/10	29	26.2	24.9
941229/03	02° 20' S	152° 25' E	W	10.5	bc	1008.8	28.0		1229/13	29	25.2	23.9
941229/06	02° 21' S	151° 58' E	W	11.3	bc	1007.9	28.7		1229/16	29	24.8	23.5
941229/09	02° 37' S	151° 34' E	WSW	10.6	c	1009.4	26.8		1229/19	29	24.6	23.8
941229/12	02° 35' S	151° 12' E	SW	7.7	bc	1011.4	27.0		1229/22	29	25.5	25
941229/15	02° 28' S	150° 48' E	WSW	6.0	bc	1009.8	27.1		1230/01	29	24.8	
941229/18	02° 30' S	150° 42' E	W	5.7	bc	1008.5	27.0		1230/04	29	25.2	
941229/21	02° 30' S	150° 42' E	S	4.0	bc	1010.7	26.0		1230/07	28	24.8	24.4
								KAVIENG	0101/10			
950102/03	02° 19' S	150° 26' E	WNW	6.0	bc	1008.7	29.0		0102/13	29	26.2	25
950102/06	01° 58' S	149° 57' E	SW	6.9	bc	1007.3	29.8		0102/16	29	26.2	24.8
950102/09	01° 38' S	149° 26' E	W	8.2	bc	1008.0	28.7		0102/19	29	25.3	24
950102/12	01° 18' S	148° 56' E	W	9.6	bc	1009.0	28.7		0102/22	29	25.0	23.6
950102/15	00° 59' S	148° 29' E	WNW	11.0	bc	1009.1	27.0		0103/01	29	25.2	24.3
950102/18	00° 43' S	148° 05' E	NW	3.7	o	1007.7	26.2		0103/04	29	24.4	23.8

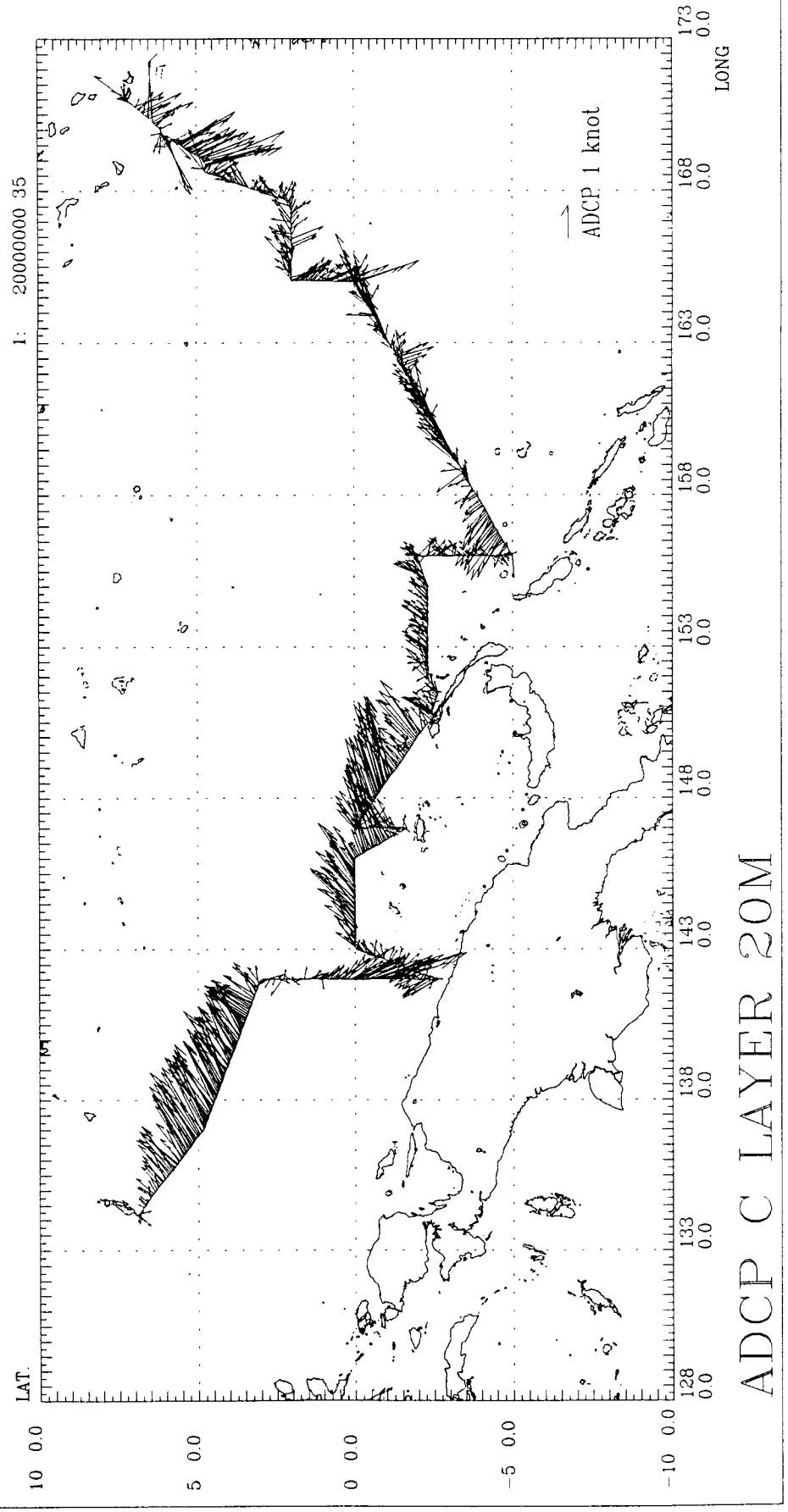
GMT	Lat.	Long.	WD(16)	WF(m/s)	Weather	Atm.P(hPa)	Air T.(°C)
950102/21	00° 26' S	147° 38' E	WNW	3.2	bc	1008.8	27.2
950103/00	00° 08' S	147° 11' E	SSW	2.4	bc	1009.9	29.3
950103/03	00° 02' S	146° 59' E	W	1.0	bc	1009.2	30.0
950103/06	00° 00' S	147° 05' E	N	6.0	o	1008.2	27.5
950103/09	00° 01' N	147° 04' E	NNE	4.8	o	1008.3	27.0
950103/12	00° 02' S	146° 58' E	NNE	2.5	bc	1008.9	27.4
950103/15	00° 04' S	147° 00' E	NNE	3.0	bc	1007.9	27.5
950103/18	00° 00' S	146° 58' E	N	1.8	bc	1007.1	27.2
950103/21	00° 01' S	146° 60' E	E	5.0	c	1006.7	27.0
950104/00							
950104/03	00° 30' S	147° 00' E	W	2.8	o	1009.2	30.6
950104/06	01° 00' S	147° 00' E	N	2.9	c	1007.3	28.5
950104/09	01° 30' S	147° 00' E		0.0	bc	1007.9	28.3
950104/12	01° 34' S	146° 56' E	NW	2.9	bc	1009.3	28.0
950104/15	01° 02' S	146° 37' E	WNW	4.9	bc	1009.0	27.6
950104/18	00° 32' S	146° 20' E	NNW	1.9	bc	1007.9	27.2
950104/21	00° 04' S	146° 02' E	NNW	5.7	c	1009.3	26.7
950105/00	00° 00' N	145° 40' E		0.0	c	1010.1	27.2
950105/03	00° 00' N	145° 10' E	N	6.7	c	1009.4	29.1
950105/06	00° 00' N	144° 42' E	NW	4.1	c	1007.8	28.9
950105/09	00° 00' N	144° 08' E	NW	5.8	bc	1009.1	27.8
950105/12	00° 00'	143° 44' E	NNW	4.9	bc	1009.9	27.8
950105/15	00° 00'	143° 13' E	NW	2.6	bc	1010.7	27.6
950105/18	00° 15' S	142° 55' E	SSW	2.6	bc	1009.8	27.8
950105/21	00° 49' S	142° 42' E	WNW	4.2	bc	1011.0	27.7
950106/00	01° 23' S	142° 29' E	WSW	6.7	bc	1012.5	27.8
950106/03	01° 59' S	142° 04' E	W	5.9	bc	1011.2	28.1
950106/06	02° 33' S	142° 03' E	WNW	6.9	bc	1008.6	29.4
950106/09	02° 30' S	141° 60' E	WNW	8.5	bc	1008.9	28.2
950106/12	01° 60' S	141° 60' E	NW	8.0	bc	1011.5	28.4
950106/15	01° 30' S	141° 60' E	NW	9.0	bc	1011.5	27.6
950106/18	01° 01' S	142° 00' E	WNW	8.0	bc	1010.1	26.8
950106/21	00° 38' S	142° 00' E	NNW	7.0	c	1010.8	27.8
950107/00	00° 13' S	141° 59' E	NW	7.1	c	1012.7	27.4
950107/03	00° 01' S	142° 01' E	WNW	4.5	c	1011.5	29.8
950107/06	00° 00' N	141° 59' E	W	7.0	c	1009.8	29.5
950107/09	00° 00' S	141° 59' E	WNW	8.4	c	1008.0	28.0
950107/12	00° 30' N	141° 60' E	WNW	6.5	bc	1010.8	27.5
950107/15	01° 00' N	141° 60' E	NNW	3.5	r	1010.7	25.2
950107/18	01° 14' N	141° 60' E	NW	4.5	r	1009.2	25.6
950107/21	01° 50' N	141° 59' E	N	7.3	o	1009.2	27.1
950108/00	02° 16' N	141° 60' E	N	8.5	o	1011.3	29.0
950108/03	02° 46' N	142° 00' E	NNE	9.4	c	1009.9	28.8

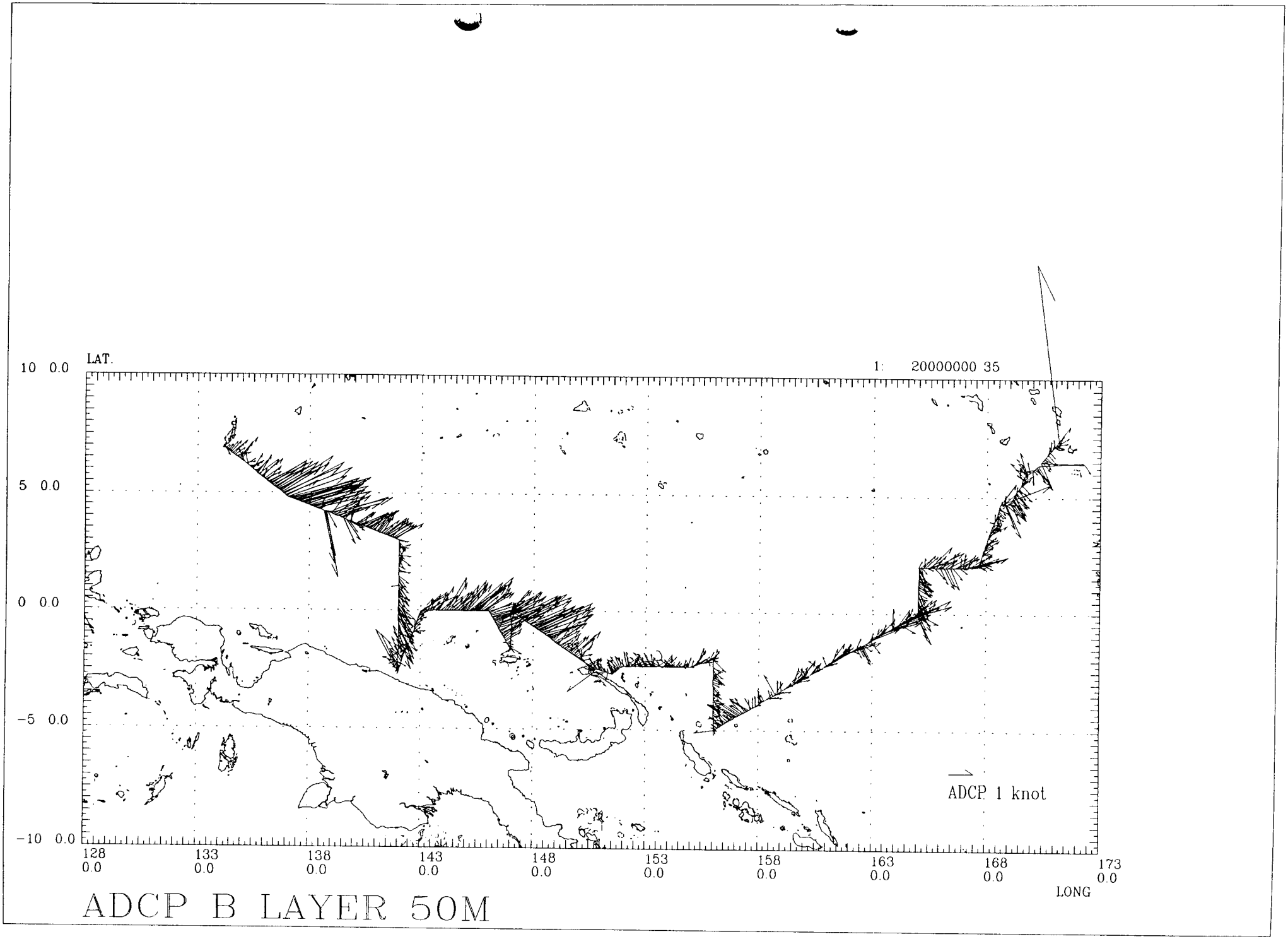
***

Ship Time	eawater TEMP.(°C	Wet bulb TEMP.(°C)	Dew point TEMP.(°C)
0103/07	29	24.2	23.1
0103/10	29	25.5	24.2
0103/13	29	26.0	24.6
0103/16	29	25.5	24.8
0103/19	29	25.0	24.3
0103/22	29	25.0	24.1
0104/01	29	25.1	24.1
0104/04	29	25.4	24.8
0104/07	29	25.5	25
0104/10			
0104/13	29	27.9	27.2
0104/16	29	26.4	25.8
0104/19	29	25.3	24.2
0104/22	29	25.2	24.2
0105/01	28	25.9	25.5
0105/04	28	25.5	25
0105/07	28	24.8	24.1
0105/10	28	25.4	23.5
0105/13	28	26.3	25.6
0105/16	28	25.9	25
0105/19	28	25.5	24.7
0105/22	28	25.4	24.6
0106/01	28	25.7	24.8
0106/04	28	24.5	23.2
0106/07	28	25.2	24.2
0106/10	28	25.4	24.6
0106/13	28	26.0	25.3
0106/16	29	25.7	24.3
0106/19	29	25.3	24.7
0106/22	29	25.8	24.8
0107/01	29	25.8	25.3
0107/04	28	25.0	24.3
0107/07	28	25.5	24.7
0107/10	28	25.2	24.4
0107/13	28	25.5	23.9
0107/16	29	25.5	23.9
0107/19	28	25.4	24.5
0107/22	28	25.4	24.7
0108/01	28	24.6	24.1
0108/04	28	25.2	24.8
0108/07	28	24.8	23.8
0108/10	28	25.0	23.5
0108/13	28	25.4	24.3

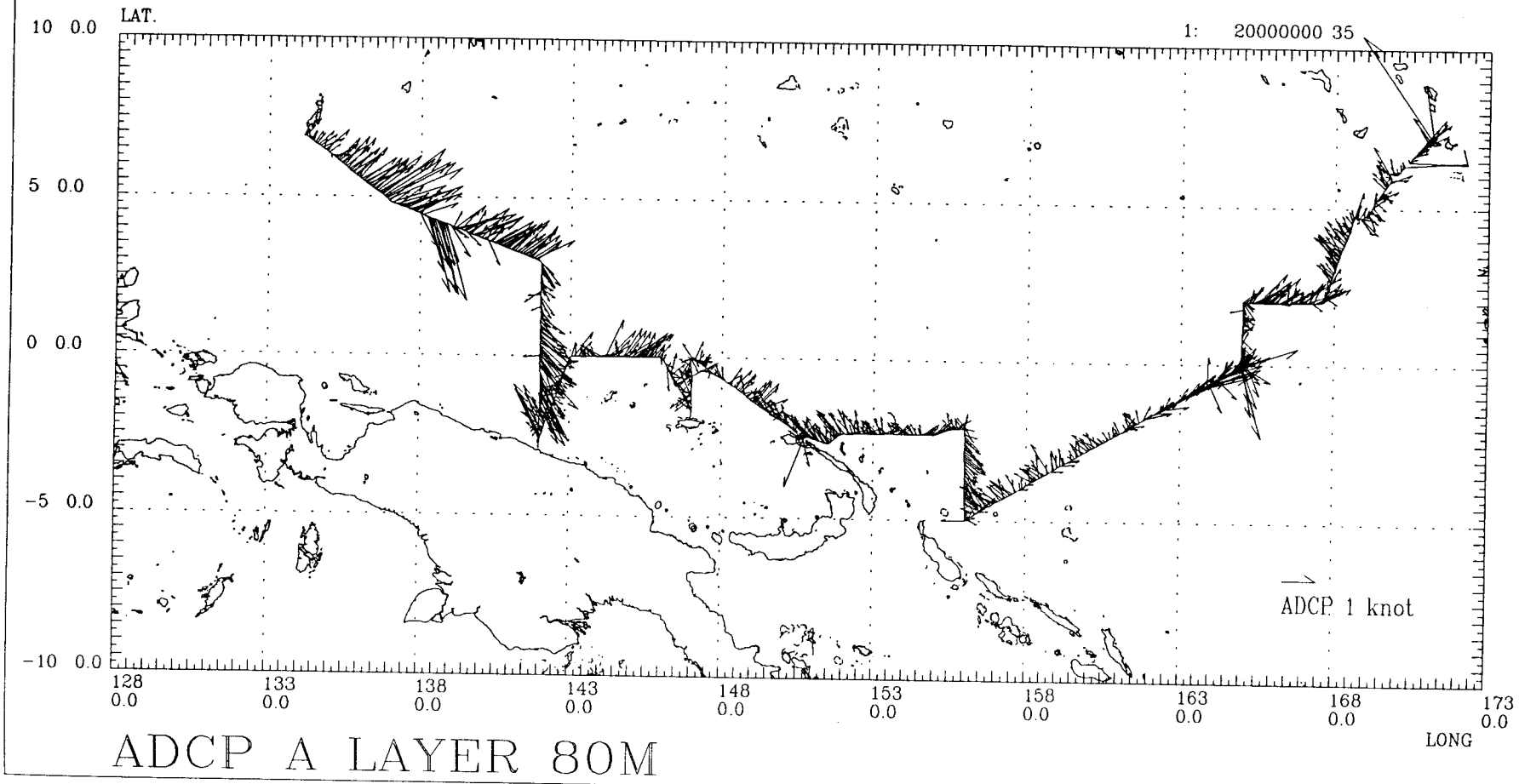
GMT	Lat.	Long.	WD(16)	WF(m/s)	Weather	Atm.P(hPa)	Air T.(°C)	***	Ship Time	eawater TEMP.(°C	Wet bulb TEMP.(°C)	Dew point TEMP.(°C)
950108/06	03° 03' N	141° 51' E	NNE	8.5	c	1008.3	28.6		0108/16	28	25.2	23.7
950108/09	03° 16' N	141° 17' E	NE	7.3	bc	1008.7	28.0		0108/19	28	24.6	23.6
950108/12	03° 25' N	140° 53' E	NE	6.2	c	1010.4	27.8		0108/22	28	24.6	23.4
950108/15	03° 37' N	140° 21' E	NNE	8.0	bc	1010.3	27.0	SHIPTIME=GMT+9h	0109/00	28	24.4	23.6
950108/18	03° 45' N	139° 58' E	NE	6.5	bc	1008.6	27.6		0109/03	28	24.2	22.7
950108/21	03° 56' N	139° 27' E	NE	6.0	bc	1008.3	26.8		0109/06	28	23.6	22.3
950109/00	04° 06' N	139° 01' E	ENE	7.5	bc	1011.0	29.2		0109/09	28	24.4	22.6
950109/03	04° 16' N	138° 34' E	ENE	4.2	bc	1009.3	30.2		0109/12	28	25.2	23.4
950109/06	04° 26' N	138° 04' E	NNE	4.2	bc	1007.1	28.4		0109/15	28	24.2	22.5
950109/09	04° 36' N	137° 40' E	NNE	6.6	bc	1007.8	28.3		0109/18	28	24.6	23.2
950109/12	04° 47' N	137° 09' E	N	3.9	bc	1009.5	26.8		0109/21	28	24.8	24.1
950109/15	04° 60' N	136° 49' E	NNE	4.3	bc	1009.3	26.4		0110/00	28	24.6	24
950109/18	05° 20' N	136° 20' E	ENE	4.2	bc	1007.6	26.4		0110/03	28	24.6	24
950109/21	05° 35' N	135° 59' E	E	5.0	bc	1008.6	26.2		0110/06	28	24.5	23.9
950110/00	05° 57' N	135° 31' E	ENE	5.2	bc	1010.4	28.4		0110/09	28	25.2	24
950110/03	06° 19' N	135° 01' E	E	5.5	bc	1008.8	32.3		0110/12	28	26.9	24.9
950110/06	06° 35' N	134° 39' E	NNE	3.8	bc	1006.8	27.8		0110/15	28	25.4	23.6
950110/09	06° 55' N	134° 11' E	NE	7.6	bc	1007.6	28.9		0110/18	28	25.5	24.3
950110/12	07° 32' N	134° 16' E	NE	8.6	bc	1009.5	28.0		0110/21	28	25.2	24.2
950110/15	07° 39' N	134° 22' E	NE	8.0	bc	1009.8	27.2		0111/00	28	25.2	24.5
950110/18	07° 39' N	134° 22' E	ENE	8.0	bc	1008.5	27.6		0111/03	28	24.4	23.4
950110/21	07° 38' N	134° 22' E	NE	9.7	bc	1009.0	27.7		0111/06	28	23.9	22.4

6. Shipboard ADCP Velocity Map





ADCP B LAYER 50M



ADCP A LAYER 80M

DEPLOYMENT & RECOVERY

MOORING No. 950104-00N147E

PROJECT	TOCS	TIME	UTC
AREA	熱帯赤道 Western Pacific	RECORDER (D)	A. ITO
POSITION	00° N 147° E	(R)	
DEPTH	4490m		
PERIOD	1995.01.04 ~ 1996.	NAVIGATION SYSTEM :	WGS 84
No.of DAYS	365		
LENGTH :	4149.1 m	DEPTH of BUOY : 270 m	BUOYANCY : kg

ACOUSTIC RELEASER

TYPE (上)	865A-DB-13	TYPE (下)	865A-DB-13
S/N	634	S/N	631
RECEIVE F.	13.0 kHz	RECEIVE F.	13.0 kHz
TRANSMIT F.	14.5 kHz	TRANSMIT F.	13.5 kHz
ENABLE C.	F	ENABLE C.	C
RELEASE C.	E	RELEASE C.	B
BATTERY	2 years	BATTERY	2 years
TEST on DECK	OK	TEST on DECK	OK

DEPLOYMENT

DATE 1995.01.04 20:50 ~ 22:36 SHIP KAIYO CRUSE No. K94-06

WEATHER bc CONDITIONS 1.0m 8.8 DIR. of WIND 40° VEL. of WIND 4.5m

DEPTH 4466 m DEPTH of A.R. 4451 m DESCEND. RATE m/s BUOY 20:55

POS. of SHIP 00° 00.855S 146 57.721 E HOR.RANGE 1414 m SINKER 22:36

POS. of DEP. 00° 01.412S 146° 57.279 E DIRECTION ° DISAPPEAR. :

POS. of MOORING 00° 01.391S 146° 57.170E LANDING :

NOTE

リリーサが眠っていたため着底まで追跡できず。

生端ブイ水没の確認は太陽光によってできず。

SSBL	TIME	S / R	DEPTH

RECOVERY

DATE SHIP CRUSE No.

WEATHER CONDITIONS DIR. of WIND VEL. of WIND

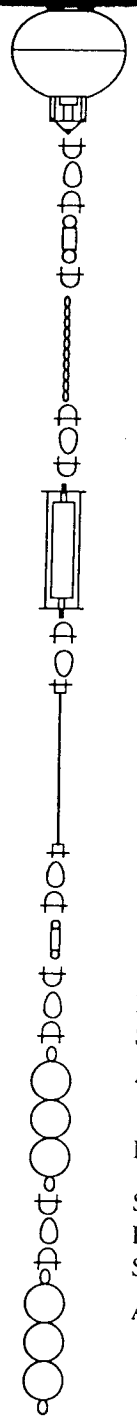
START of RELEASE : FINISH of RELEASE : :

POS. of DISCOVERY ° ° ASCENDING RATE m/s

DIRECTION ° DISTANCE m

NOTE

SSBL	TIME	S / R	DEPTH



ADCP
S/N 1221

SHACKLE 18mm
RING 19mm
SHACKLE 18mm
SWIVEL BS103
SHACKLE 16mm

CHAIN
13mm x 3.0m

SHACKLE 16mm
RING 19mm
SHACKLE 16mm

CTD SBE16
S/N 1286

SHACKLE 16mm
RING 19mm

WIRE
9mm x 50m

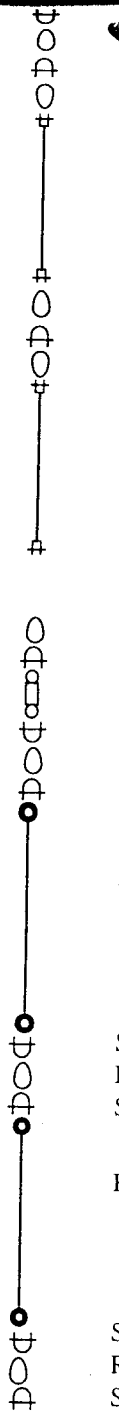
RING 19mm
SHACKLE 18mm
SWIVEL BS103
SHACKLE 18mm
RING 19mm
SHACKLE 26mm

ABS BUOY
CT608B

NYLON 3.3m

SHACKLE 26mm
RING 19mm
SHACKLE 26mm

ABS BUOY
CT608B



SHACKLE 26mm
RING 19mm
SHACKLE 18mm
RING 19mm

WIRE
11mm x 200m

RING 19mm
SHACKLE 18mm
RING 19mm

WIRE
11mm x 200m

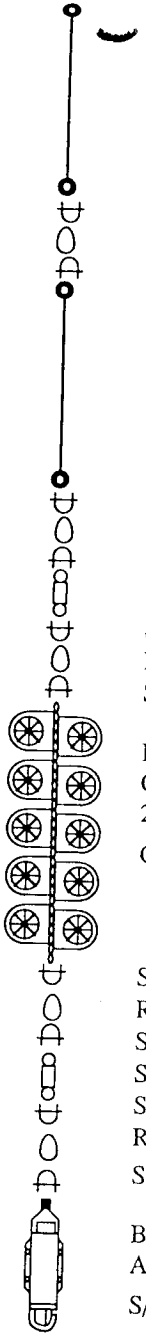
RING 19mm
SHACKLE 18mm
SWIVEL BS103
SHACKLE 18mm
RING 19mm
SHACKLE 16mm

KEVLER
12mm x 1010m

SHACKLE 16mm
RING 19mm
SHACKLE 16mm

KEVLER
12mm x 1010m

SHACKLE 16mm
RING 19mm
SHACKLE 16mm



KEVLER
12mm x 1010m

SHACKLE 16mm
RING 19mm
SHACKLE 16mm

KEVLER
12mm x 505m

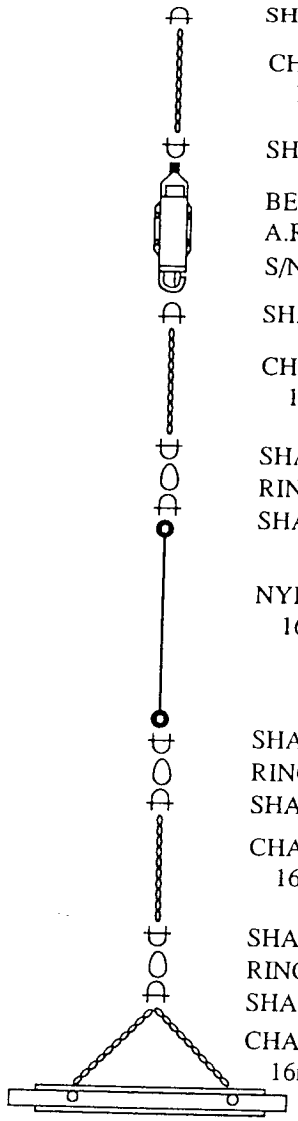
SHACKLE 16mm
RING 19mm
SHACKLE 18mm
SWIVEL BS103
SHACKLE 18mm
RING 19mm
SHACKLE 16mm

BENTHOS
GLASS BALL
2040-17V x 10ps.

CHAIN
13mm x 8m

SHACKLE 16mm
RING 19mm
SHACKLE 18mm
SWIVEL BS103
SHACKLE 18mm
RING 19mm
SHACKLE 16mm

BENTHOS
A.R.
S/N 634



SHACKLE 14mm

CHAIN
16mm x 5m

SHACKLE 16mm

BENTHOS
A.R.
S/N 631

SHACKLE 14mm

CHAIN
16mm x 2.0m

SHACKLE 18mm
RING 19mm
SHACKLE 18mm

NYLON
16mm x 145m

SHACKLE 18mm
RING 19mm
SHACKLE 20mm

CHAIN
16mm x 10m

SHACKLE 20mm
RING 19mm
SHACKLE 20mm

CHAIN
16mm x 5m x 2

RAIL SINKER

0° 147° E
4495m

TIME RECORD

MOORING NO.: 950105-00N147E

		DEPLOYMENT		RECOVERY (Date:)	
		START: 20:50		START:	
		FINISH: 22:36		FINSH:	
ITEMS	S/N etc.	TIME	MEMO	TIME	MEMO
ADCP	1221	20:55			
CTD	1282	20:55			
WIRE ROPE	50m	20:58			
ABS BUOY	CT-608B ×6	21:03			
WIRE ROPE	200m	21:05~21:10			
WIRE ROPE	200m	21:12~21:15			
KEVLER ROPE	1010m	21:20~21:31			
KEVLER ROPE	1010m	21:33~21:41			
KEVLER ROPE	1010m	21:45~21:55			
KEVLER ROPE	505m	21:57~22:03			
GLASS BALL	2040-17V ×10	22:09			
A.R.	634	22:09			
A.R.	631	22:10			
NYLON ROPE	145m	22:10~22:13			
CHAIN	10m	22:31	22:15~22:25 航走		
ANCHOR		22:36			

GLASS BALLは回収したものを使用せず、全て新品を使用
NYLON ROPEは設計より30m短くする。

TIME RECORD

MOORING NO.: 940428-00N147E

		DEPLOYMENT		RECOVERY (Date: 95.01.03)	
		START: 23:50		START: 02:41	
		FINISH: 01:51		FINSH: 04:17	
ITEMS	S/N etc.	TIME	MEMO	TIME	MEMO
ADCP	1220	23:58		02:48	
CTD	1284	23:59		02:54	
WIRE ROPE	50m	00:04		02:56~02:58	
ABS BUOY	CT-608B × 6	00:09		02:59	
WIRE ROPE	200m	00:09 ~		03:02~	
WIRE ROPE	200m	00:17~		03:06~	
KEVLER ROPE	1010m	00:28~		03:09~	
KEVLER ROPE	1010m	00:41~		03:25~	
KEVLER ROPE	500m	00:59~		03:48~	
KEVLER ROPE	1010m	01:10~01:23		03:58~	
GLASS BALL	2040-17V × 10	01:33		04:16	
A.R.	663	01:34		04:16	
A.R.	665	01:34		04:16	
NYLON ROPE	150m	01:34~01:38			
CHAIN	10m				
ANCHOR		01:49			

GLASS BALLは回収したものをそのまま使用。
アンカー直上にパラシュートを装着。そのためGLASS BALL水没に約2分かかった。

02:38 ADCPライセにロープを
つけた。
03:15 ガラスブイ浮上確認
ガラスブイをふんで揚収
ドリースコマンド = 02:14

DEPLOYMENT & RECOVERY

MOORING No. 950107-00N 142E

PROJECT	TOCS	TIME	UTC
AREA	Western Pacific	RECORDER (D)	Y. KURODA
POSITION	0°, 142°E	(R)	
DEPTH	3390m		
PERIOD	1995.01.07 ~ 1996	NAVIGATION SYSTEM :	WGS 87
No.of DAYS	400		
LENGTH :	m	DEPTH of BUOY :	m BUOYANCY : kg

ACOUSTIC RELEASER

TYPE (E)	865A DB-13	TYPE (F)	865A-DB-13
S/N	635	S/N	662
RECEIVE F.	13.0 kHz	RECEIVE F.	13.0 kHz
TRANSMIT F.	14.5 kHz	TRANSMIT F.	13.5 kHz
ENABLE C.	G	ENABLE C.	B
RELEASE C.	F	RELEASE C.	A
BATTERY	2 year	BATTERY	2 year
TEST on DECK	OK	TEST on DECK	OK

(00°-00.017N. 141°-59.022E DEPLOYMENT

DATE	1995.01.07 04:00 ~ 05:23	SHIP	KAIYO CRUSE No. K94-06
WEATHER	C. 9 CONDITIONS 1.8m 8.4sec	DIR. of WIND	280 VEL. of WIND 9 m/s
DEPTH	3390 m DEPTH of A.R. m	DESCEND. RATE	2.8 m/s BUOY 04:02
POS. of SHIP	00°00.017N 141°58.518E	HOR.RANGE	930 m SINKER 05:23
POS. of DEP.	00°00.015N 141°59.020E	DIRECTION	90° DISAPPEAR. :
POS. of MOORING	00°00.017N 141°58.862E		LANDING 05:43

NOTE

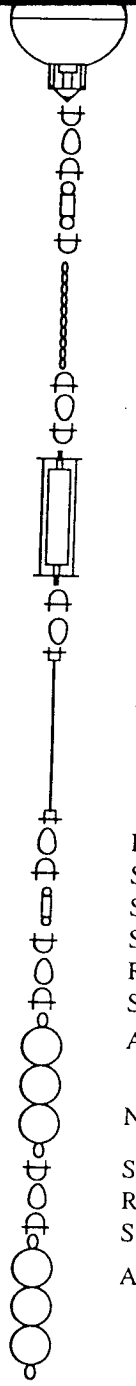
Start : 00-00.106N, 142°-00.754E 3357m 4:00 1.8 kt.
Kevler : 00-00.056N, 142°-00.496E 3386m 4:23 1.9 kt.
Nylon : 00-00.068N, 141°-59.368E 3394m 4:59 2.3 kt.

	TIME	S/R	DEPTH
SSBL			

RECOVERY

DATE		SHIP	CRUSE No.
WEATHER	CONDITIONS	DIR. of WIND	VEL. of WIND
START of RELEASE	:	FINISH of RELEASE	:
POS. of DISCOVERY	°	°	
DIRECTION	°	ASCENDING RATE	m/s
NOTE		DISTANCE	m

	TIME	S/R	DEPTH
SSBL			



S/N 1150

SHACKLE 18mm
RING 19mm
SHACKLE 18mm
SWIVEL BS103
SHACKLE 16mm

CHAIN
13mm x 3.0m

SHACKLE 16mm
RING 19mm
SHACKLE 16mm

CTD SBE16
S/N 1279

SHACKLE 16mm
RING 19mm

WIRE
11mm x 50m

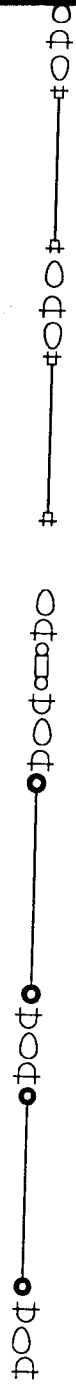
RING 19mm
SHACKLE 18mm
SWIVEL BS103
SHACKLE 18mm
RING 19mm
SHACKLE 26mm

ABS BUOY
CT608B

NYLON 3.3m

SHACKLE 26mm
RING 19mm
SHACKLE 26mm

ABS BUOY
CT608B



RING 19mm
SHACKLE 18mm
RING 19mm

WIRE
11mm x 200m

RING 19mm
SHACKLE 18mm
RING 19mm

WIRE
11mm x 200m

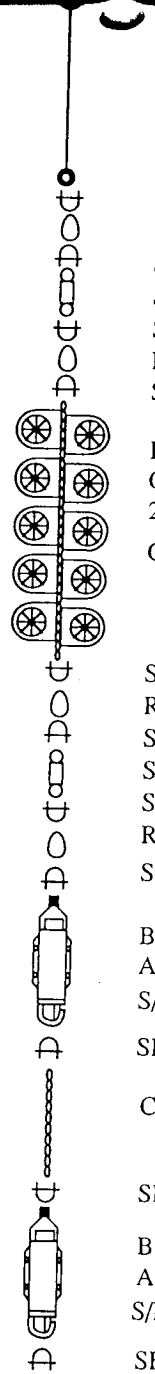
RING 19mm
SHACKLE 18mm
SWIVEL BS103
SHACKLE 18mm
RING 19mm
SHACKLE 16mm

KEVLER
12mm x 1010m

SHACKLE 16mm
RING 19mm
SHACKLE 16mm

KEVLER
12mm x 1010m

SHACKLE 16mm
RING 19mm
SHACKLE 16mm



KEVLER
12mm x 505m

SHACKLE 16mm
RING 19mm
SHACKLE 18mm
SWIVEL BS103
SHACKLE 18mm
RING 19mm
SHACKLE 16mm

BENTHOS
GLASS BALL
2040-17V x 10ps.

CHAIN
13mm x 8m

SHACKLE 16mm
RING 19mm
SHACKLE 18mm
SWIVEL BS103
SHACKLE 18mm
RING 19mm
SHACKLE 16mm

BENTHOS
A.R.
S/N 635

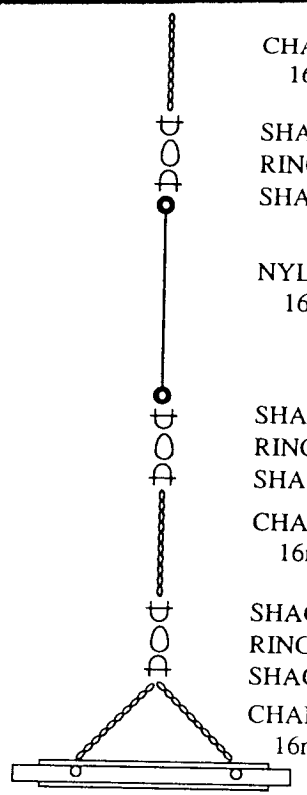
SHACKLE 14mm

CHAIN
16mm x 5m

SHACKLE 16mm

BENTHOS
A.R.
S/N 662

SHACKLE 14mm



CHAIN
16mm x 2.0m

SHACKLE 18mm
RING 19mm
SHACKLE 18mm

NYLON
16mm x 65 m

SHACKLE 18mm
RING 19mm
SHACKLE 20mm

CHAIN
16mm x 10m

SHACKLE 20mm
RING 19mm
SHACKLE 20mm

CHAIN
16mm x 5m × 2

RAIL SINKER

0° 142° E
3394m

TIME RECORD

MOORING NO.: 950107-00N142E

		DEPLOYMENT		RECOVERY (Date:)	
		START : 04:00		START:	
		FINISH: 05:23		FINSH:	
ITEMS	S/N etc.	TIME	MEMO	TIME	MEMO
ADCP	1150	04:02			
CTD	1279	04:02			
WIRE ROPE	50m	04:03~04:04			
ABS BUOY	CT-608B x 6	04:08			
WIRE ROPE	200m	04:10~04:14			
WIRE ROPE	200m	04:17~04:21			
KEVLER ROPE	1010m	04:24~04:36			
KEVLER ROPE	1010m	04:38~04:49			
KEVLER ROPE	505m	04:50~04:56			
GLASS BALL	2040-17V x 10	05:04			
A.R.	635	05:04			
A.R.	662	05:04			
NYLON ROPE	65m	05:04~05:05	05:06 ~ 05:16 船走		
CHAIN	10m				
ANCHOR		05:23			

04:00のADCP作動確認後 投入
147°Eと同位置で回収したシャックル、リング、スウィベル、チェーンを再使用す。
アンカーレッコの時、ふれ止めを切り離すところをストーンフックを切り離してしまった。

TIME RECORD

MOORING NO.: 940501-00N 142E

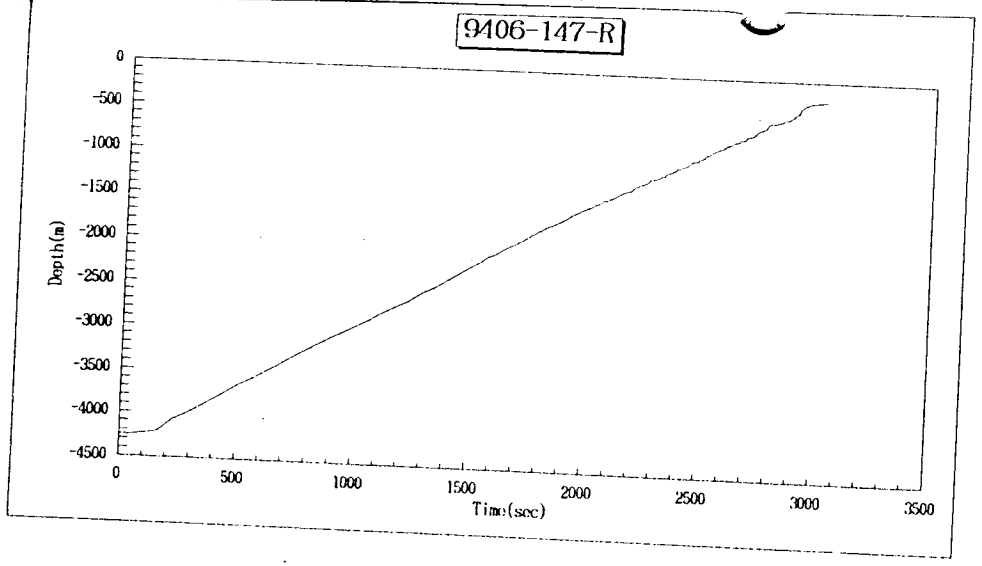
		DEPLOYMENT		RECOVERY (Date: 95.01.07)	
		START : 03:02		START: 02:00	
		FINISH: 04:36		FINSH: 03:14	
ITEMS	S/N etc.	TIME	MEMO	TIME	MEMO
ADCP	1224	03:06		02:02	
CTD	1285	03:07		02:02	
WIRE ROPE	50m	03:07~03:09		02:12~02:14	
ABS BUOY	CT-608B ×6	03:15		02:15	
WIRE ROPE	50m	03:16~		02:16~	
WIRE ROPE	50m	03:18~		02:19~	
WIRE ROPE	50m	03:21~		02:21~	
WIRE ROPE	200m	03:27~		02:22~	
KEVLER ROPE	1010m	03:37~		02:25~	
KEVLER ROPE	1010m	03:53~		02:45~	途中、手巻きになった
KEVLER ROPE	500m	04:10~04:17		03:05~03:12	
GLASS BALL	2040-17U ×10	04:24		03:14	
A.R.	664	04:24		03:13	
A.R.	667	04:25		03:13	
NYLON ROPE	135m	04:25~04:31	200m 航走		
CHAIN	10m	04:34			
ANCHOR		04:36			

NYLON ROPE 15m CUT.

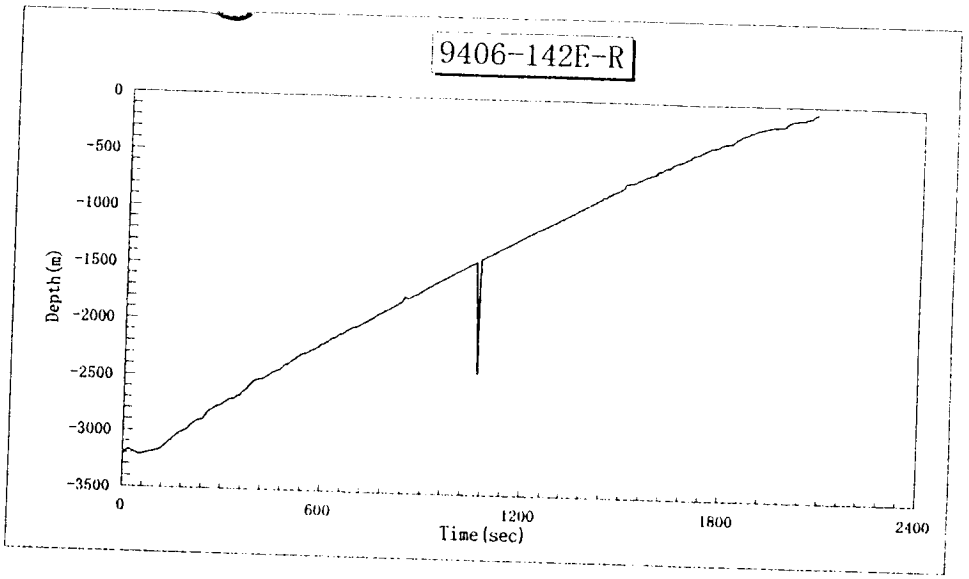
回収したADCPブイのフレームに腐食した裂け目と
また フロートに穴があいていた。 (CREVIS CORROSION)

リリースコマンド 01:29
浮上確認 01:34
ボートをブイにロープ 01:56
グラスブイ 浮上確認 02:03

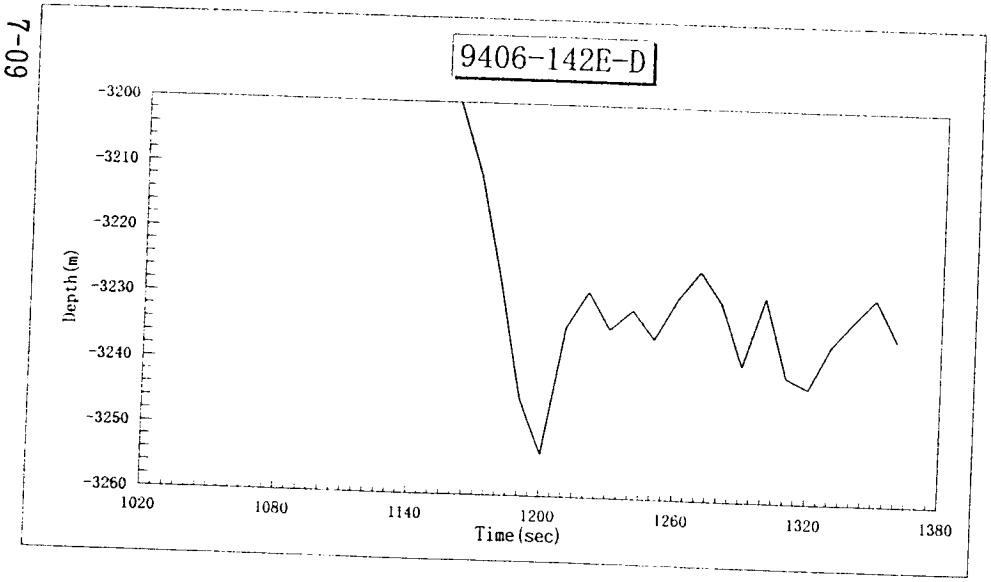
9406-147-R



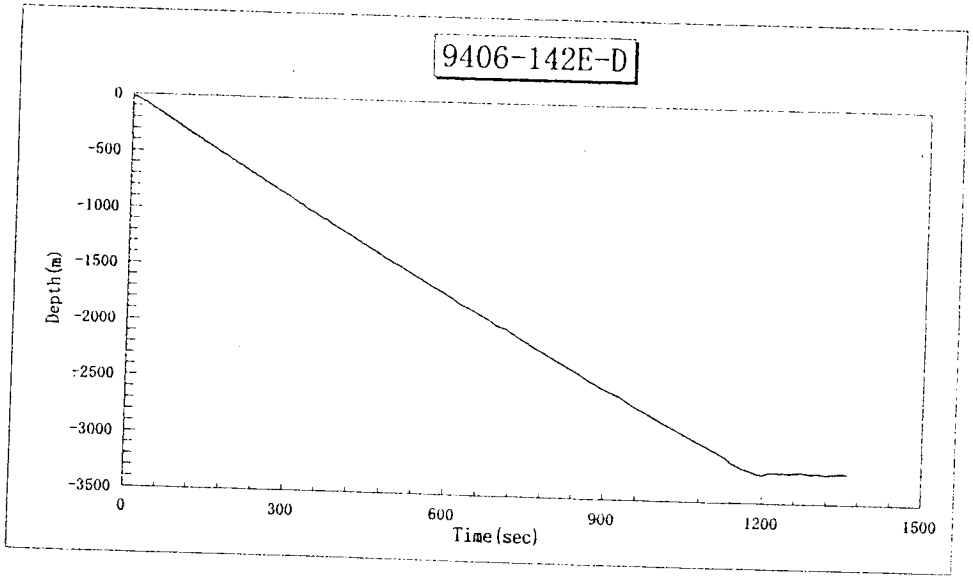
9406-142E-R



9406-142E-D



9406-142E-D



The Results of the recovered ADCP

The time series of the zonal and meridional current components are shown in

Page 7-11～14 [(0°N, 147°E), L22 = 50m depth],
Page 7-15～18 [(0°N, 147°E), L09 = 150m depth],
Page 7-19～21 [(0°N, 142°E), L25 = 50m depth],
and Page 7-22～24 [(0°N, 142°E), L08 = 180m depth].

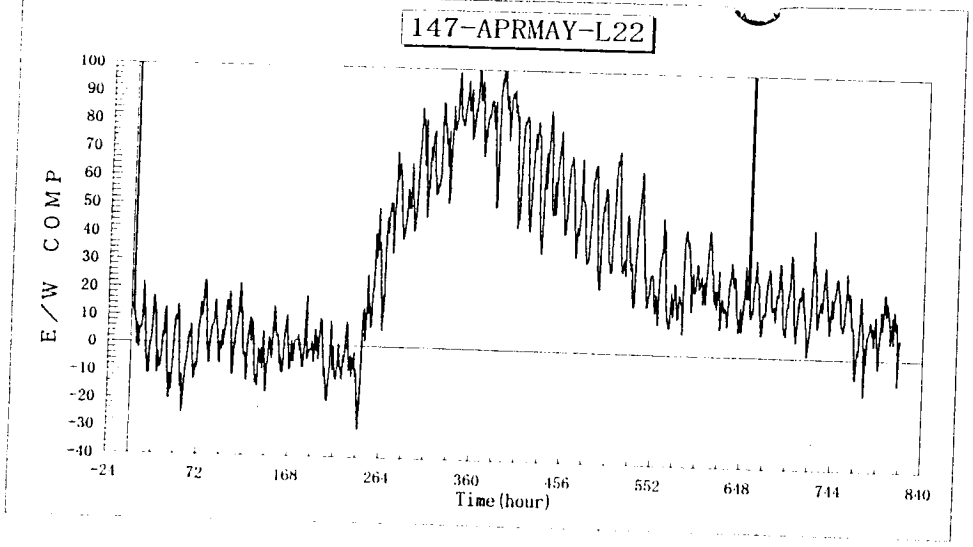
Notes (for deployed moorings)

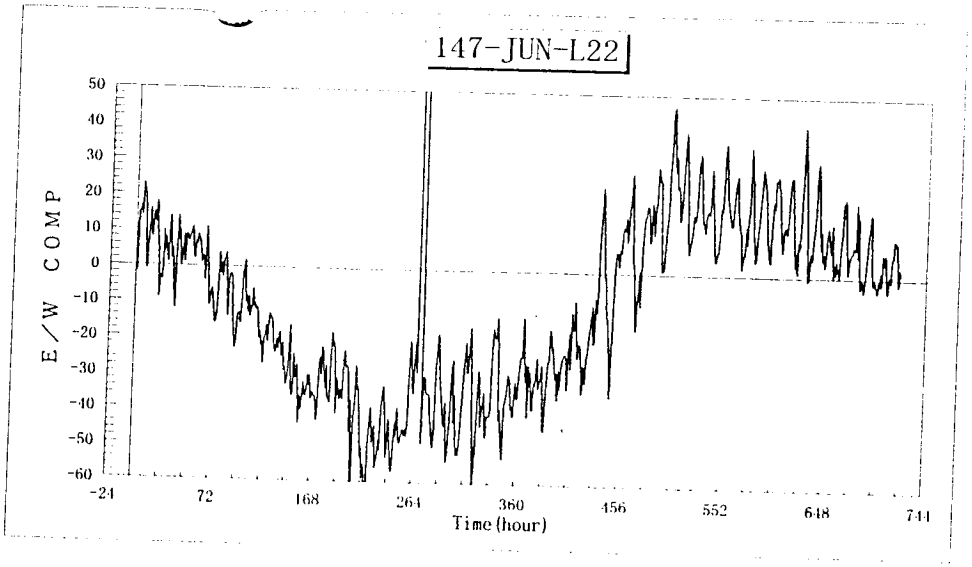
ADCP Set Up Status

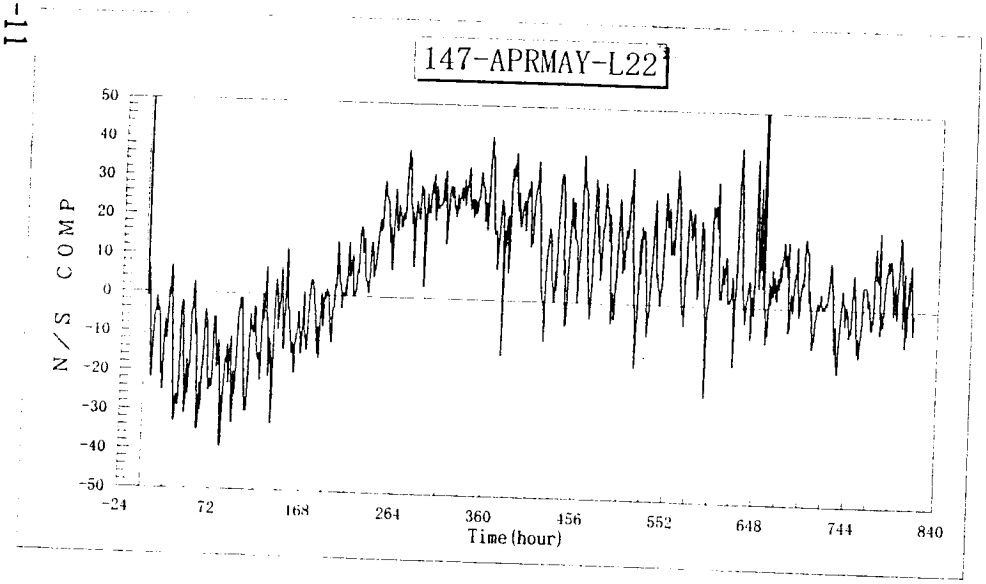
Ping per ensemble		16	
Depth cell size		8	m
Number of depth cells		40	
Blank after transmit		8	m
Profiling mode		4	
Ambiguity velocity		480	cm/s
Time btwn ping groups		2	sec
Time per ensemble		01:00:00.00	(1h)
Deployment length		380	days
S/N 1221	(0°,147°E)	TF = 9501010000	VMVDC = 57.7 V
S/N 1150	(0°,142°E)	TF = 9501020000	VMVDC = 58.3 V

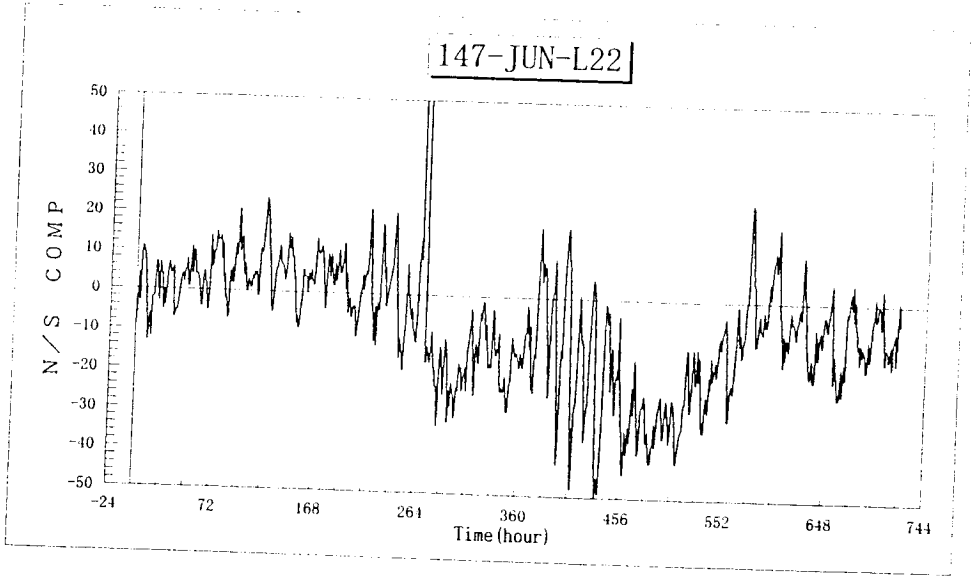
CTD Set Up Status

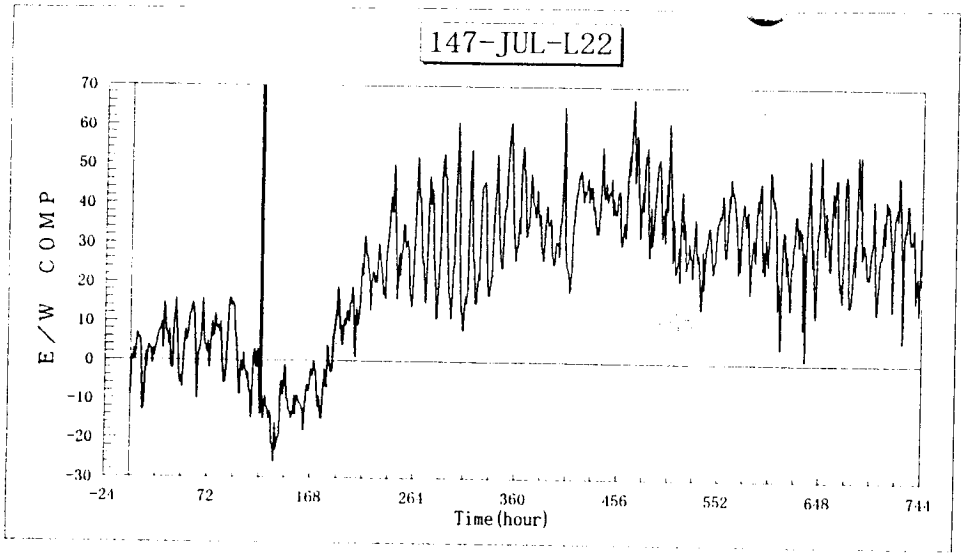
S/N 1282	(0°,147°E)	Vmain = 12.1 V	Int = 1800 sec
		Start Time = 94.12.16 00:00	
S/N 1279	(0°,142°E)	Vmain = 12.3 V	Int = 1800 sec
		Start Time = 94.12.16 00:00	

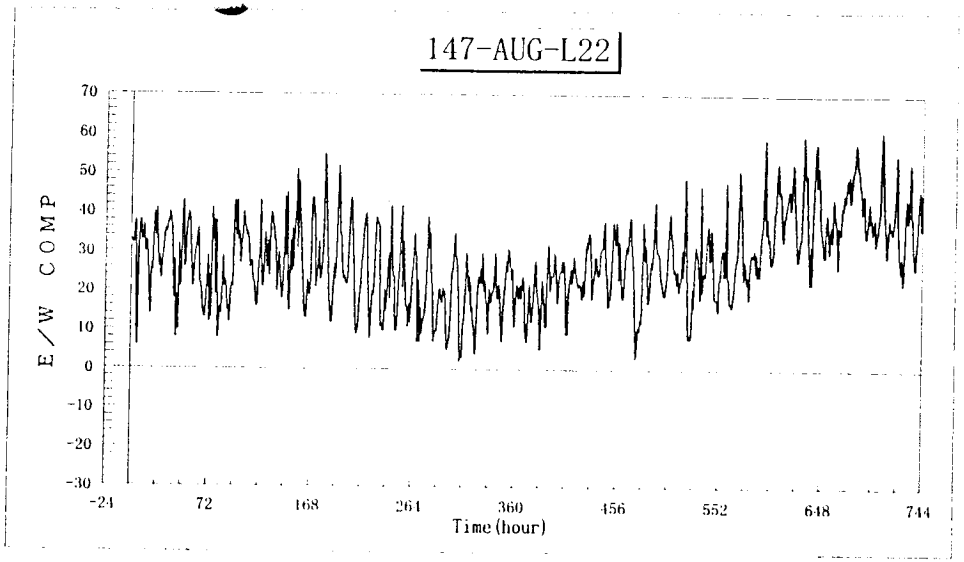

147-APRMAY-L22
E/W COMP
Time (hour)

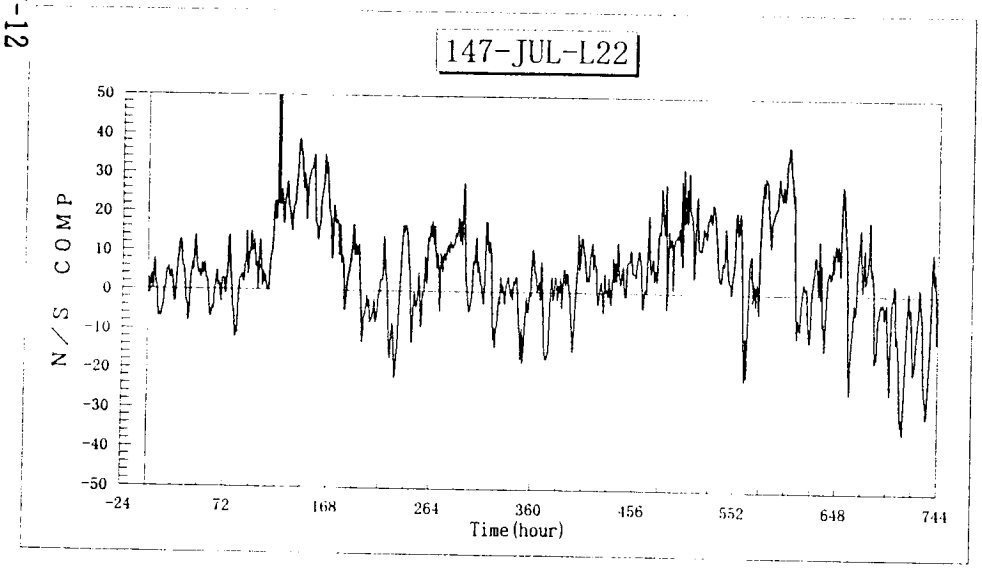

147-JUN-L22
E/W COMP
Time (hour)

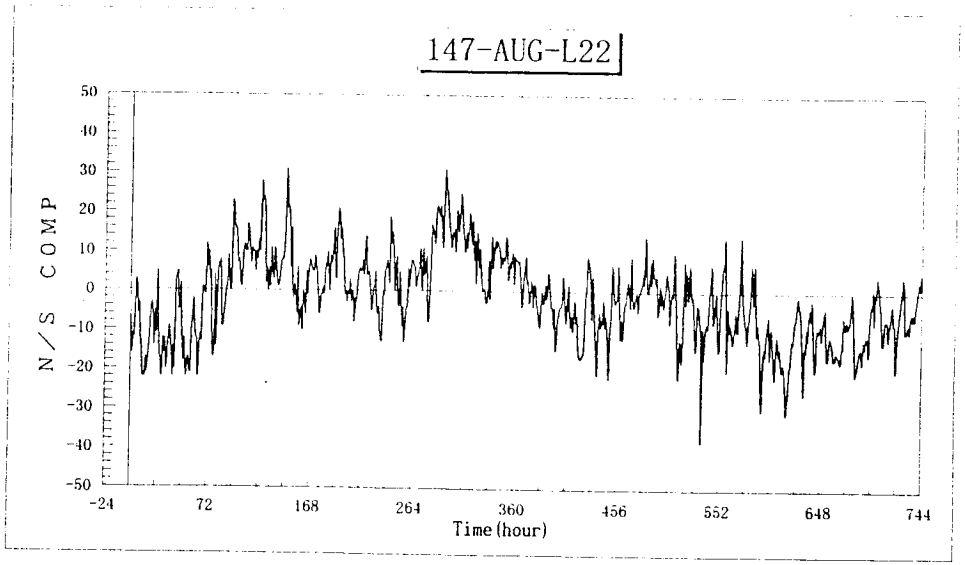

147-APRMAY-L22
N/S COMP
Time (hour)

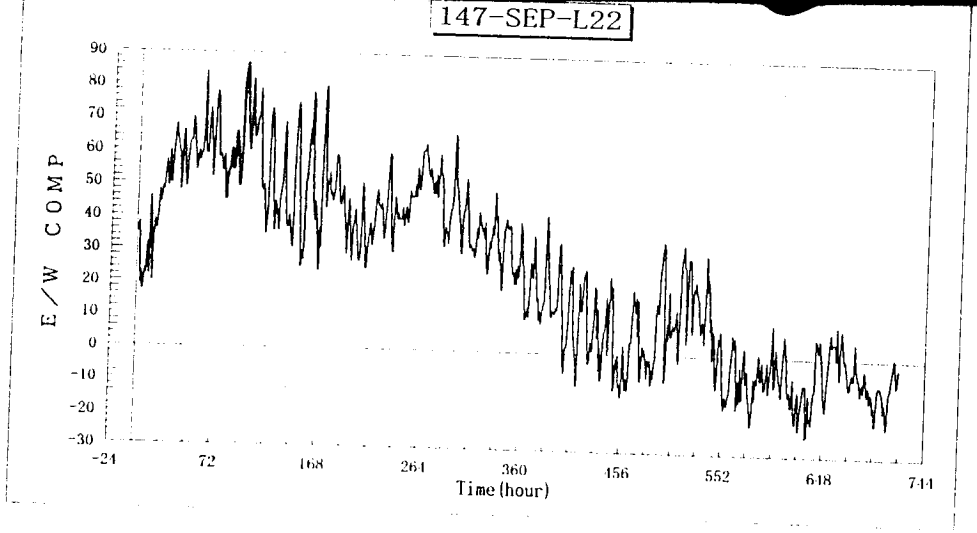

147-JUN-L22
N/S COMP
Time (hour)

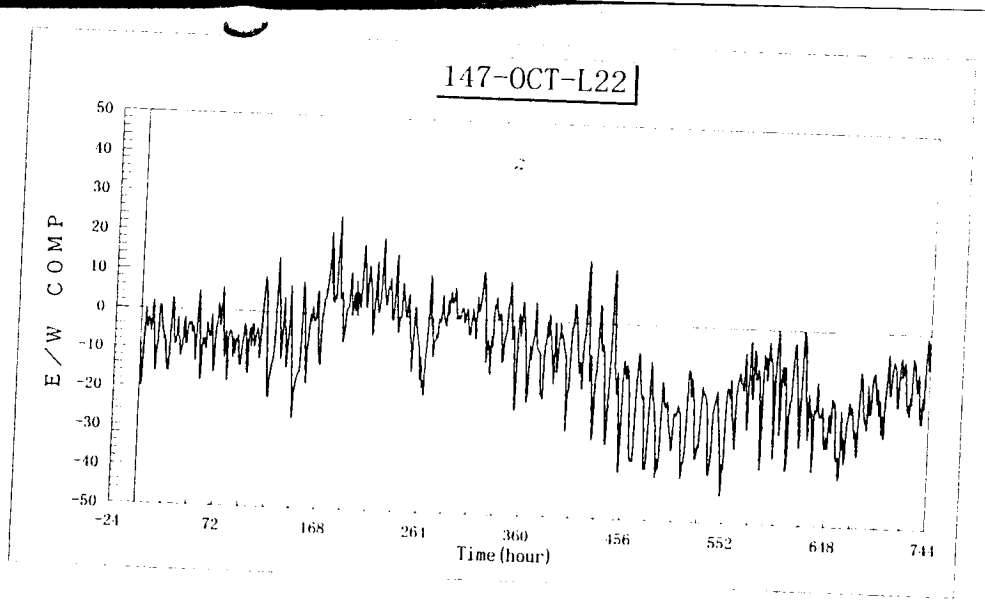

147-JUL-L22
E/W COMP
70
60
50
40
30
20
10
0
-10
-20
-30
-24
72
168
264
360
456
552
648
744
Time (hour)

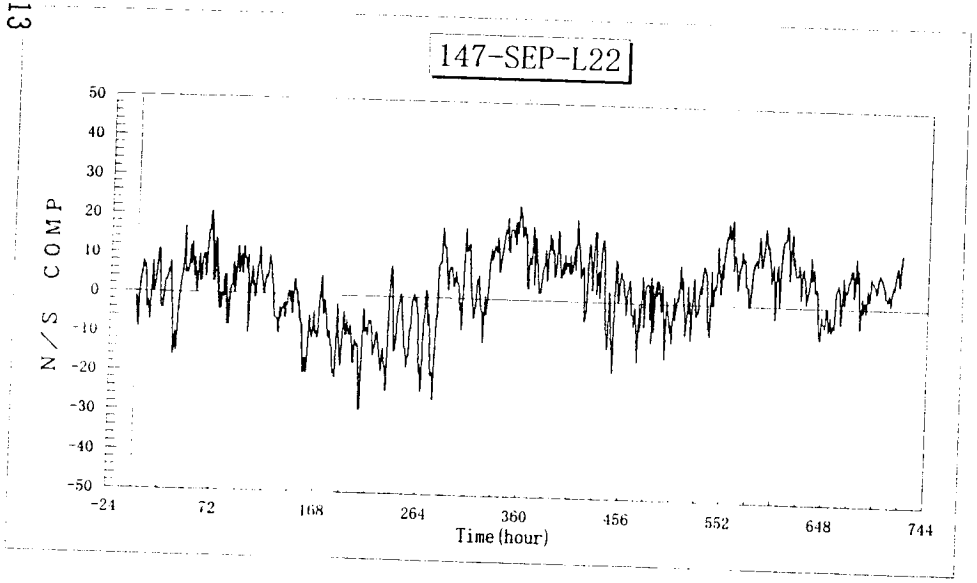

147-AUG-L22
E/W COMP
70
60
50
40
30
20
10
0
-10
-20
-30
-24
72
168
264
360
456
552
648
744
Time (hour)

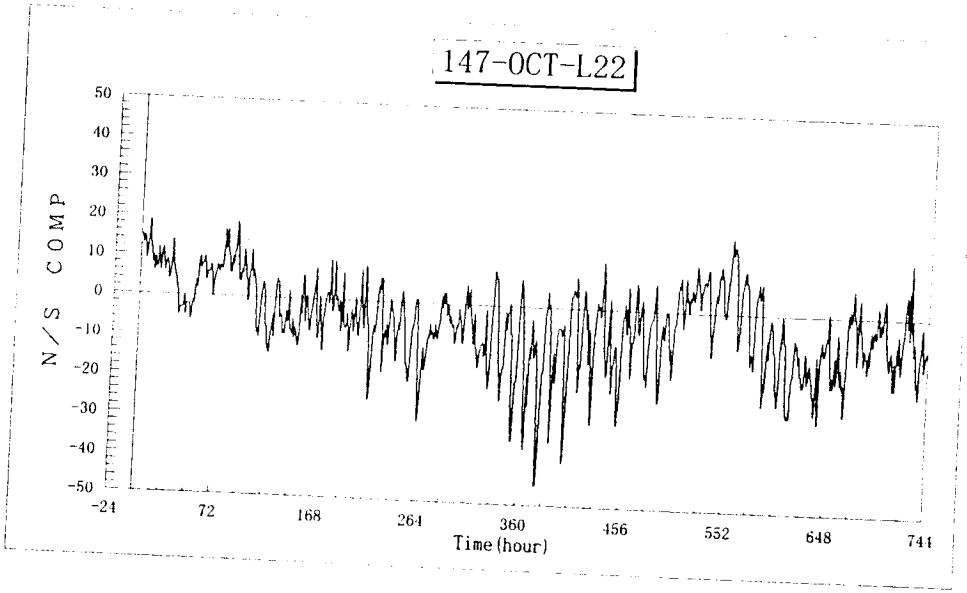

147-JUL-L22
N/S COMP
50
40
30
20
10
0
-10
-20
-30
-40
-50
-24
72
168
264
360
456
552
648
744
Time (hour)

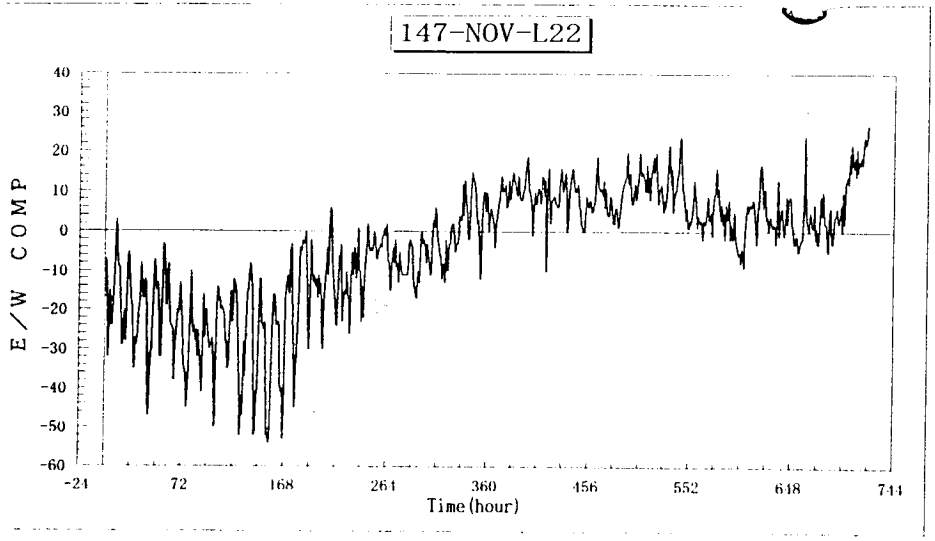

147-AUG-L22
N/S COMP
50
40
30
20
10
0
-10
-20
-30
-40
-50
-24
72
168
264
360
456
552
648
744
Time (hour)

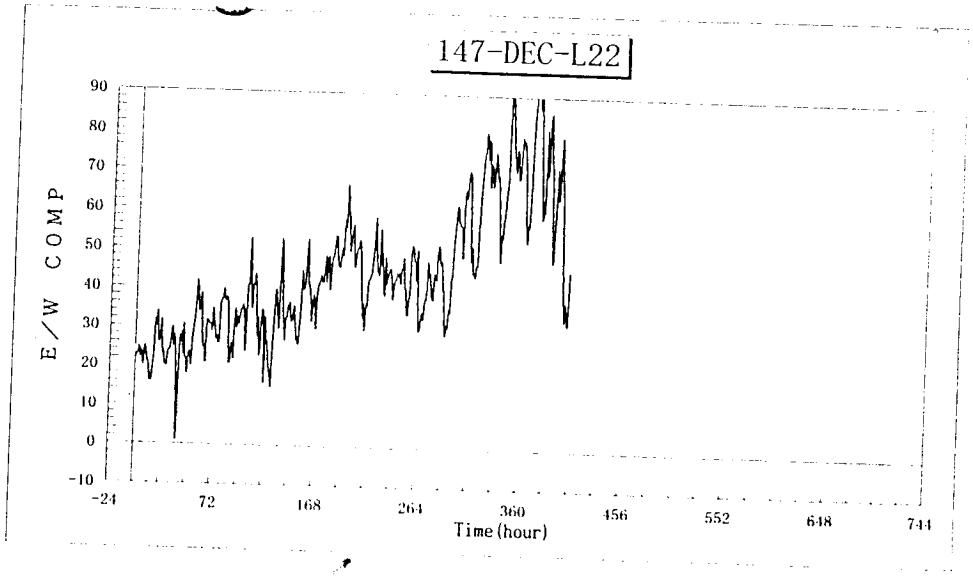

147-SEP-L22
E/W COMP
90
80
70
60
50
40
30
20
10
0
-10
-20
-30
-24
72
168
264
360
456
552
648
744
Time (hour)

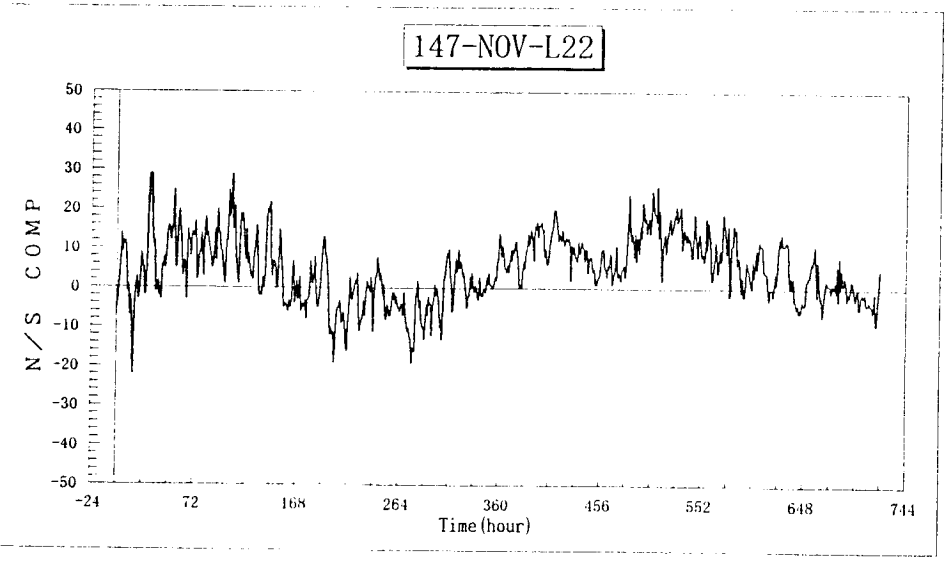

147-OCT-L22
E/W COMP
50
40
30
20
10
0
-10
-20
-30
-40
-50
-24
72
168
264
360
456
552
648
744
Time (hour)

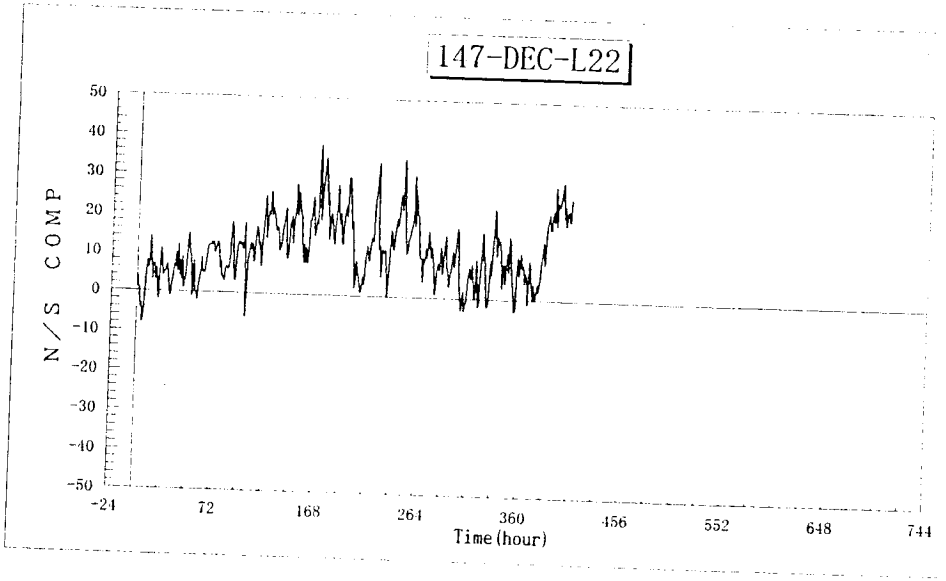

147-SEP-L22
N/S COMP
50
40
30
20
10
0
-10
-20
-30
-40
-50
-24
72
168
264
360
456
552
648
744
Time (hour)

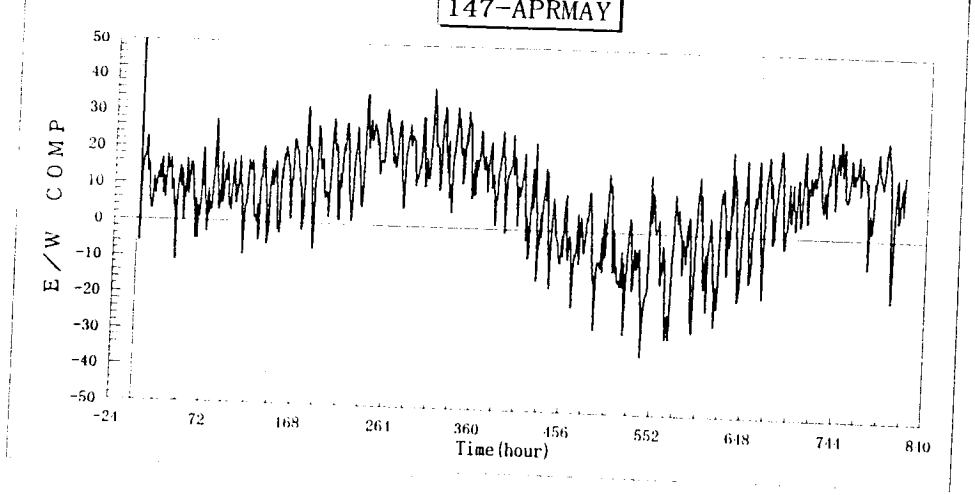

147-OCT-L22
N/S COMP
50
40
30
20
10
0
-10
-20
-30
-40
-50
-24
72
168
264
360
456
552
648
744
Time (hour)

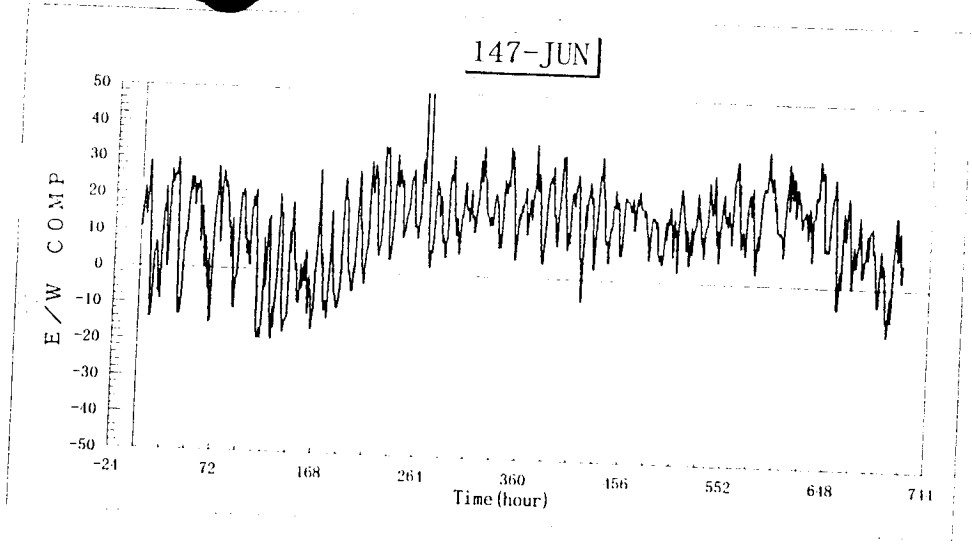

147-NOV-L22
E/W COMP
40
30
20
10
0
-10
-20
-30
-40
-50
-60
-24
72
168
264
360
456
552
648
744
Time (hour)


147-DEC-L22
E/W COMP
90
80
70
60
50
40
30
20
10
0
-10
-24
72
168
264
360
456
552
648
744
Time (hour)


147-NOV-L22
N/S COMP
50
40
30
20
10
0
-10
-20
-30
-40
-50
-24
72
168
264
360
456
552
648
744
Time (hour)


147-DEC-L22
N/S COMP
50
40
30
20
10
0
-10
-20
-30
-40
-50
-24
72
168
264
360
456
552
648
744
Time (hour)


147-APRMAY
E/W COMP
50
40
30
20
10
0
-10
-20
-30
-40
-50
-24
72
168
264
360
456
552
648
744
840
Time (hour)


147-JUN
E/W COMP
50
40
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-30
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264
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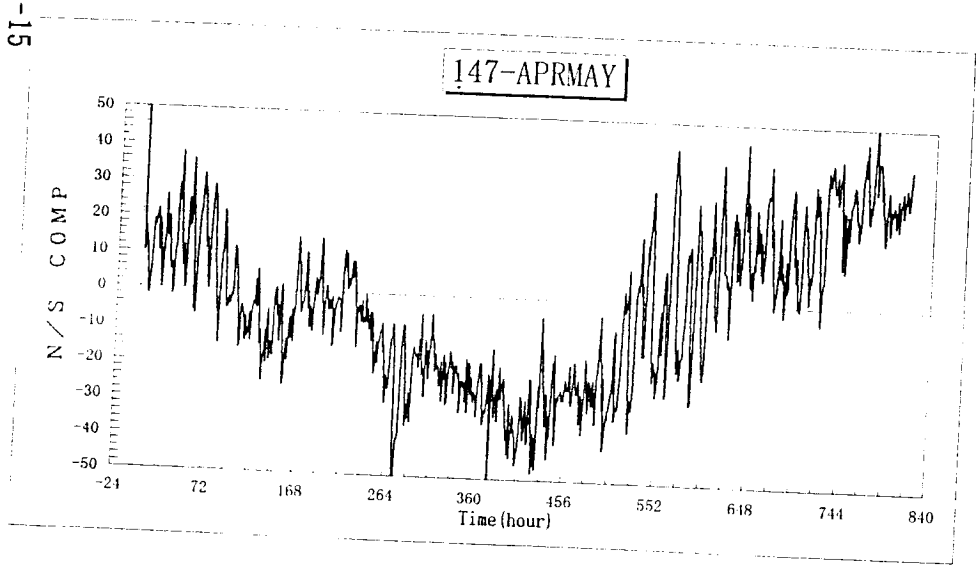
552
648
744
Time (hour)


147-APRMAY
N/S COMP
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40
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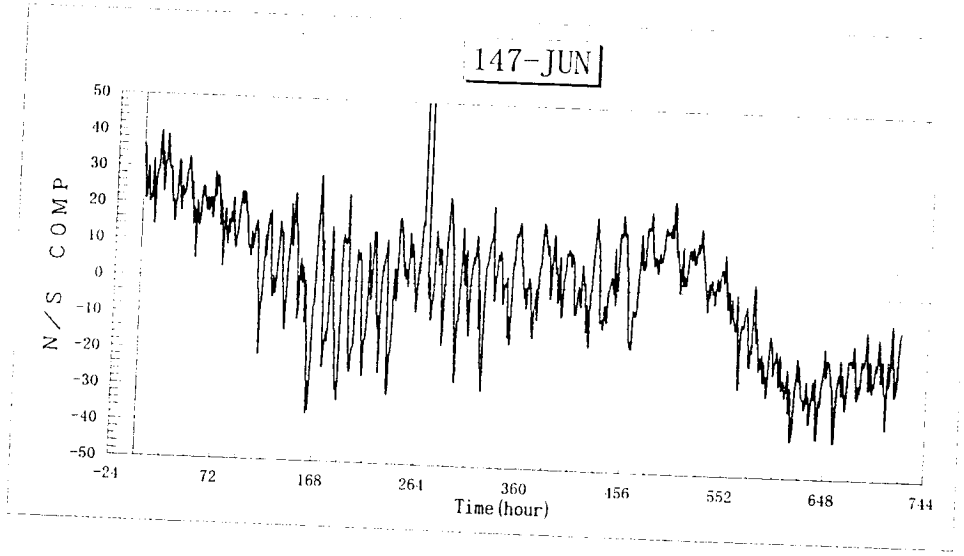
264
360
456
552
648
744
840
Time (hour)


147-JUN
N/S COMP
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40
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-30
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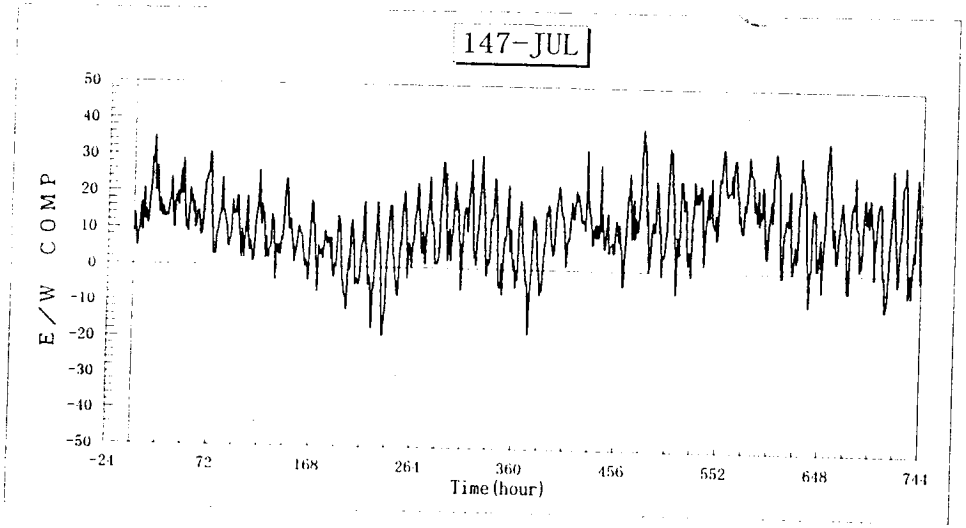
264
360
456
552
648
744
Time (hour)


147-JUL
E/W COMP
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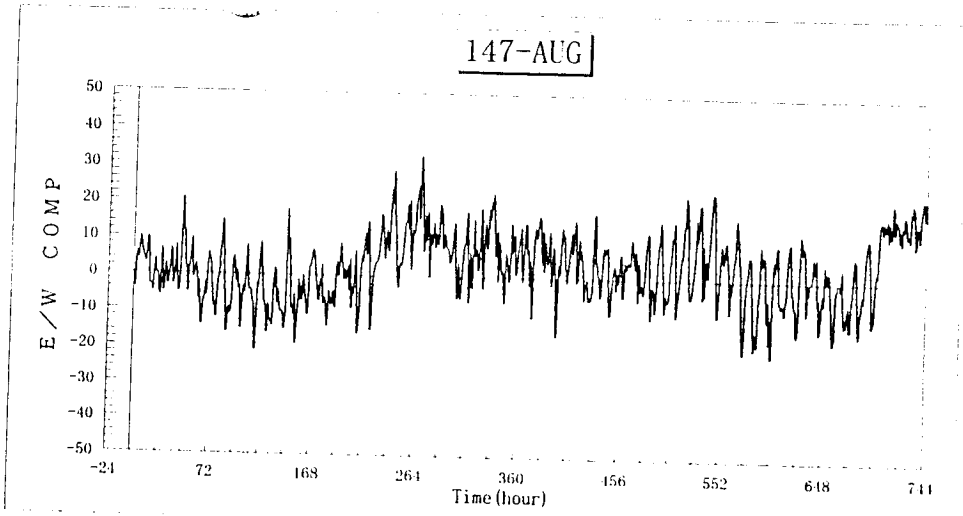
456
552
648
744
Time (hour)


147-AUG
E/W COMP
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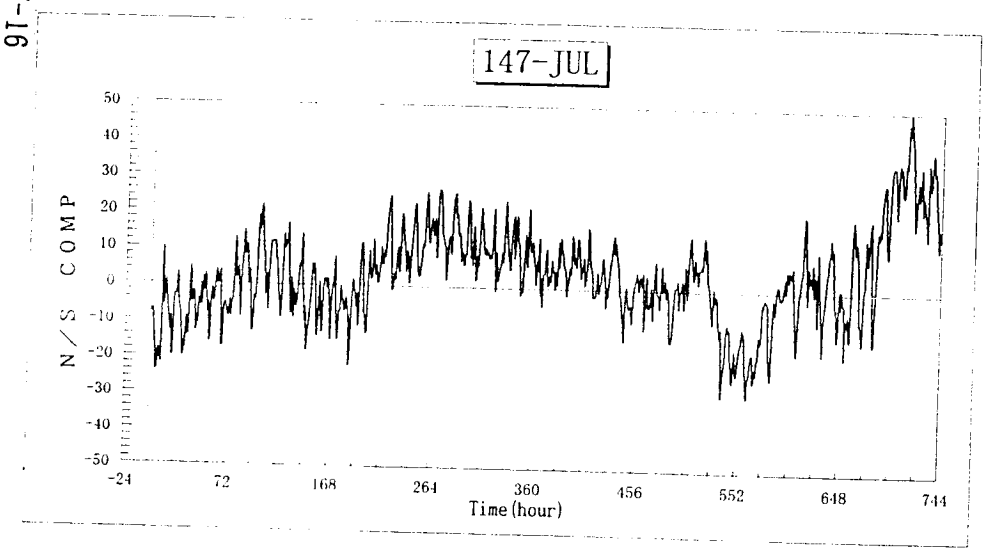
456
552
648
744
Time (hour)


147-JUL
N/S COMP
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648
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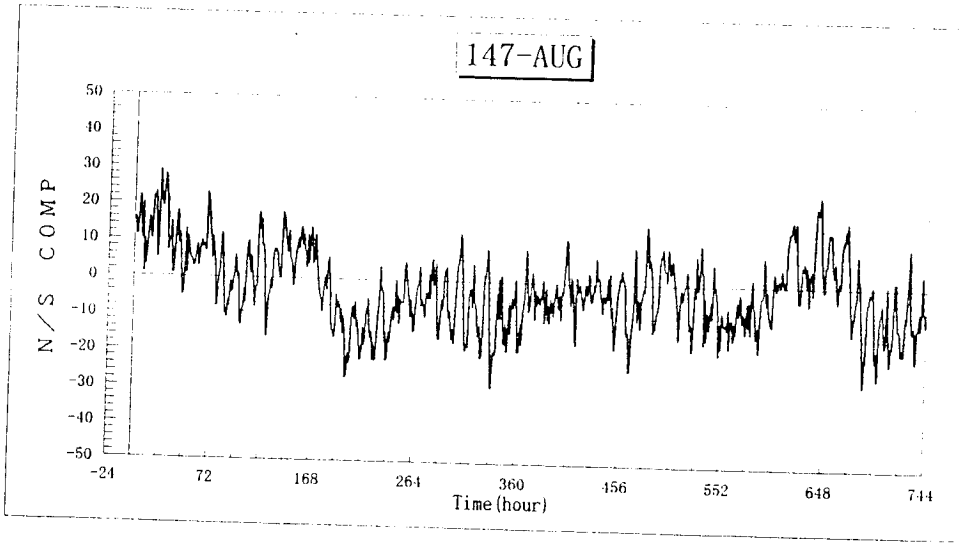
Time (hour)


147-AUG
N/S COMP
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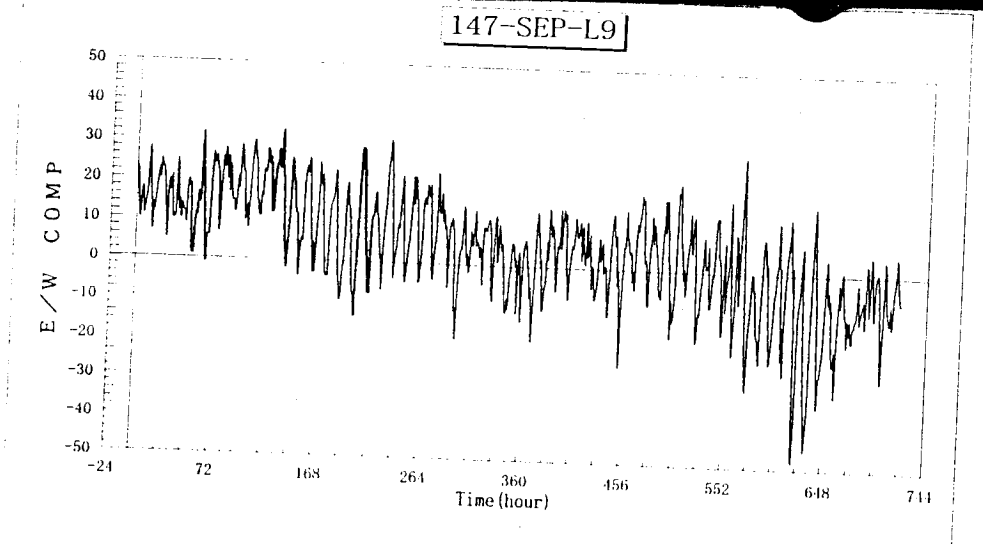
648
744
Time (hour)


147-SEP-L9
E/W COMP
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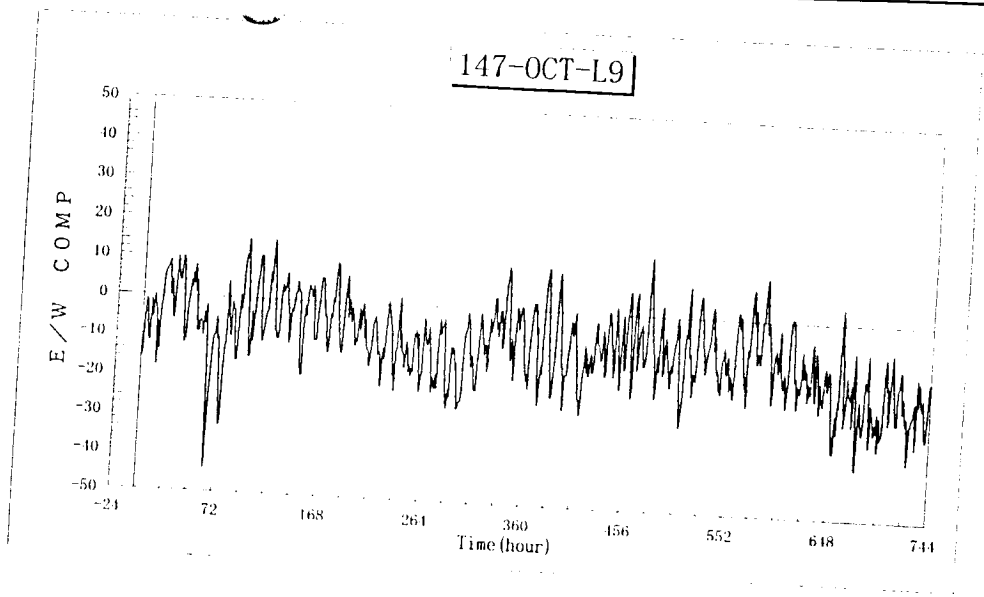
456
552
648
744
Time (hour)


147-OCT-L9
E/W COMP
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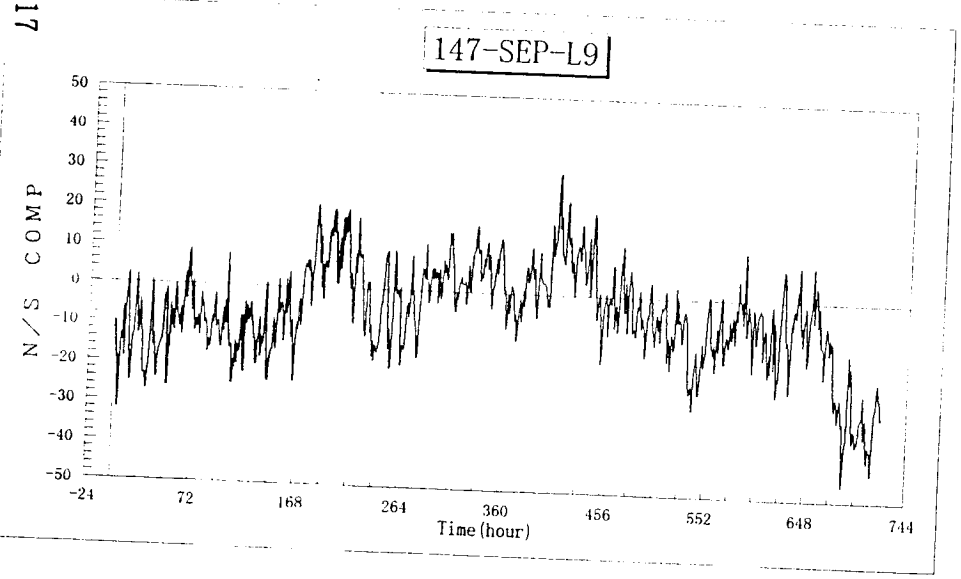
264
360
456
552
648
744
Time (hour)


147-SEP-L9
N/S COMP
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648
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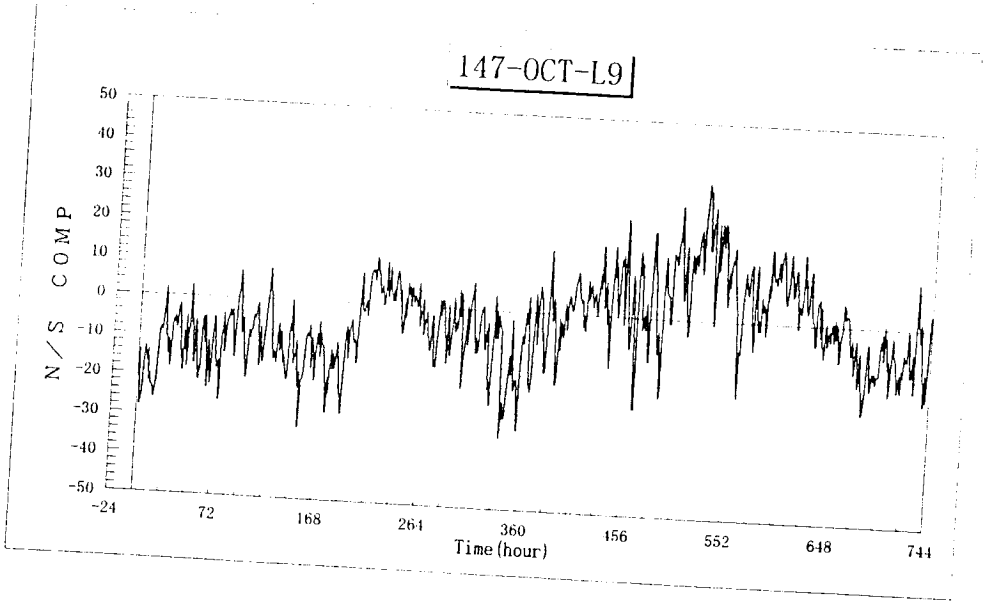
Time (hour)


147-OCT-L9
N/S COMP
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40
30
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-24
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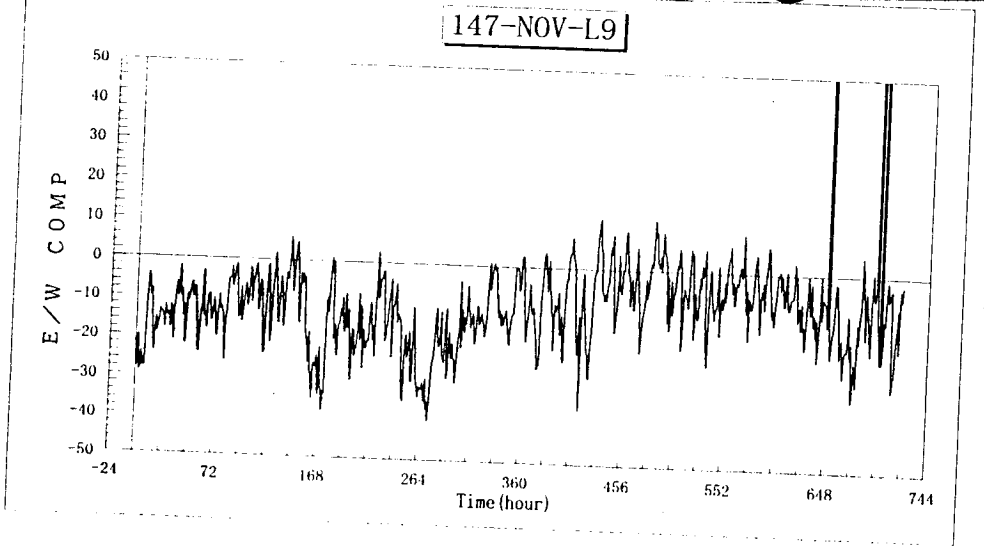
168
264
360
456
552
648
744
Time (hour)


147-NOV-L9
E/W COMP
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40
30
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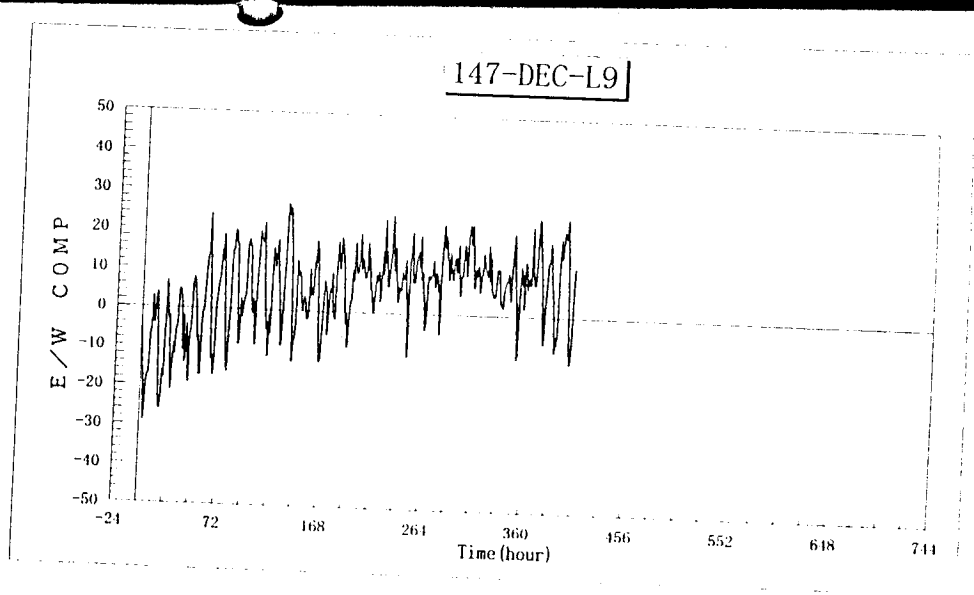
10
0
-10
-20
-30
-40
-50
-24
72
168
264
360
456
552
648
744
Time (hour)


147-DEC-L9
E/W COMP
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40
30
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10
0
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-20
-30
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-50
-24
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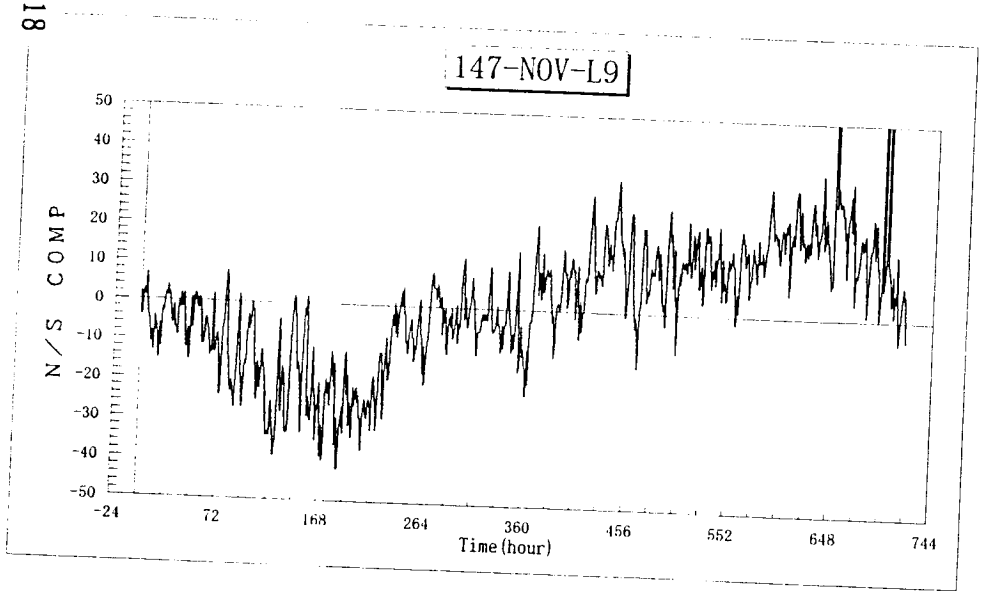
264
360
456
552
648
744
Time (hour)


147-NOV-L9
N/S COMP
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40
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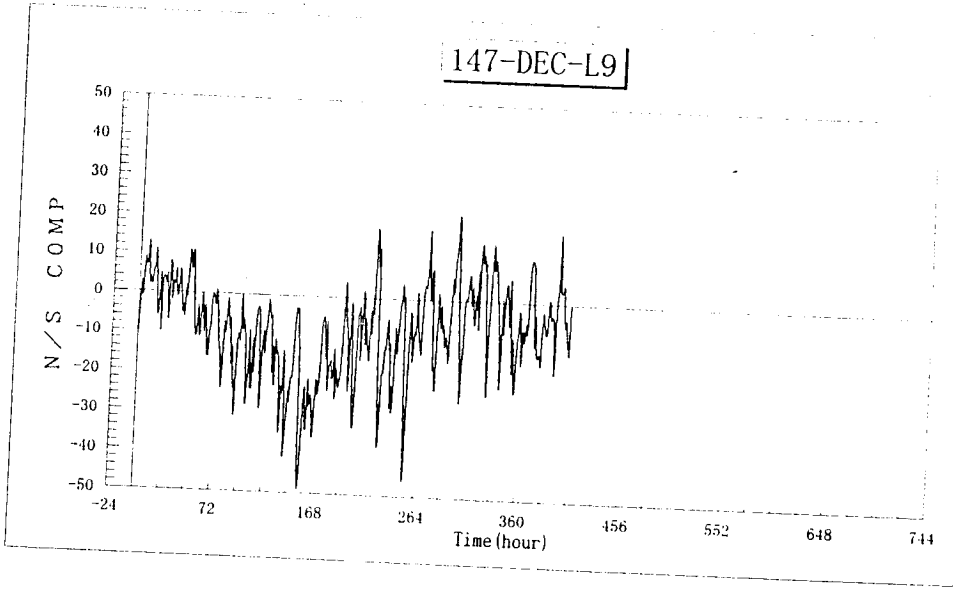
264
360
456
552
648
744
Time (hour)


147-DEC-L9
N/S COMP
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40
30
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264
360
456
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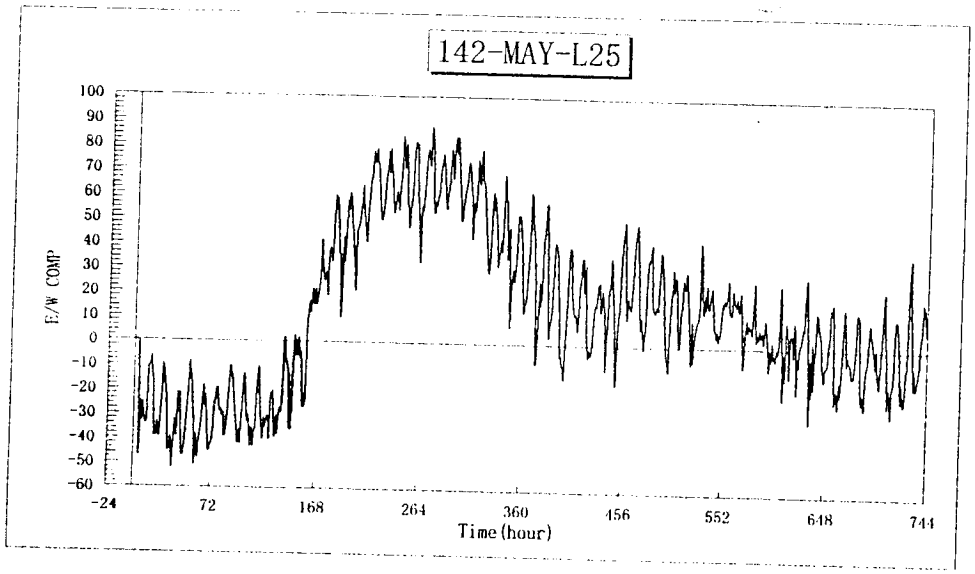
648
744
Time (hour)


142-MAY-L25
E/W COMP
100
90
80
70
60
50
40
30
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-60
-24
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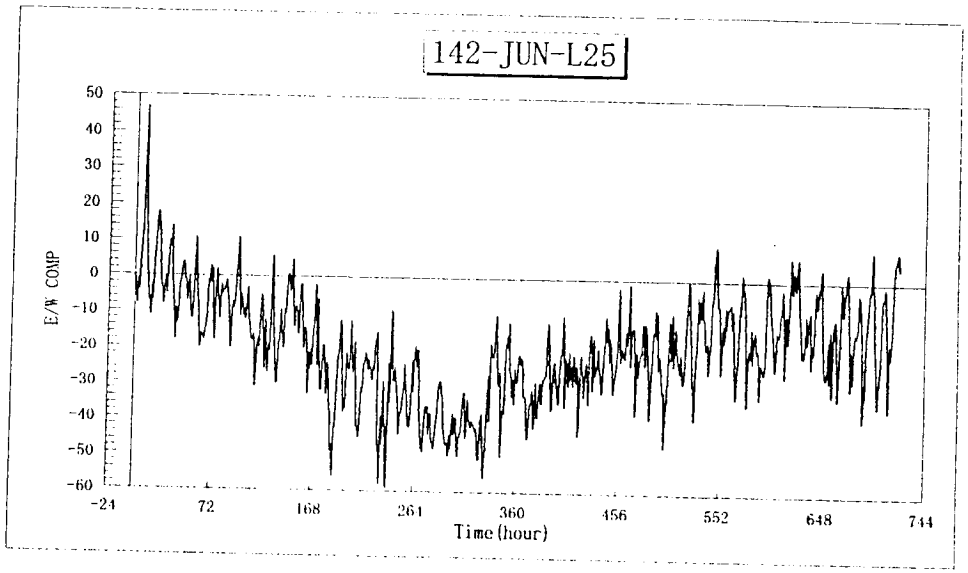
264
360
456
552
648
744
Time (hour)


142-JUN-L25
E/W COMP
50
40
30
20
10
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-30
-40
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-60
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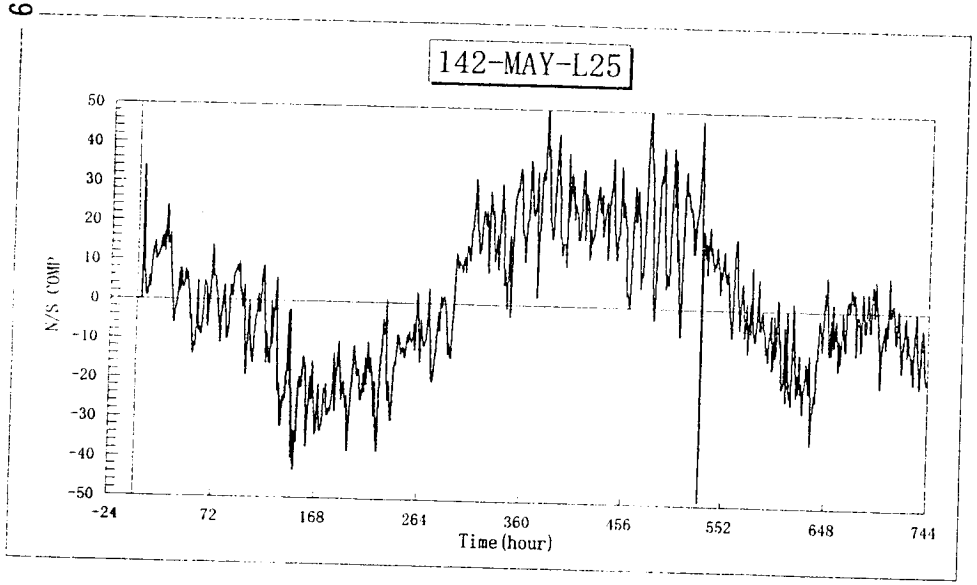
264
360
456
552
648
744
Time (hour)


142-MAY-L25
N/S COMP
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40
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360
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648
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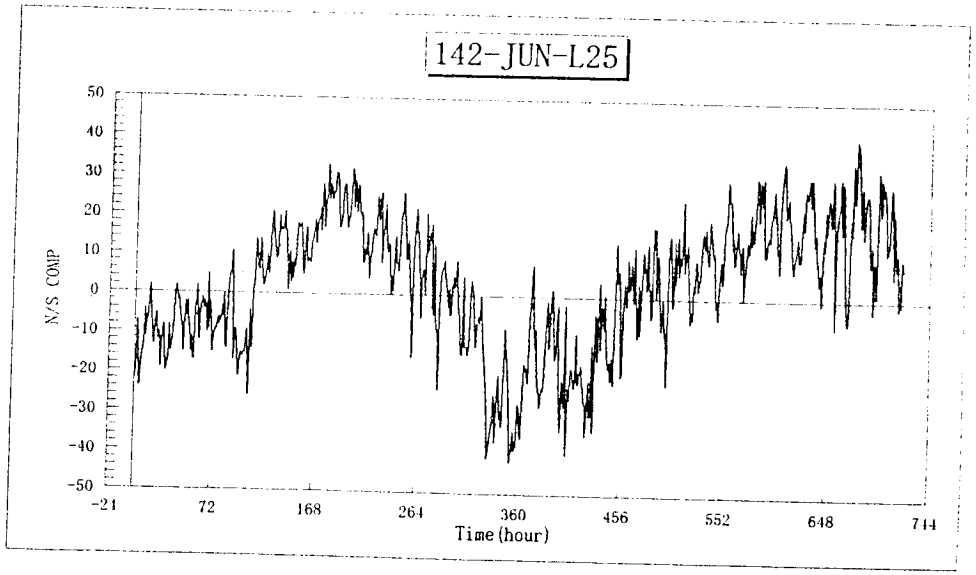
Time (hour)


142-JUN-L25
N/S COMP
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40
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648
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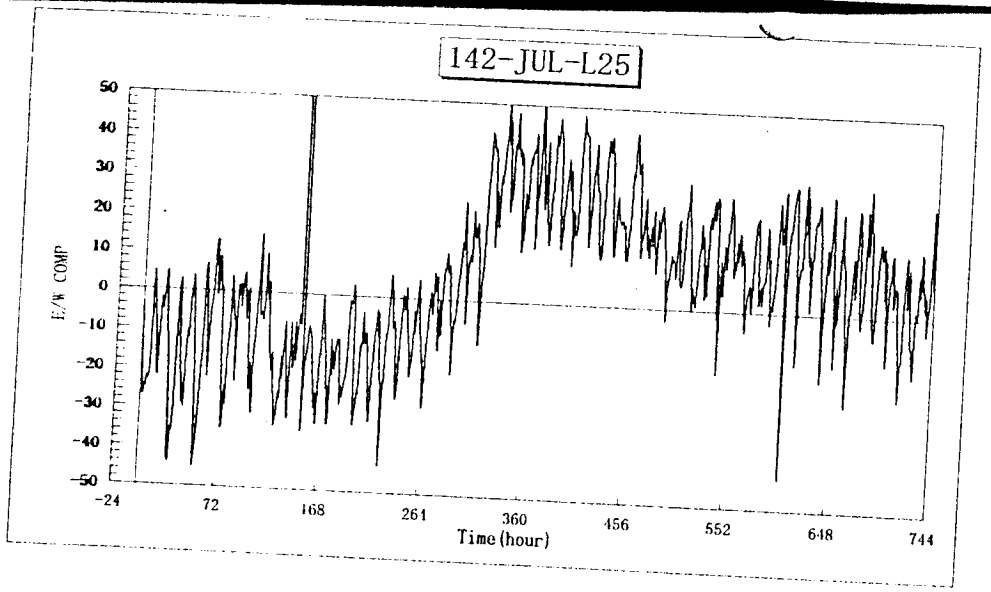
Time (hour)


142-JUL-L25
E/W COMP
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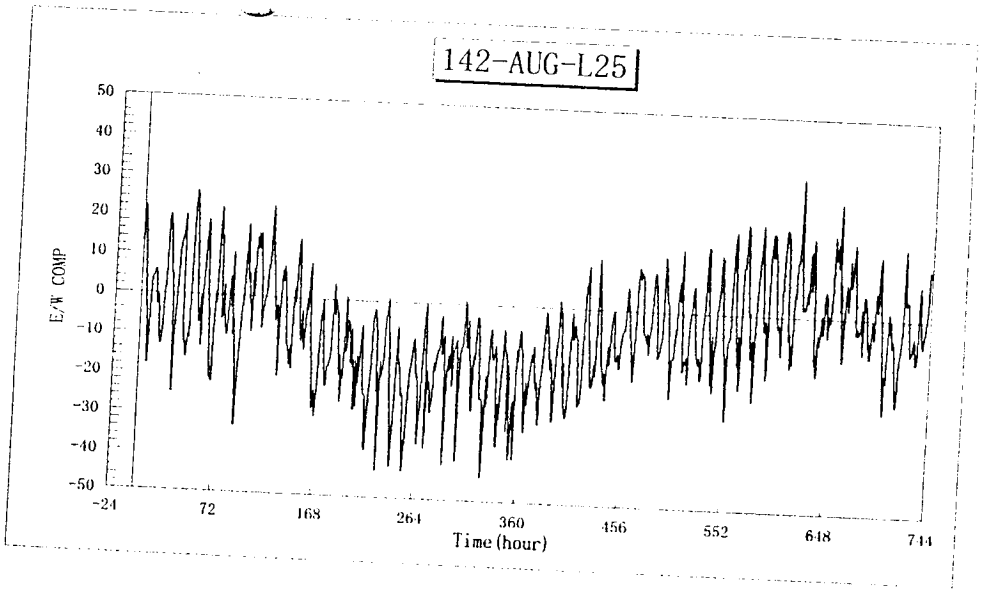
456
552
648
744
Time (hour)


142-AUG-L25
E/W COMP
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40
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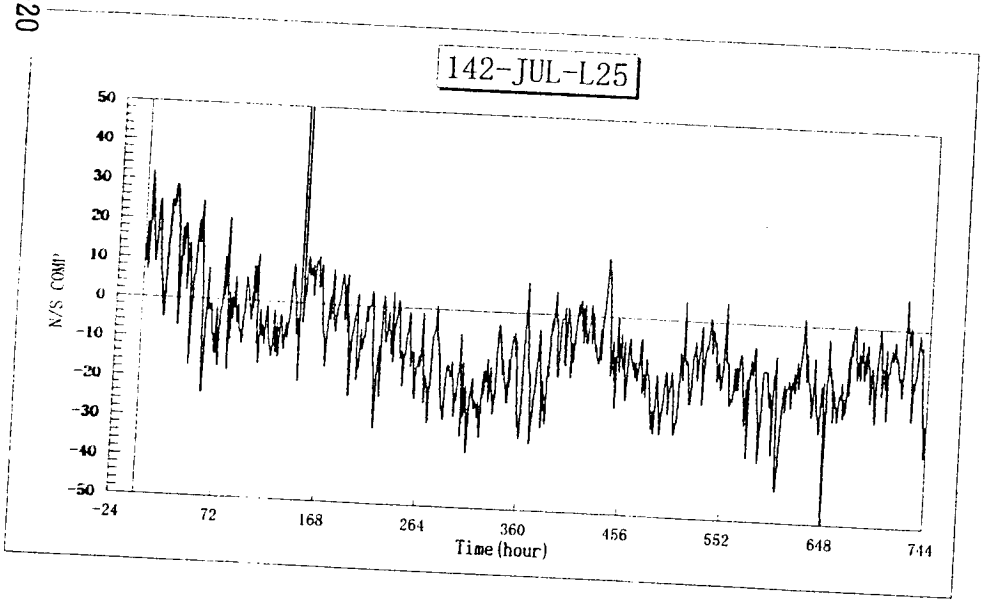
264
360
456
552
648
744
Time (hour)


142-JUL-L25
N/S COMP
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40
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-50
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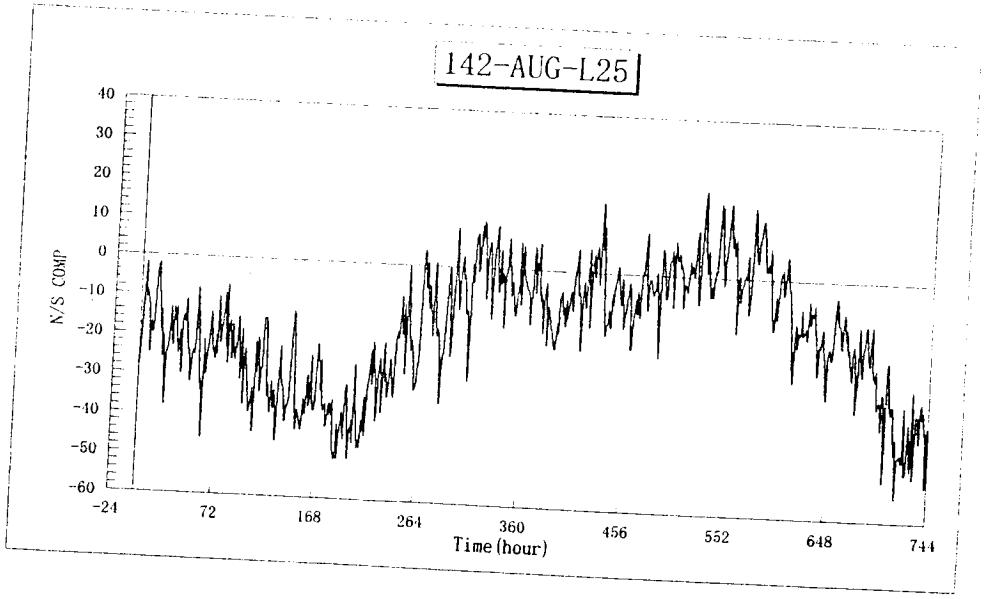
648
744
Time (hour)


142-AUG-L25
N/S COMP
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30
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360
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648
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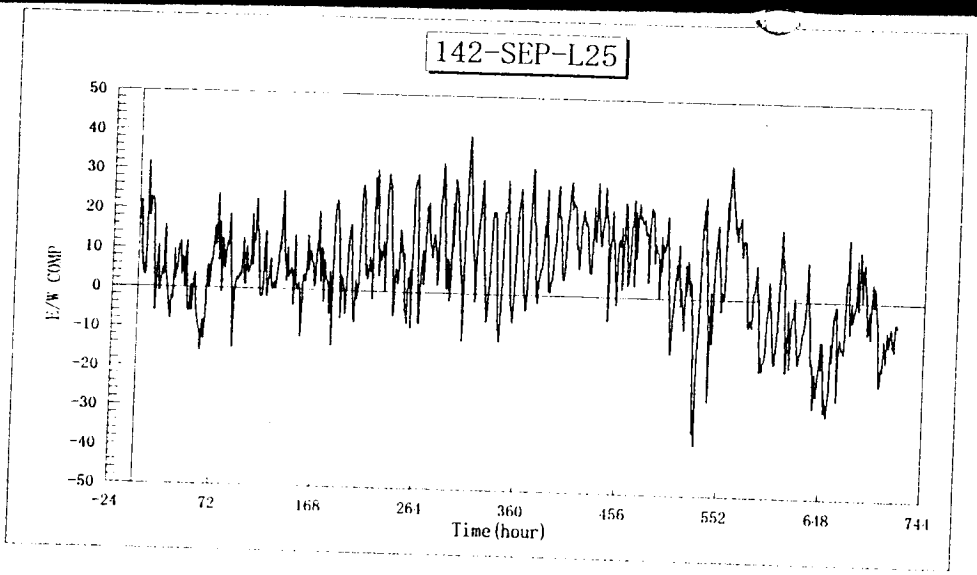
Time (hour)


142-SEP-L25
E/W COMP
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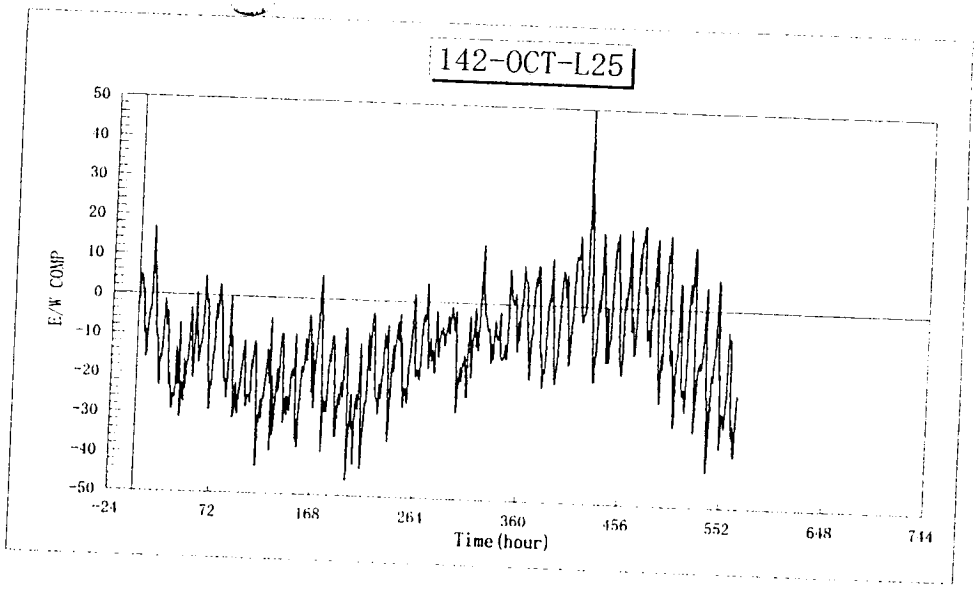
360
456
552
648
744
Time (hour)


142-OCT-L25
E/W COMP
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40
30
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-50
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264
360
456
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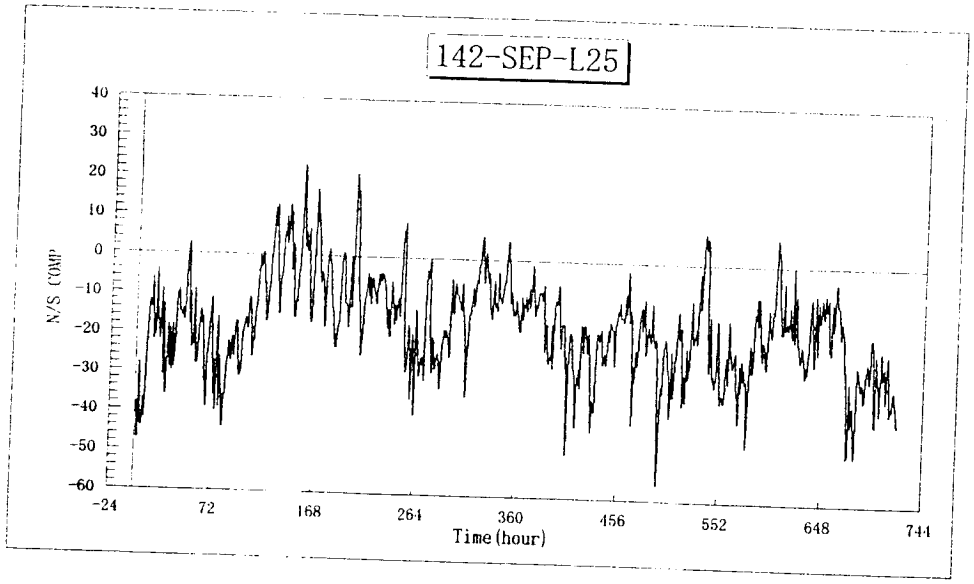
648
744
Time (hour)


142-SEP-L25
N/S COMP
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30
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-50
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264
360
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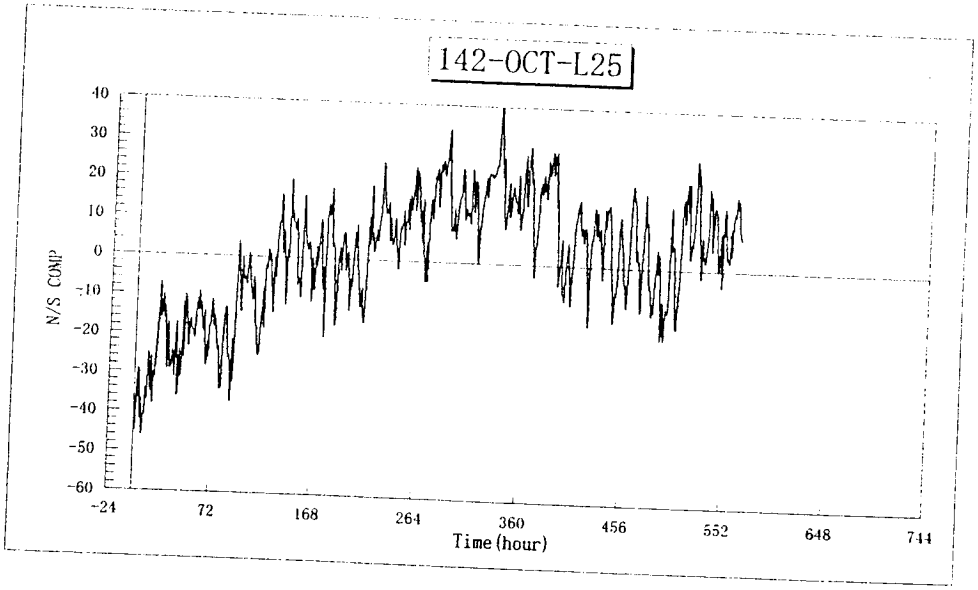
648
744
Time (hour)


142-OCT-L25
N/S COMP
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30
20
10
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264
360
456
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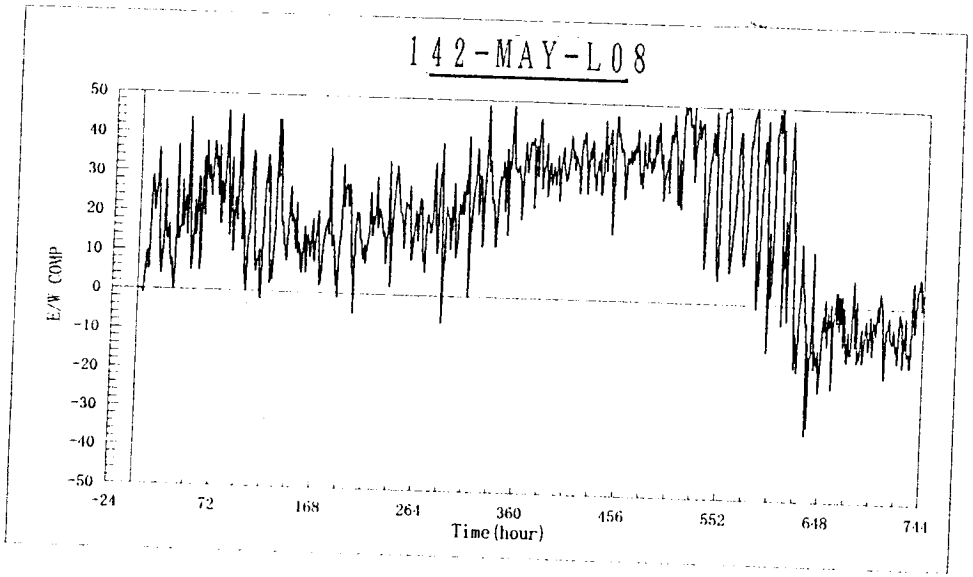
648
744
Time (hour)


142-MAY-L08
E/W COMP
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264
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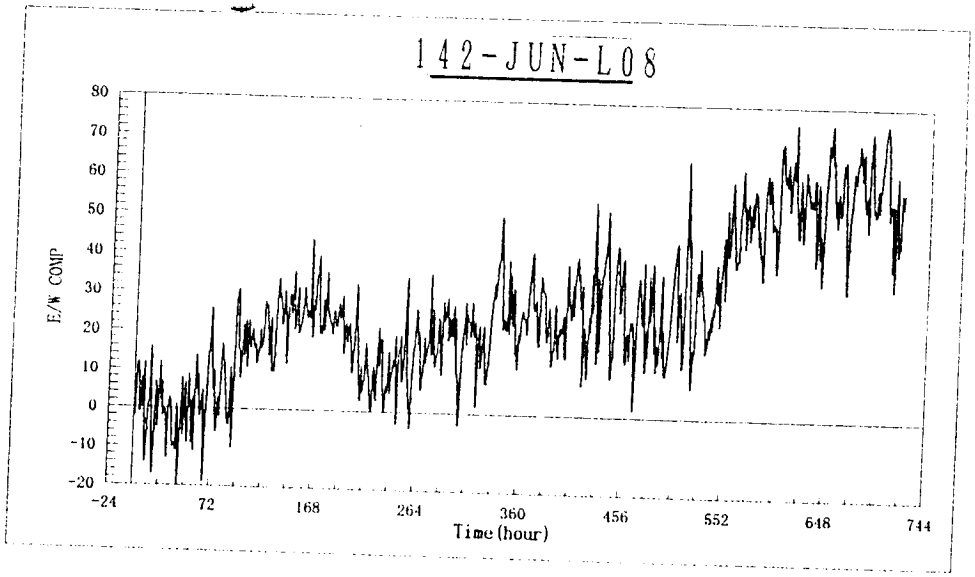
456
552
648
744
Time (hour)


142-JUN-L08
E/W COMP
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70
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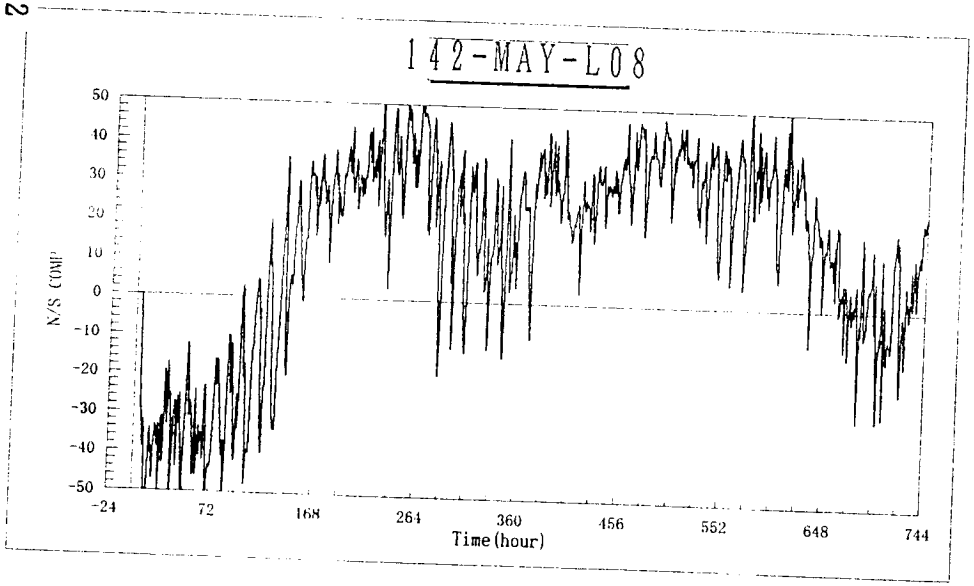
264
360
456
552
648
744
Time (hour)


142-MAY-L08
N/S COMP
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40
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264
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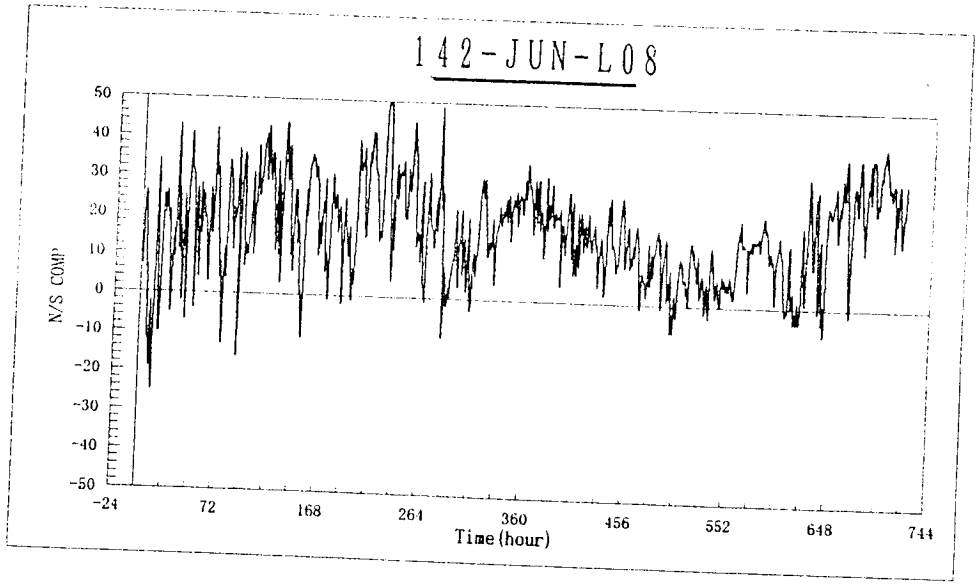
456
552
648
744
Time (hour)


142-JUN-L08
N/S COMP
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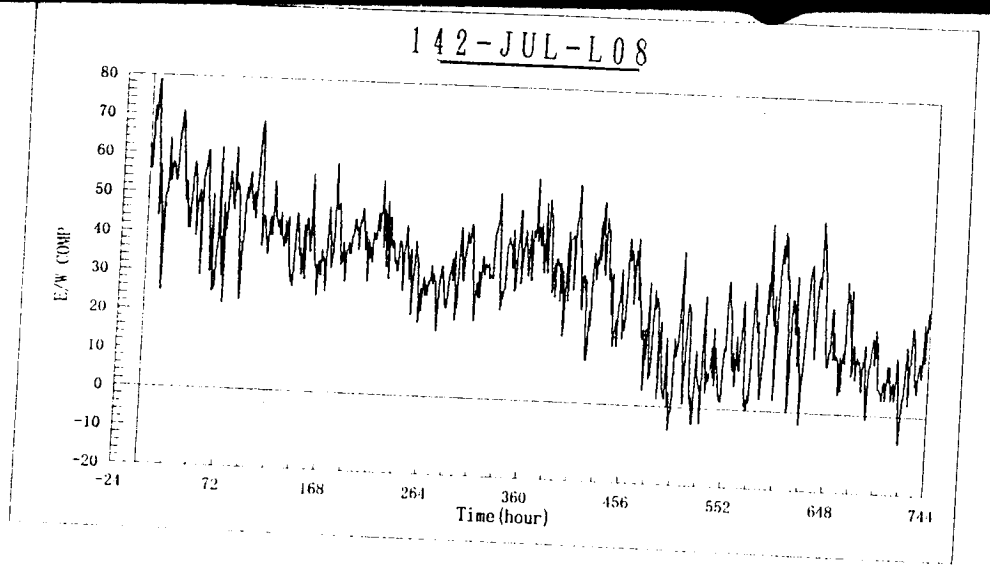
264
360
456
552
648
744
Time (hour)


142-JUL-L08
E/W COMP
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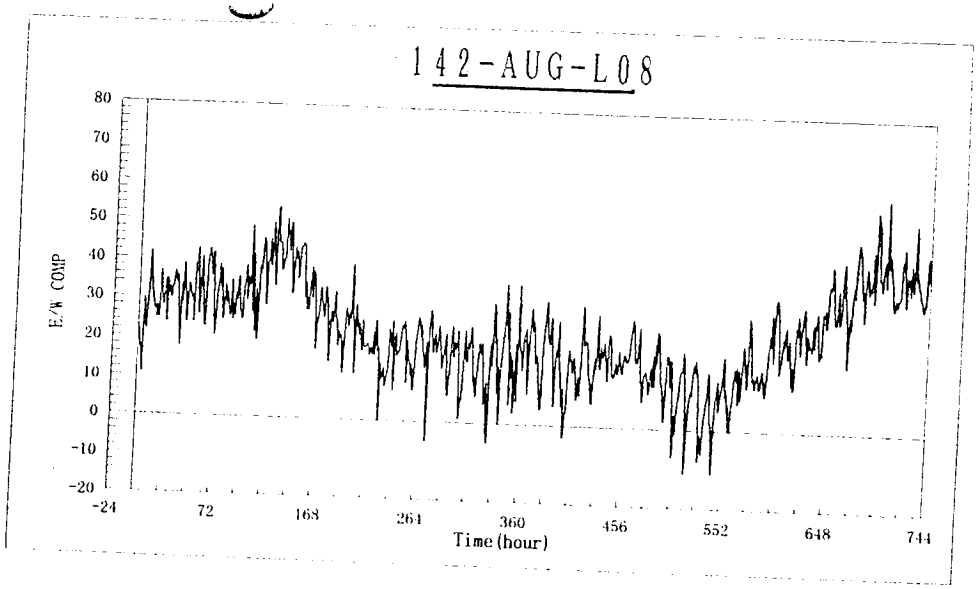
264
360
456
552
648
744
Time (hour)


142-AUG-L08
E/W COMP
80
70
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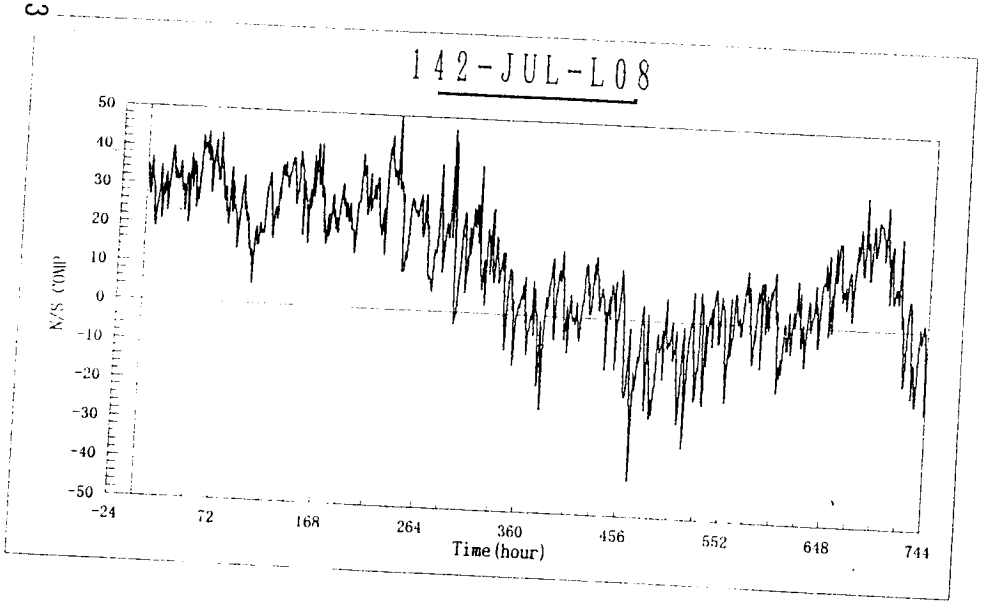
264
360
456
552
648
744
Time (hour)


142-JUL-L08
N/S COMP
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40
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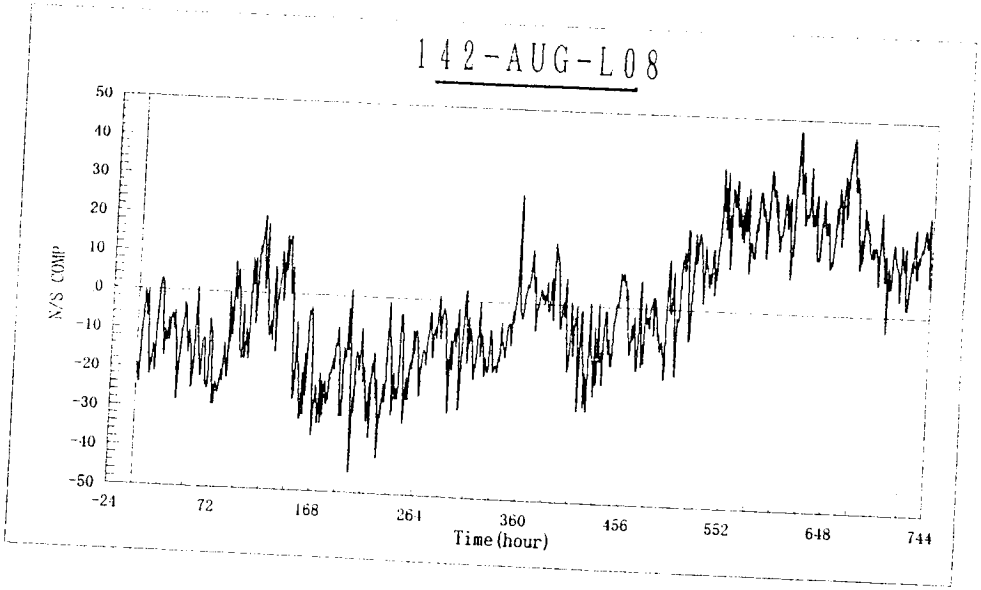
168
264
360
456
552
648
744
Time (hour)


142-AUG-L08
N/S COMP
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40
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264
360
456
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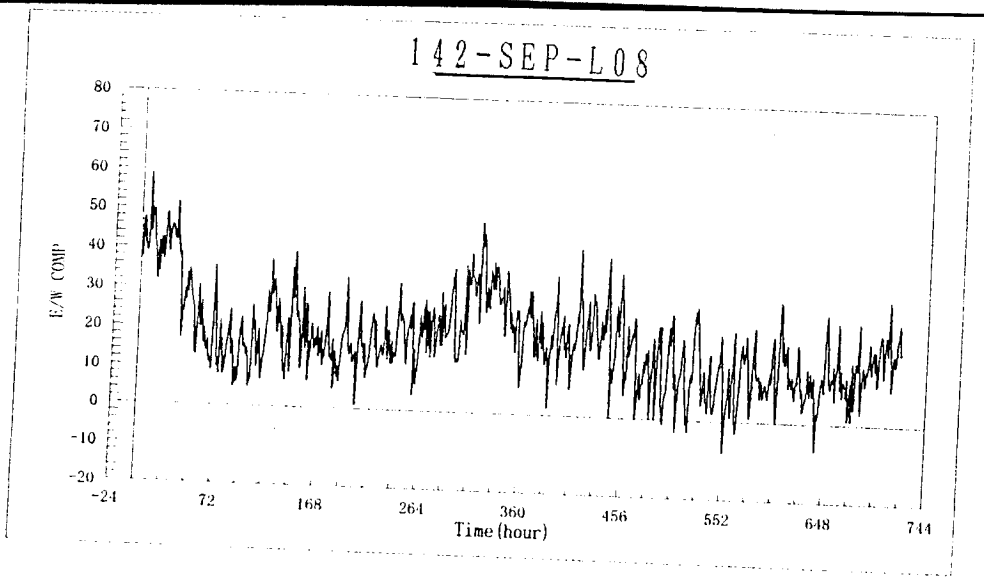
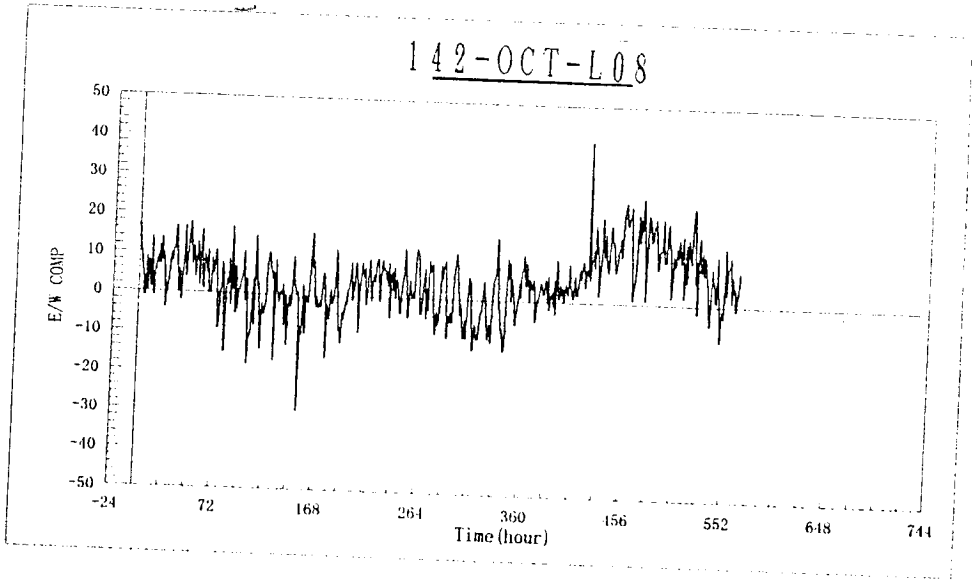
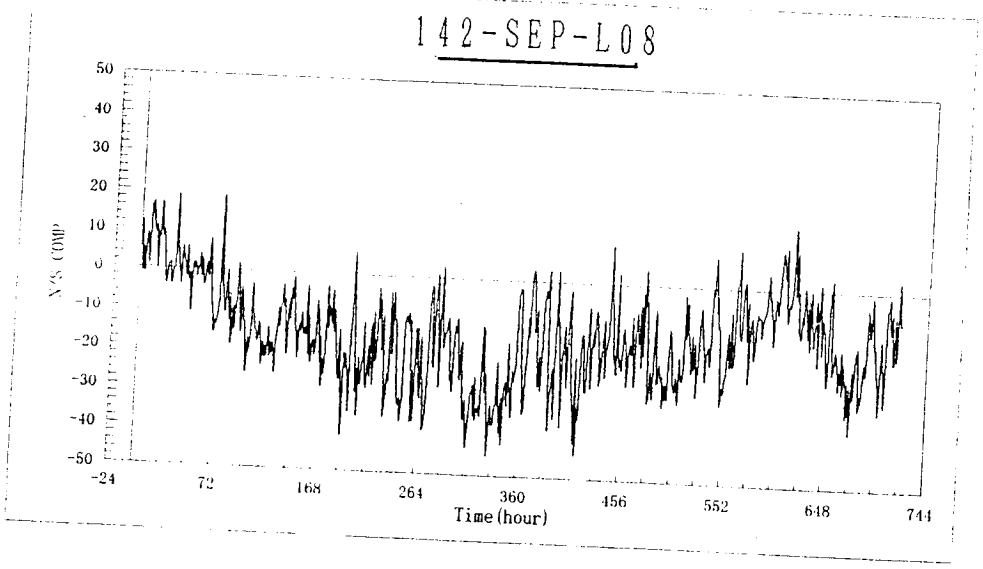
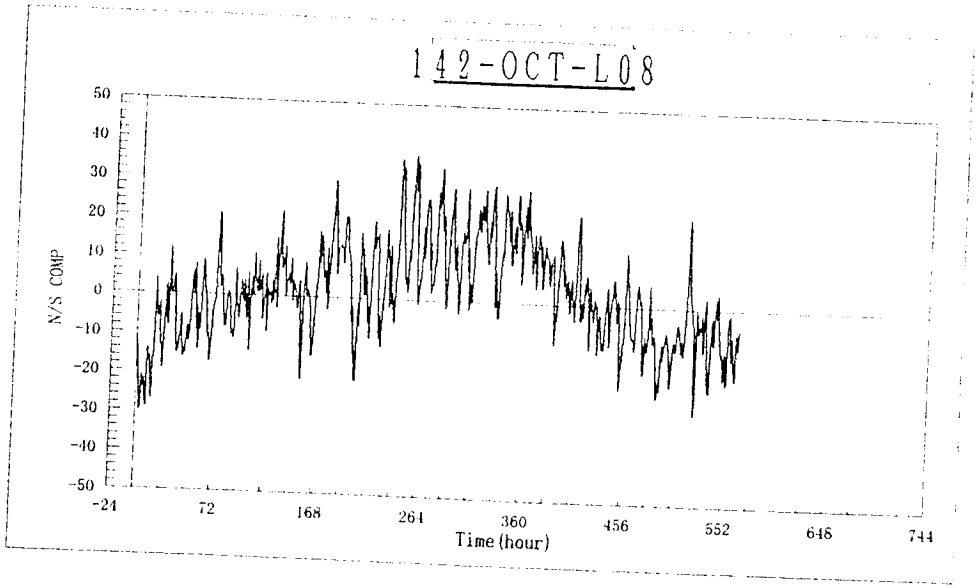
648
744
Time (hour)


142-SEP-L08
E/W COMP
Time (hour)


142-OCT-L08
E/W COMP
Time (hour)


142-SEP-L08
N/S COMP
Time (hour)


142-OCT-L08
N/S COMP
Time (hour)

8. PMEL TAO Buoys

R/V Kaiyo

Dec 20, 1994 - Jan 11, 1995
Majuro, MI - Kavieng, PNG - Koror, ROP

TAO personnel: Andrew Shepherd

Deployments:

ET-309	2N, 165E
TC-3	0, 165E
ET-310	5S, 156E
ET-311	0, 147E

Recoveries:

ET-243	2N, 165E
ET-241	5S, 156E

Visits:

TC-1	0, 165E
ET-248	2S, 156E

Worked cancelled:

TC-1	0, 165 Recovery
ET-262	Wind Repair

Introduction:

Kevin and I arrived in Majuro on the 16th with high winds and rain. The ship was docked at the downtown pier across from our hotel and not at the container pier as expected. The agent informed us the ship was unable to dock with it's beam into the wind which would be required to load our equipment at the container pier. I made arrangments to transfer the containers to the downtown pier along with forklifts etc. We finished loading the ship on the 17th. There were problems. The forklift we use had no brakes. To stop it you would shift it into the opposite gear and slowly let the clutch out. This made unloading the containers very slow and dangerous. During the lifting of two buoys from the contianer the forklift lunged in reverse and dropped two buoys to the ground damaging one severely(The buoy is in the container on it's way back from Palau.)

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The winds and rain continued during or stay in Majuro and on the morning of the 19th, Kuroda and the Captian announced a delay in sailing until the 20th. The seas were still up on the 20th but lessening and we sailed Majuro heading not to the 5N site but south staying on the lee of the atolls that run south from Majuro. Small boat operations become very difficult above 2.5 meters wave height and are not done. The ship itself is unstable at a wave heights of 3.5 meters and they do not like to exceed 3 meters for safety reasons.

During our stay in Majuro, Kevin Kinsey came down with a fever and chills. During loading operations on the 17th he became weak. On the 18th Kevin became worse and the decision was made to send him home.

Late in the evening on the 21st, with the most recent wave height predictions from Japan, the decision was made to forego the 5N site. Ops at 2N were also in question unless the seas settled. There was much discussion on wether to go to th equator first and then to the 2N site allowing the weather to subside or go directly to the 2N ATLAS. The possibility of only a deployment at 2N was discussed, since a small boat operation would not be necessary on a deployment. On the 22nd we decided to go to the 2N site and make a decision then. The morning brought fair seas and operations became normal.

ATLAS
The operations during this cruise went extremely well. The ship's personnel performed in an extremely professional manner. Obviously, with the repeated TAO cruises, the officers and crew have become accostumed to TAO mooring operations. There where only a few very minor problems during the cruise.

At the 2N, 165E site the bottom Oceano release failed and the backup EG&G release was used. I discovered there are a few oddball sized SEACAT brackets that will not fit on the bridle mounts of the ATLAS and PROTEUS buoys and are near impossible to attach to the

ATLAS cable. I only ran into 2 of these brackets out of the 18 I sent on the cruise and the 6 I recovered. I have no idea how many we have in our TAO inventory like this.

The tube swap and rain gauge refurbishment at ET-241 were very routine. We checked the cable for problems, found none, and swapped the tube and RM Young. We brought the rain gauge back to the ship, dumped the data, installed batteries, and initialized the system. We were receiving good data from both the rain gauge and the ATLAS tube. I did not swap out the Rotronix sensor on the since I was receiving good humidities after the tube swap. In hind sight I think I should have just to replace the sensor with a more recently calibrated unit. Of course, after the two buoy rides it took to swap the tube and rain gauge, I would have been the only one that would have gone.

0, 165E PROTEUS

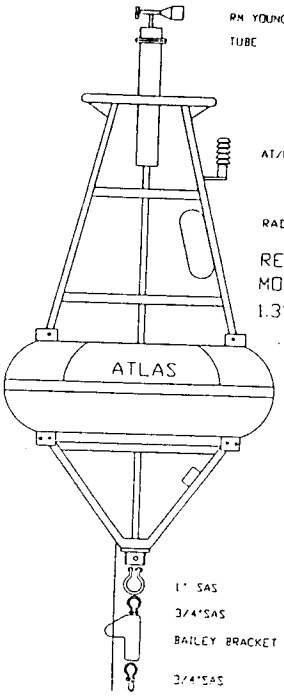
Paul had called me after the ship left Majuro that the 165E buoy had stopped transmitting. All 4 transmitters on the buoy had stopped at the same time on the 17th of December. This was very unusual and lead Paul and I to the conclusion there was a strong possibility the buoy went down with the mooring.

We arrived at the equator with no surface buoy in sight. We started an acoustic survey at the last transmitted position of the buoy and were able to triangulate on the bottom portion of the mooring(see attached diagram). Both releases were in good working order and a very good GPS position was obtained. The decision was made to leave the recovery operations for the spring. The delay in recovering TC-1 would give us the opportunity to plan for a major dragging effort in case the buoy had sank.

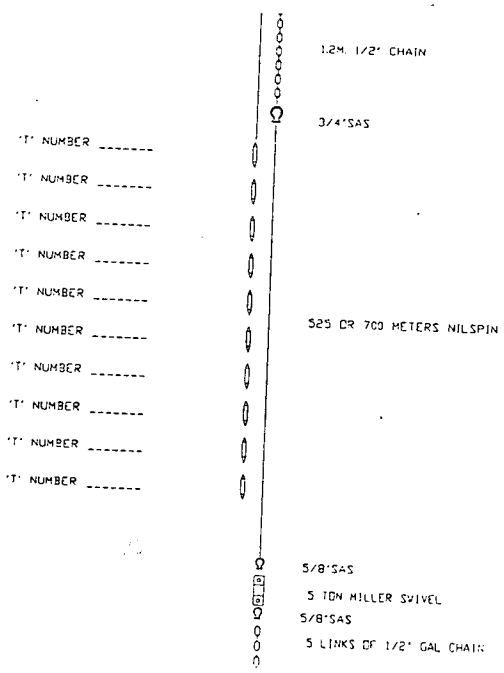
Deployment operations for TC-3 were begun and finished that afternoon. The only note of concern was the lack of fairing onboard. I was able to deploy only 175 meters on TC-3. Otherwise the mooring went in with no problems.

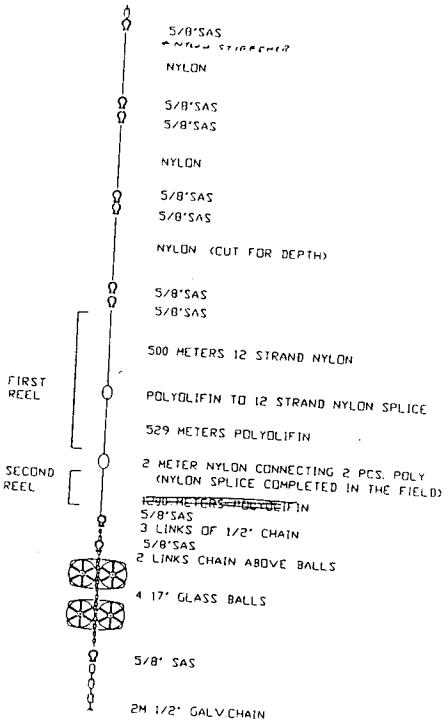
Acknowledgements:

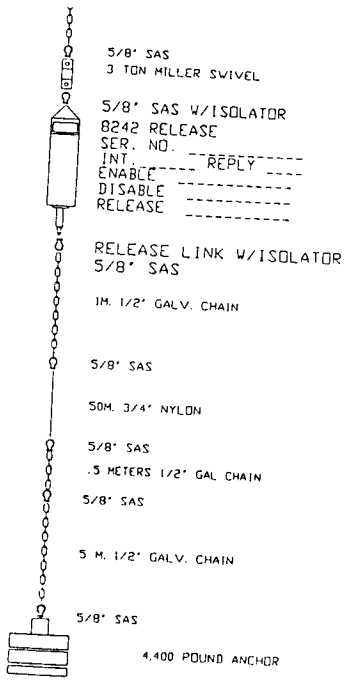
I would like to thank the officers and crew of the Kaiyo for a very enjoyable cruise. It is a pleasure to sail on this ship with such a professional attitude. I would like to thank Mr. Kuroda, Mt Yoneyama and Mr Takao and their staffs. They were of immense help with the ATLAS and PROTEUS operations and with everyday life aboard Kaiyo.



REVERSE CATENARY
MOORING
1.35 SCOPE







9. CO2 measurements

Part I

1.Tittle

Measurements for distribution of atmospheric and oceanic CO2 in the equatorial Pacific, during December 1994 - January 1995.

2.Responsible scientists

H.Yosikawa 1) M.Ishii 1) A.Kuyoshi 2)

1)Geochemical Research Laboratory Meteorological Research Institute (MRI/GRL) Nagamine 1-1, Tsukuba-sh, Ibaraki-ken, 305 Japan

2)Ocean Carbon Flux Study Department

Kansai Environmental Engineering Center Co. LTD. (KEEC) 3-39, Nakazaki-nish, 2-chome, Kita-ku, Osaka, 530 Japan

3. Object

Atmospheric CO2, known as a greenhouse gas, has been incresing due to the emission of anthropogenic CO2. It has increased approximately 25% in comparison with the pre-industrial era (280 ppm). In order to predict the level of atmospheric CO2 in the future, it is necessary to better understand the present inventory among global carbon reservoirs: atmosphere ,biosphere and ocean.

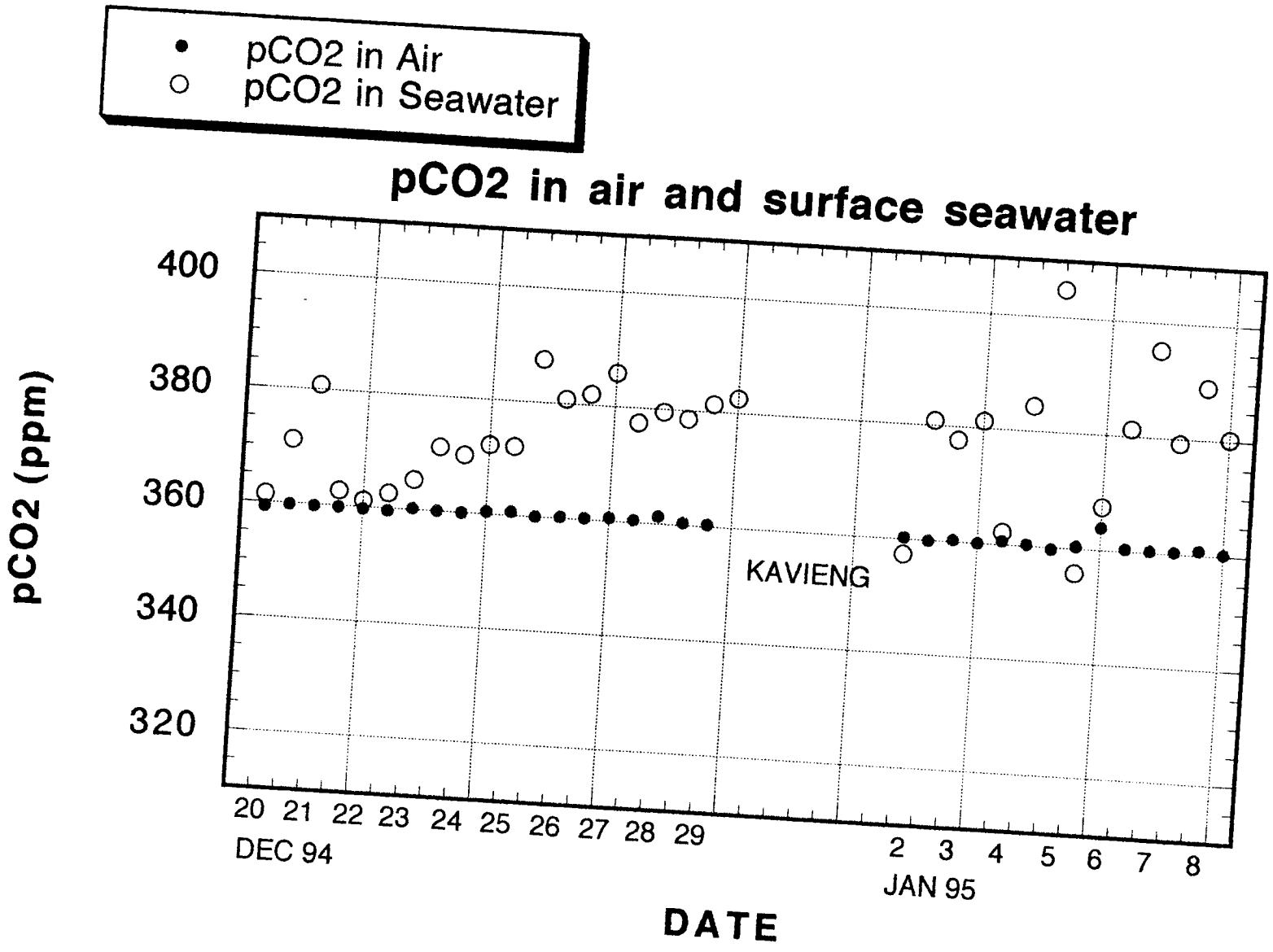
CO2 exchange between the atmosphere and ocean plays an important role in determining the level of atmospheric CO2 . The difference in partial pressure of CO2 between the ocean and the atmosphere (delta pCO2) is the driving force for air/sea CO2 exchange. Central equatorial Pacific acts as a source for atmospheric CO2. but time and spatisl distribution of delta pCO2 is not enough to elucidate the interannual variation in CO2 outflow. During this cruise measurements of pCO2 are made to study the interannual change CO2 outflow from the ocean to the atmosphere in the tropical Pacific region.

4.Method

Measurements of the CO2 concentration in the background air and the air equilibrated with surface seawater were made using the MRI CO2 measuring system. Air sample was taken from the top of the bridge into the 2nd laboratory at a flow rate of 15 ℓ /min. Sea water was continuously taken from the bottom of the ship and then was introduced into the MRI equilibrator at the 2nd laboratory.

5.Equipment

We used a non-dispersive infrared gas analyzer (BINOS 1.4, Germany) to determine the CO2 concentration. CO2 will be published based on the WMO X85 mole fraction scale after this cruise, but the measurements in this report are tentative. Because four CO2 calibration gases will be re-analyzed at out laboratory after this cruise to evaluate a concentration drift.


pCO2 in Air
pCO2 in Seawater
pCO2 in air and surface seawater
pCO2 (ppm)
400
380
360
340
320
KAVIENG
20 21 22 23 24 25 26 27 28 29
DEC 94
2 3 4 5 6 7 8
JAN 95
DATE

Part II

1.Tittle

Spatial variation of total inorganic carbon in seawater in the equatorial Pacific during December 1994 - January 1995.

2. Object

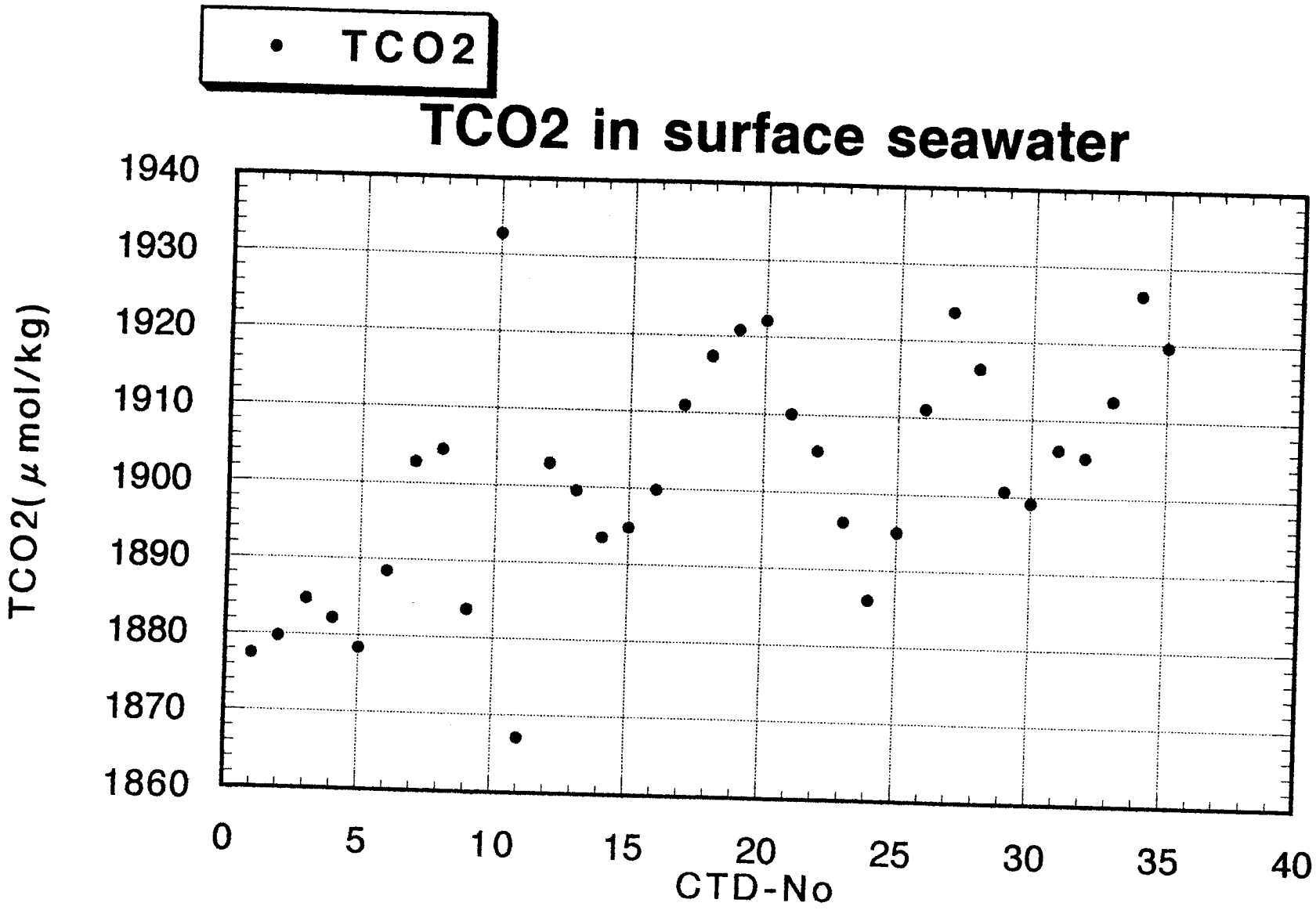
Total inorganic carbon (TCO2) is defined as a sum of the concentrations of hydrated carbon dioxide carbonic acid bicarbonate and carbonate in the seawater. TCO2 concentration in the surface seawater varies with time and space due to the physical, chemical and biological processes. Such TCO2 variation significantly affects the level of pCO2 which is an important factor for the air/sea exchange of CO2. During this cruise we will focus on the carbonate system in this equatorial Pacific based on simultaneous measurements of TCO2 and pCO2 in the surface seawater.

3. Method

TCO2 in surface seawater: Seawater was continuously pumped up from the bottom of the ship to the 2nd laboratory and then was was introduced (1 ℓ /min) into the MRI coulometric TCO2 measuring system (1) at a flow rate of about 1 ℓ /min. TCO2 in the standard seawater and CO2 standard gas (1% CO2 in air) were also analyzed occasionally to calibrate the measurements of seawater samples.

4. Equipment

We used CO2 coulometer Model (UIC Inc.USA) for measuring the extracted CO2 in the seawater sample. The CO2 extraction system was operated by a computer system to automatically introduce the extracted CO2 into the coulometer.


• TCO2
TCO2 in surface seawater
TCO2(μmol/kg)
1940
1930
1920
1910
1900
1890
1880
1870
1860
0
5
10
15
20
25
30
35
40
CTD-No

10. Participants List

Position	Name	Address/Telephone No.
Chief Scientist JAMSTEC	Yoshifumi Kuroda	Japan Marine Science & Technology Center 2-15 Natsushima,Yokosuka-shi,Kanagawa 237 Japan Tel. 0468-66-3811
Scientist JAMSTEC	Kunio Yoneyama	
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Technical Stuff NME	Hiroshi Yamamoto	
Technical Stuff NME	Atsuo Ito	
Technical Stuff NME	Mitsuru Hayashi	
Technical Stuff NME	Takaya Nakamura	
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Technical Stuff PMEL/NOAA	Amdrew J. Shepherd	Pacific Marine Enviromental Laboratory 7600 Sand Point Way Northeast,Seattle, Washington 98115 U.S.A. Tel. 206-526-6728

KAIYO Crew Members

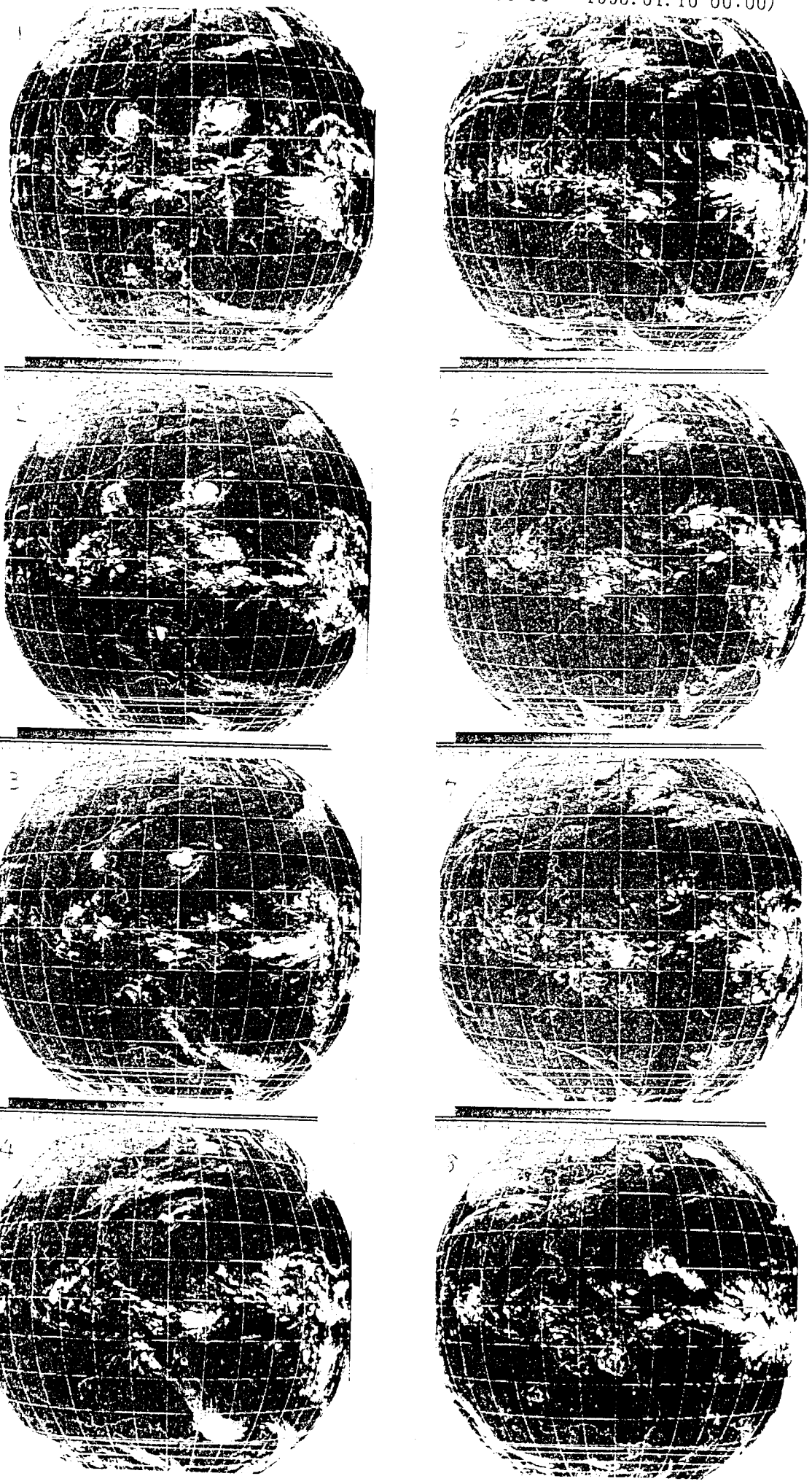
Captain	Hiroshi Hyodo
Chief Officer	Yukinori Orita
Second Officer	Kazunori Fujihara
Third Officer	Takashi Yamamoto
Chief Engineer	Tatsuo Jidouzono
First Engineer	Akemitsu Fukuda
Second Engineer	Kiyonori Kajinishi
Third Engineer	Atsushi Takeya
Chief Radio Operater	Hideyuki Akama
Second Radio Operater	Hiroyasu Saitake
Boatswain	Takami Hayashi
Able Seaman	Tsutomu Sato
Able Seaman	Masayoshi Matsumoto
Able Seaman	Ichiro Oba
Able Seaman	Yoshiaki Shirai
Sailor	Takashi Kiyohara
Sailor	Tomohiro Ishizaki
No.1 Oiler	Tsuneaki Yasunami
Oiler	Mitsuo Yashiki
Oiler	Masayuki Masunaga
Oiler	Kozo Miura
Oiler	Katsushi Chiba
Chief Steword	Kiyotoshi Teranishi
Steward	Yoshitaro Tamiya
Steward	Kaoru Takashima
Steward	Tomihisa Morita
Steward	Isao Matsumoto
Jr. Third Officer	Satoshi Tsuruta

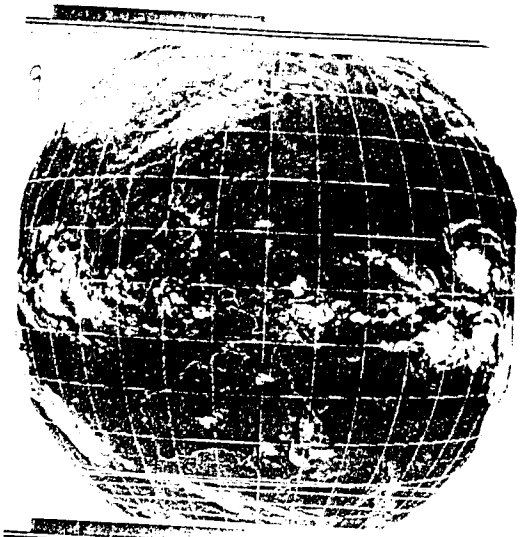
Appendices

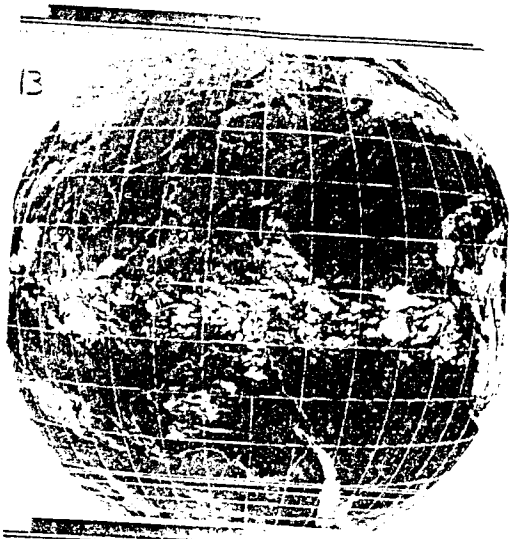
20/12/94 Local Time (-12=UTC)
10:00 Depart Majuro
ADCP, CO_2 measurements started
21/12/94 Local Time (-12=UTC)
13:00 XBT measurement started
15:00 Sounding measurement started
22/12/94 Local Time(-12=UTC)
11:00 Meeting for mooring operation
23/12/94 Local Time(-11=UTC)
06:00-11:27 01-59.8N,165-00.3E ATLAS recovery
14:23-17:42 01-59.74N,165-02.03E ATLAS deployment Depth 4170m
18:04-18:35 CTD measurement start
24/12/94 Local Time(-11=UTC)
06:00-08:08 PROTEUS underwater portion positioning (00-00.201N,165-0
2.213E)
13:15-16:31 00-00.28S,164-55.80E PROTEUS deployment Depth 4388m
17:55-19:00 ADCP comparison test between mooring and ship
25/12/94 Local Time(-11=UTC)
cruising for 5S,156E with CTD, ADCP and sounding measurements
26/12/94 Local Time(-11=UTC)
cruising for 5S,156E with CTD, ADCP and sounding measurements
27/12/94 Local Time(-10=UTC)
08:00-10:12 5S,156E ATLAS recovery
13:33-15:21 05-00.083S,156-01.541E ATLAS deployment Depth 1500m
28/12/94 Local Time (-10=UTC)
08:00-10:10 2-00S,156-00E ATLAS repair
10:26-11:00 CTD (C11) last CTD on leg 1
18:00-19:30 Seminor on ENSO Yoneyama & Kuroda
29/12/94 Local Time (-10=UTC)
09:00 Sounding (RS27) last sounding on leg1
30/12/94 Local Time (-10=UTC)
10:45 Arrived in Kavieng
Bunkering
31/12/94 Local Time (-10=UTC)
Day off
1/1/95 Local Time (-10=UTC)
7:30 New year celebration

1/2/95 Local Time(-10=UTC)
9:45 Departed Kavieng. ADCP,CO_2 measurements started
1/3/95 Local Time(-10=UTC)
9:32 Upper air sounding started (RS28)
11:30-14:16 0,147E ADCP recovery (12:13 released)
15:30-17:42 0-00.12N,147-03.42E ATLAS 設置 水深4464m
1/4/95 Local Time(-10=UTC)
6:55-9:07 0-01.391S,146-57.170E ADCP deployment Depth 4466m
CTD measurements along 147E
1/5/95 Local Time(-10=UTC)
CTD measurements along 0,146E-0,143E
1/6/95 Local Time (-10=UTC)
CTD measurements along 0,146E-0,143E
Cruising for 02-40S,142E
CTD measurements along142E
1/7/95 Local Time (-10=UTC)
11:30-13:13 0,142E ADCP Recovery
14:00-15:23 00-00.017SN,141-59.022E ADCP Deployment Depth 3390m
16:42-19:20 Comparison between shipboard ADCPand mooring ADCP
1/8/95 Local Time(-10=UTC)
CTD measurements along 142E
1/9/95 Local Time (-9=UTC)
CTD measurements from 3N,142E to 4-50N,137E
1/10/95 Local Time (-9=UTC)
CTD measurements from 4-50N,137E to Palau
12:13 Last CTD cast (C40)
15:00 Upper air sounding ended (RS57)
1/11/95 Local Time (-9=UTC)
10:20 Arrival in Palau
13:00-16:00 Unloarding PMEL buoy gear

GMS IR Images (1994.12.22 00:00 - 1994.12.29 00:00,
1995.01.03 00:00 - 1995.01.10 00:00)



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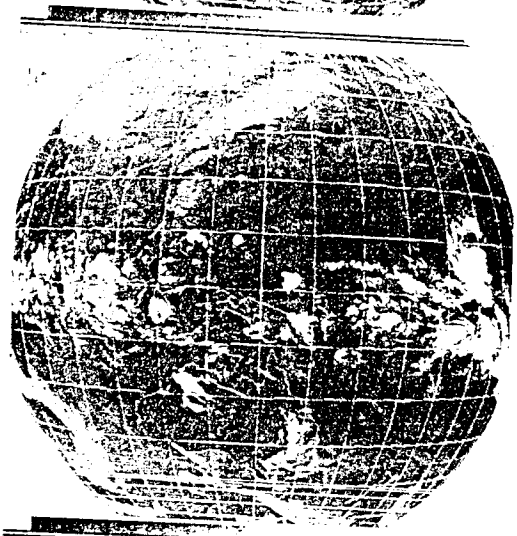

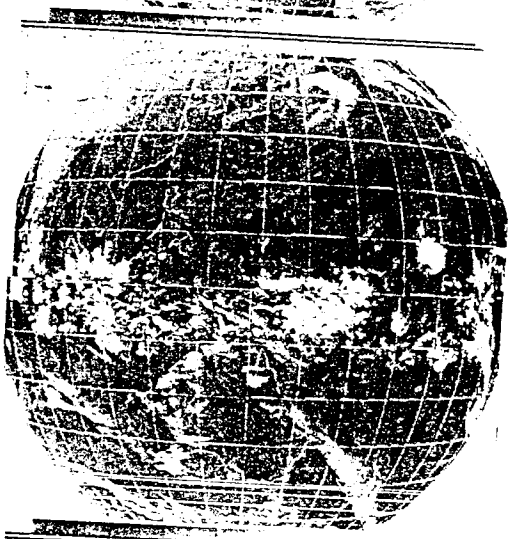

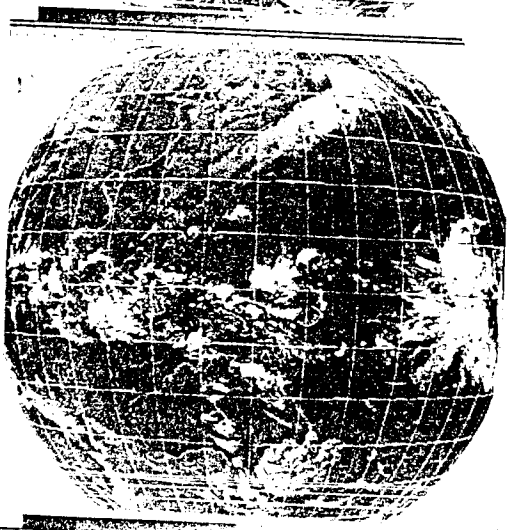

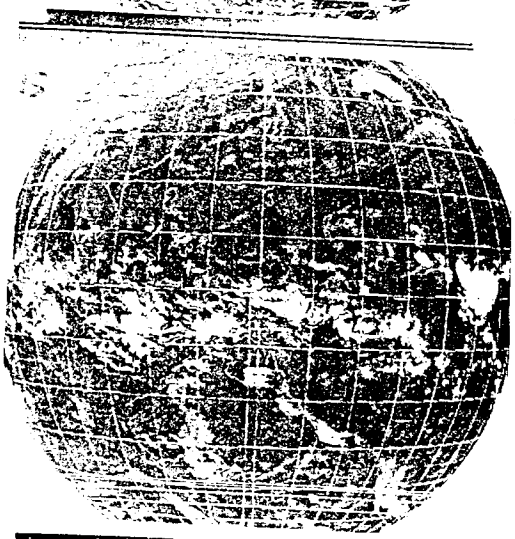


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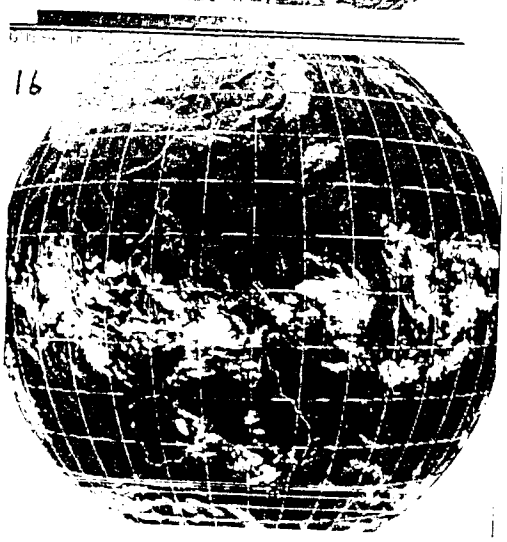
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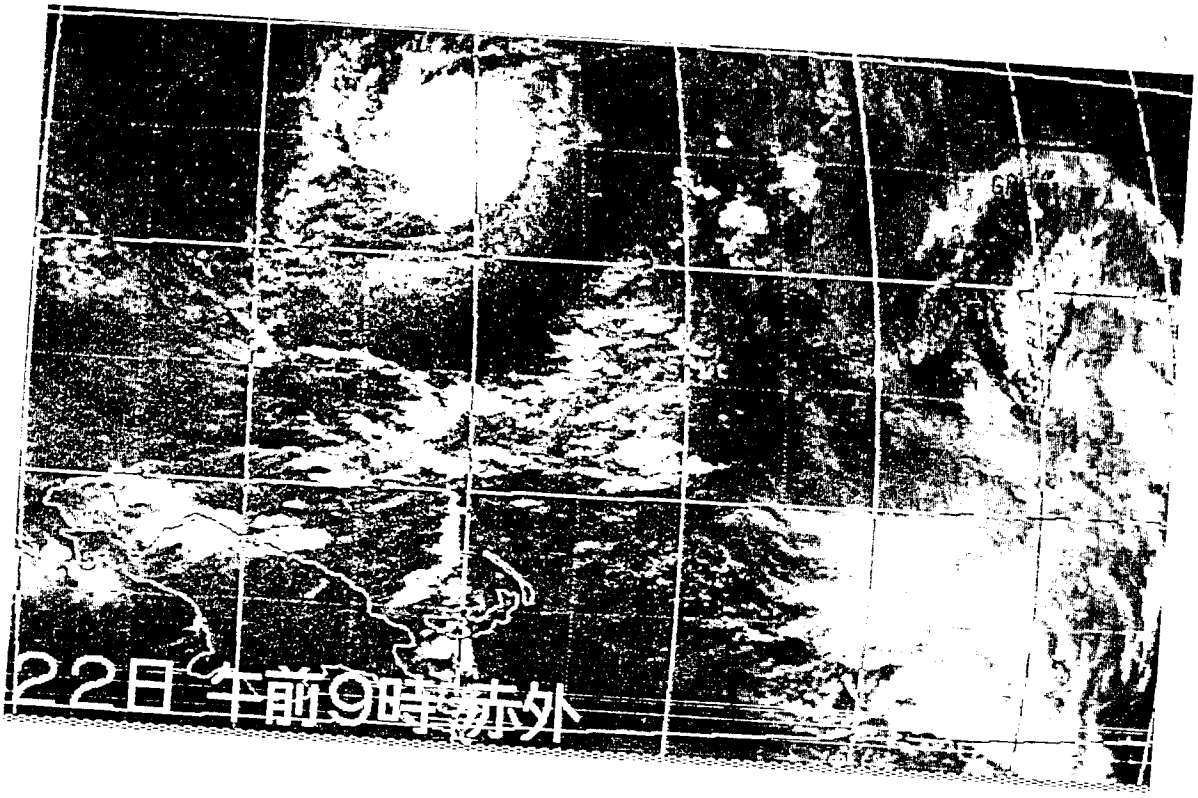
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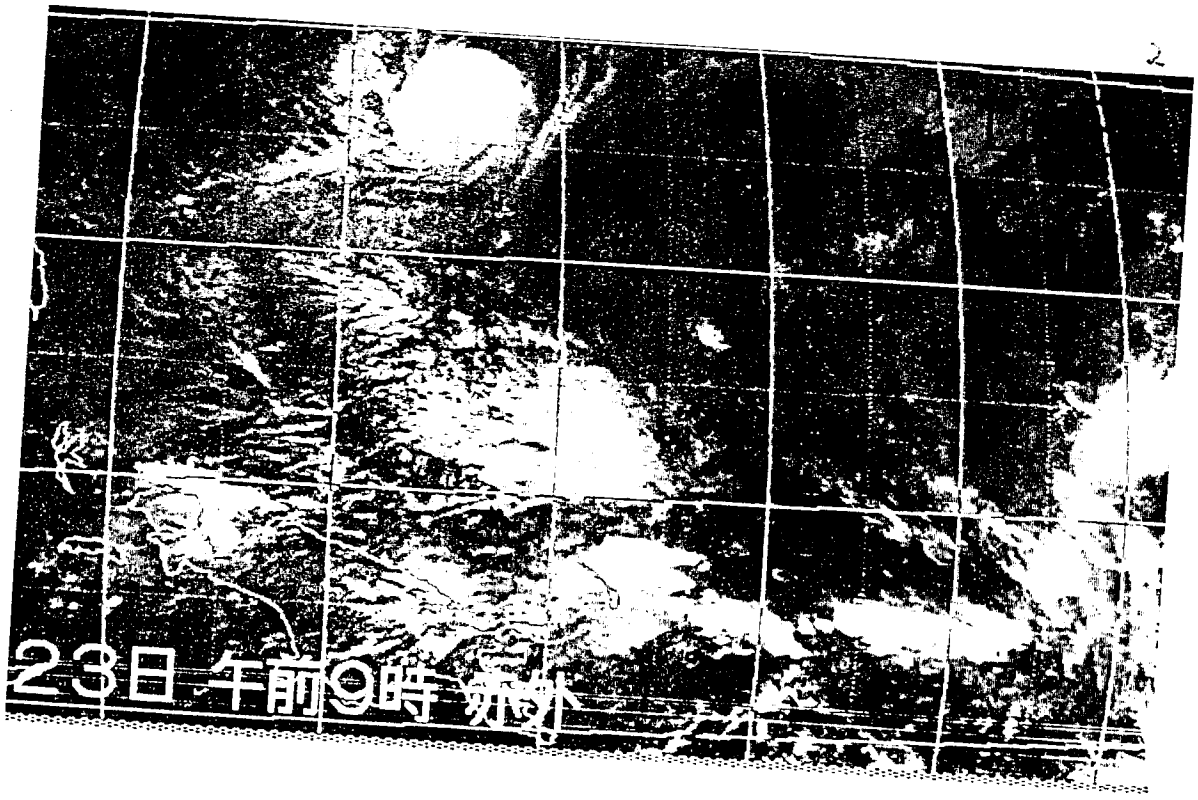
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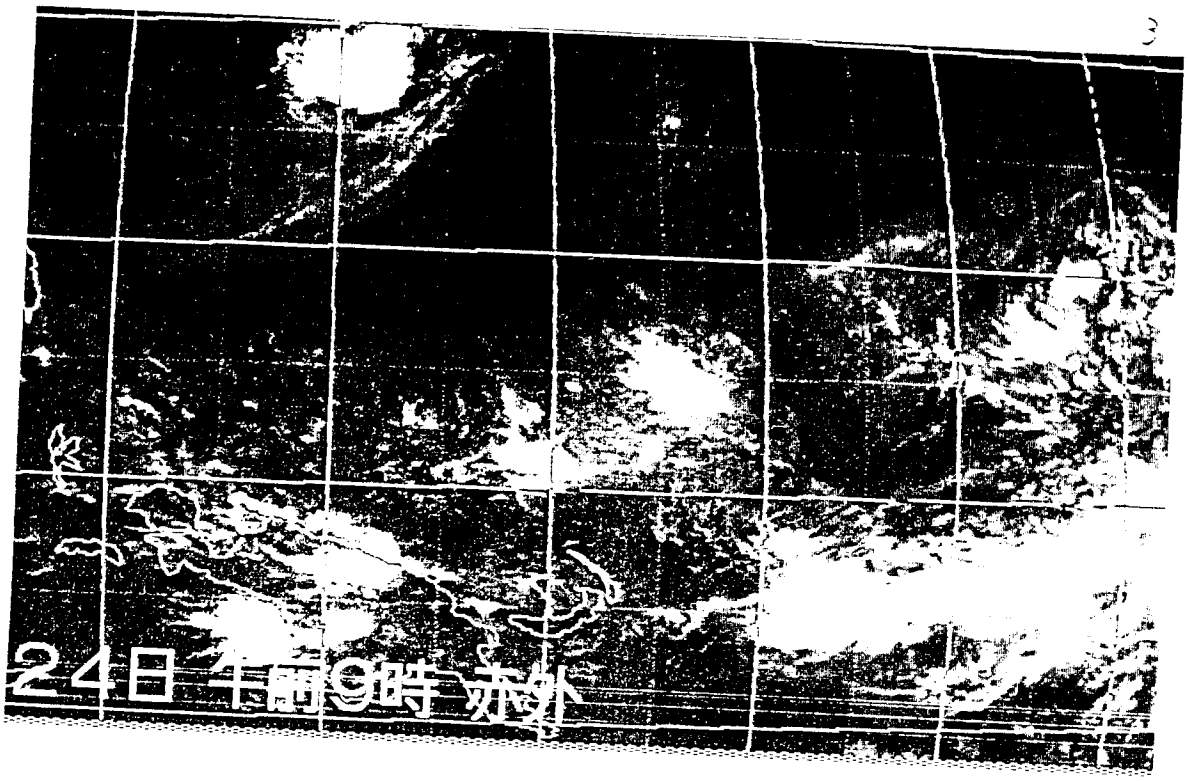

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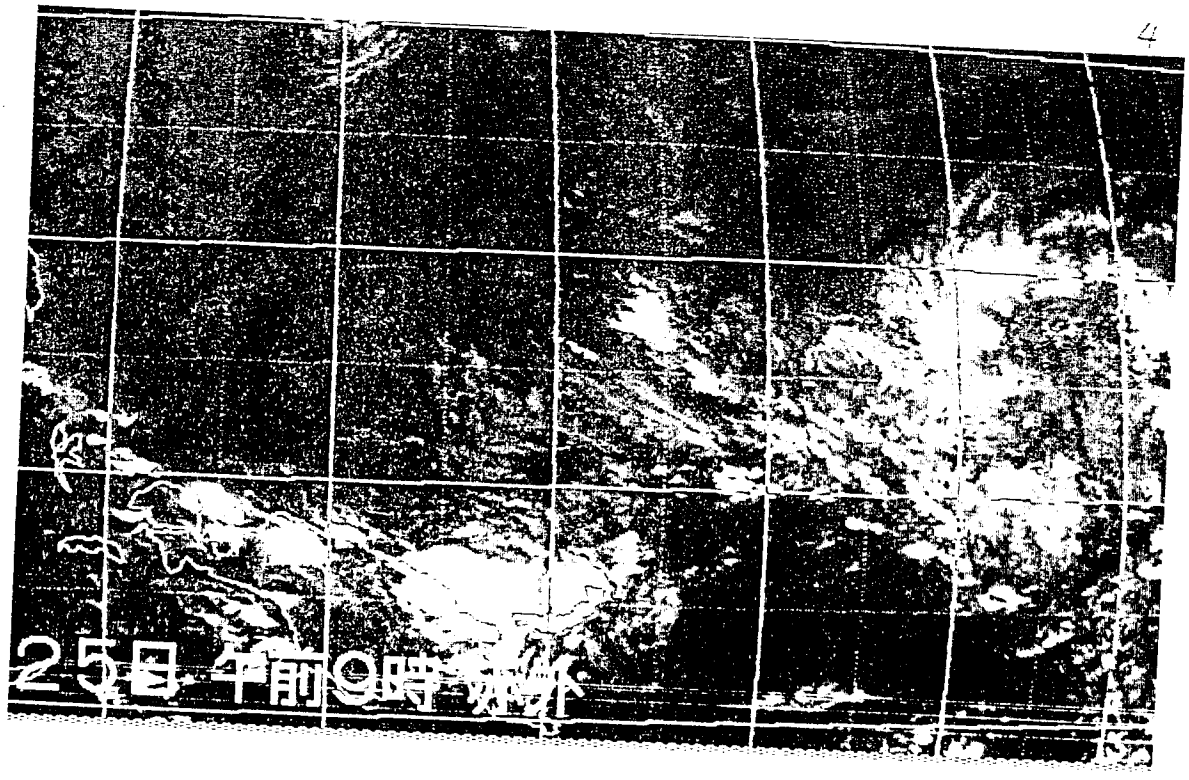

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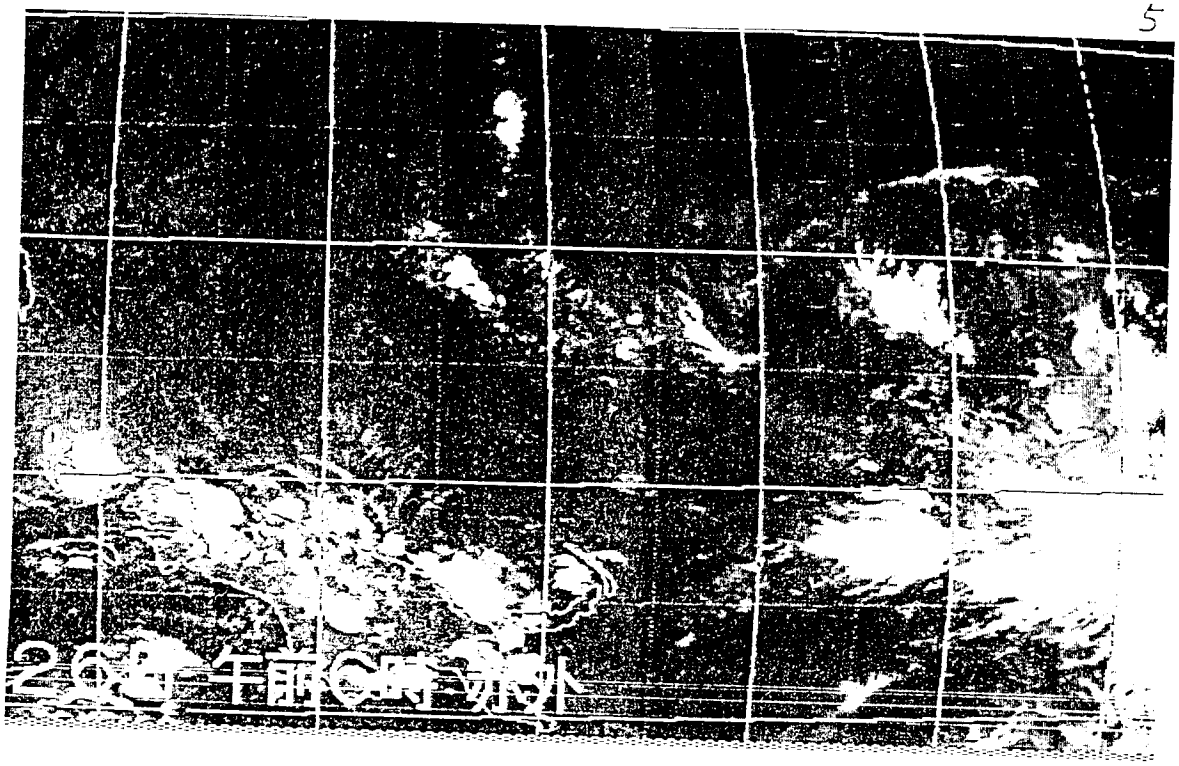

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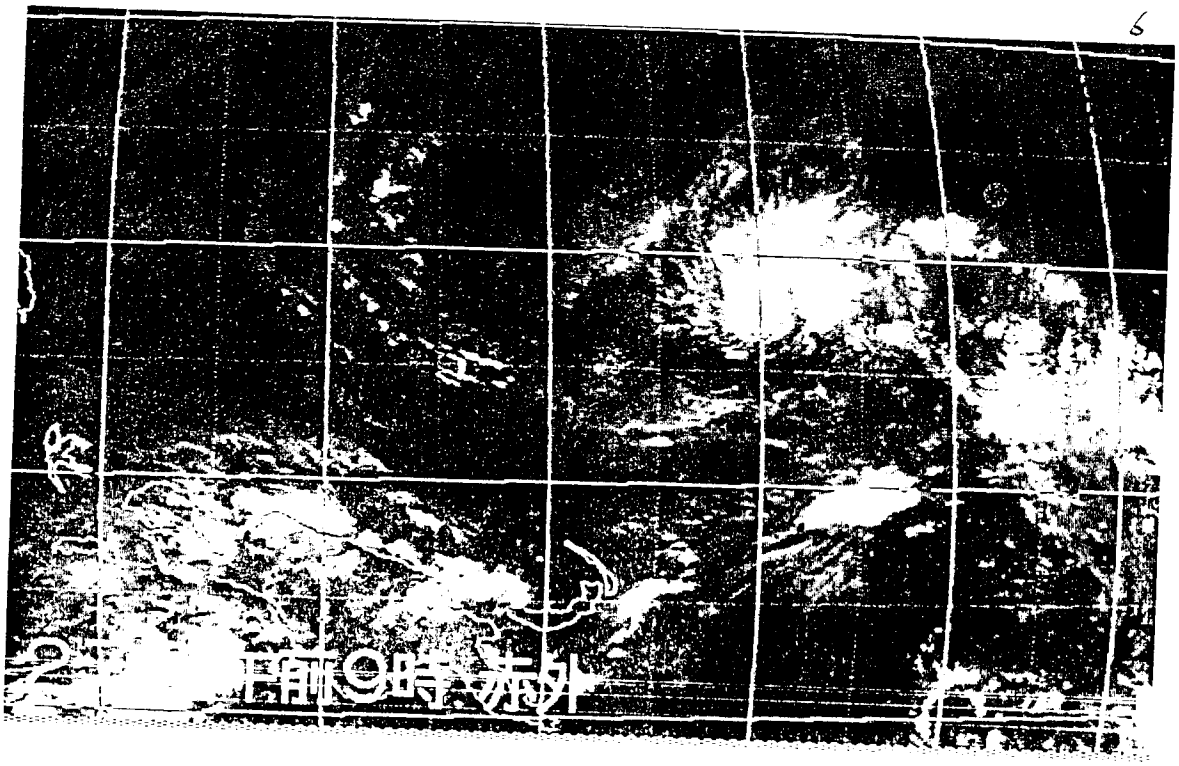

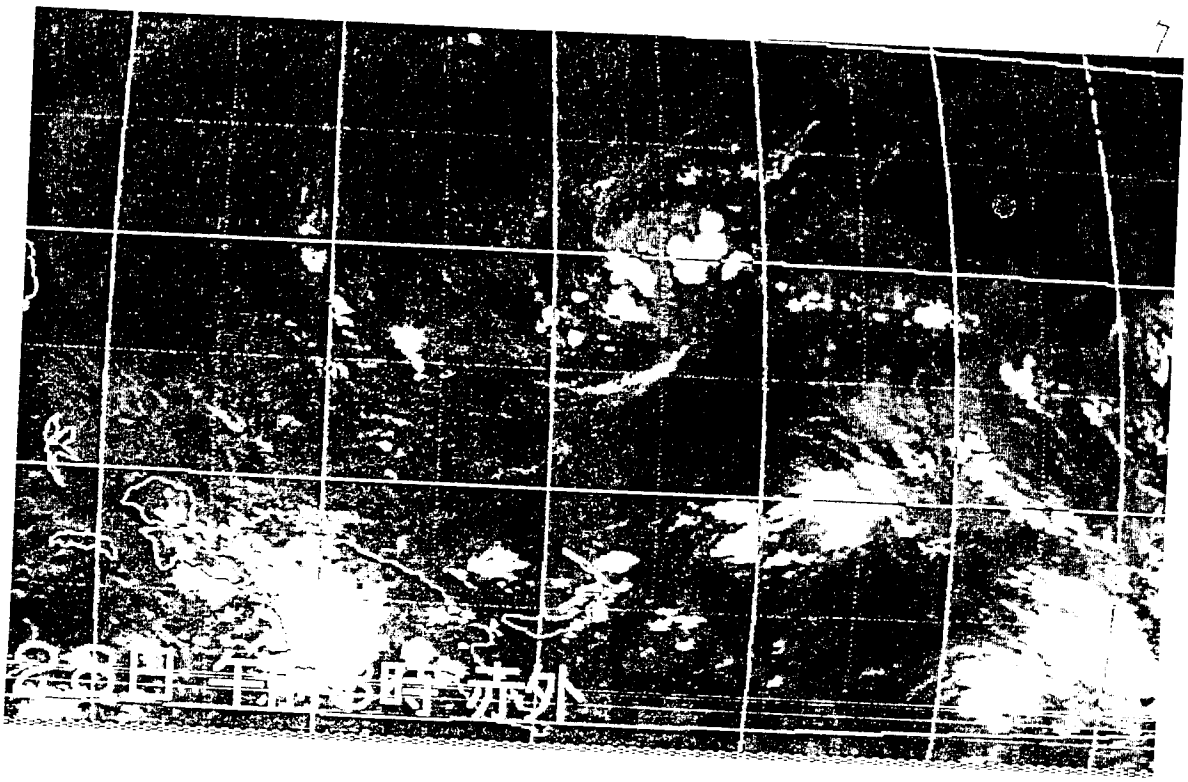
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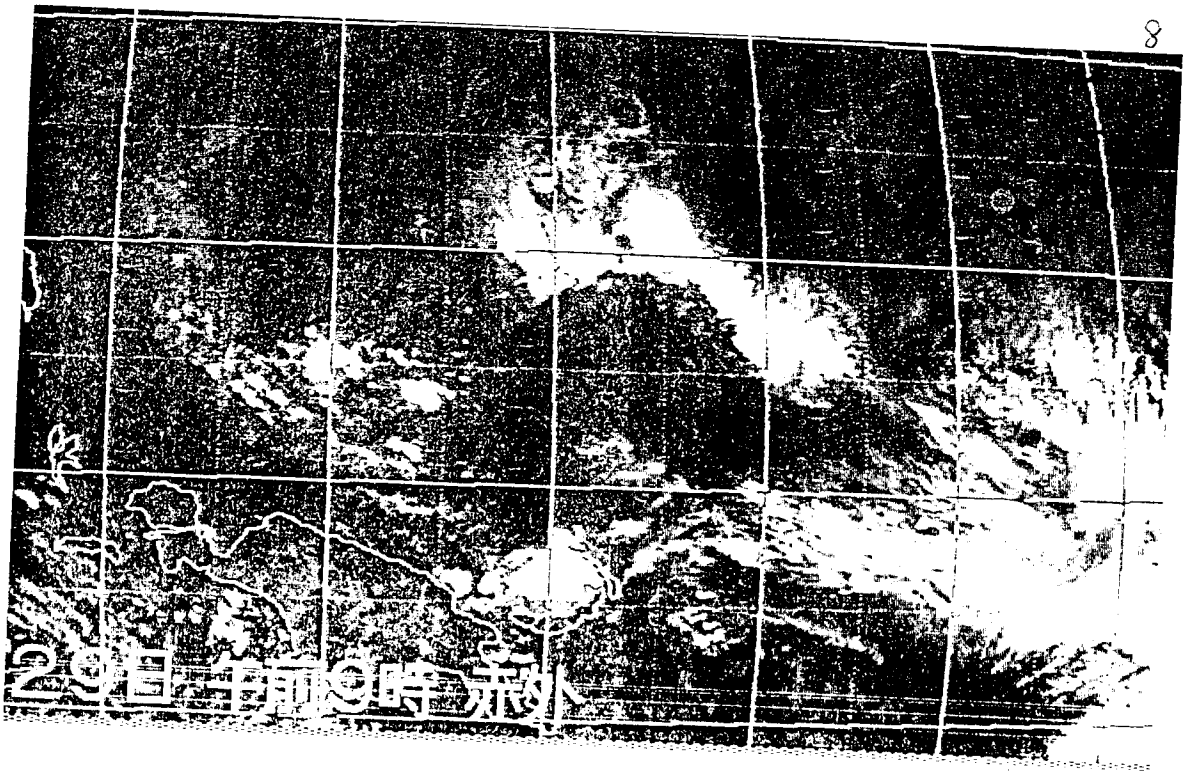
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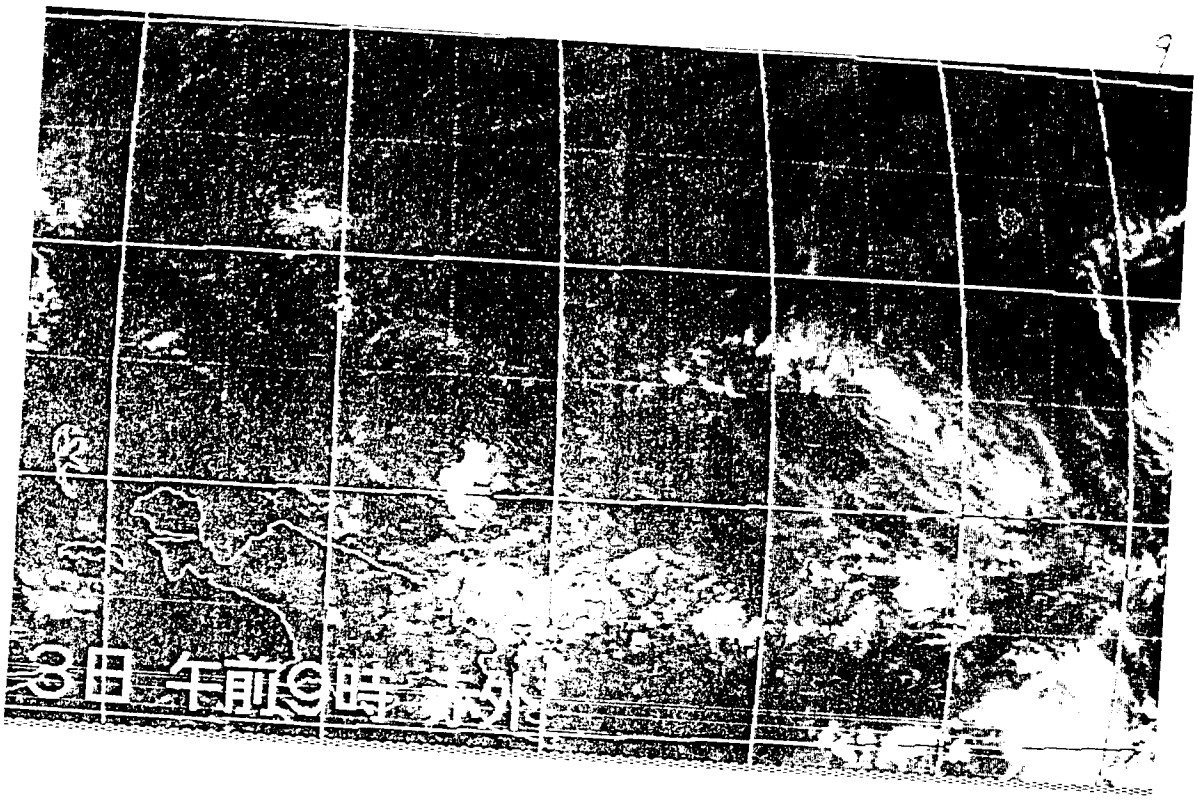
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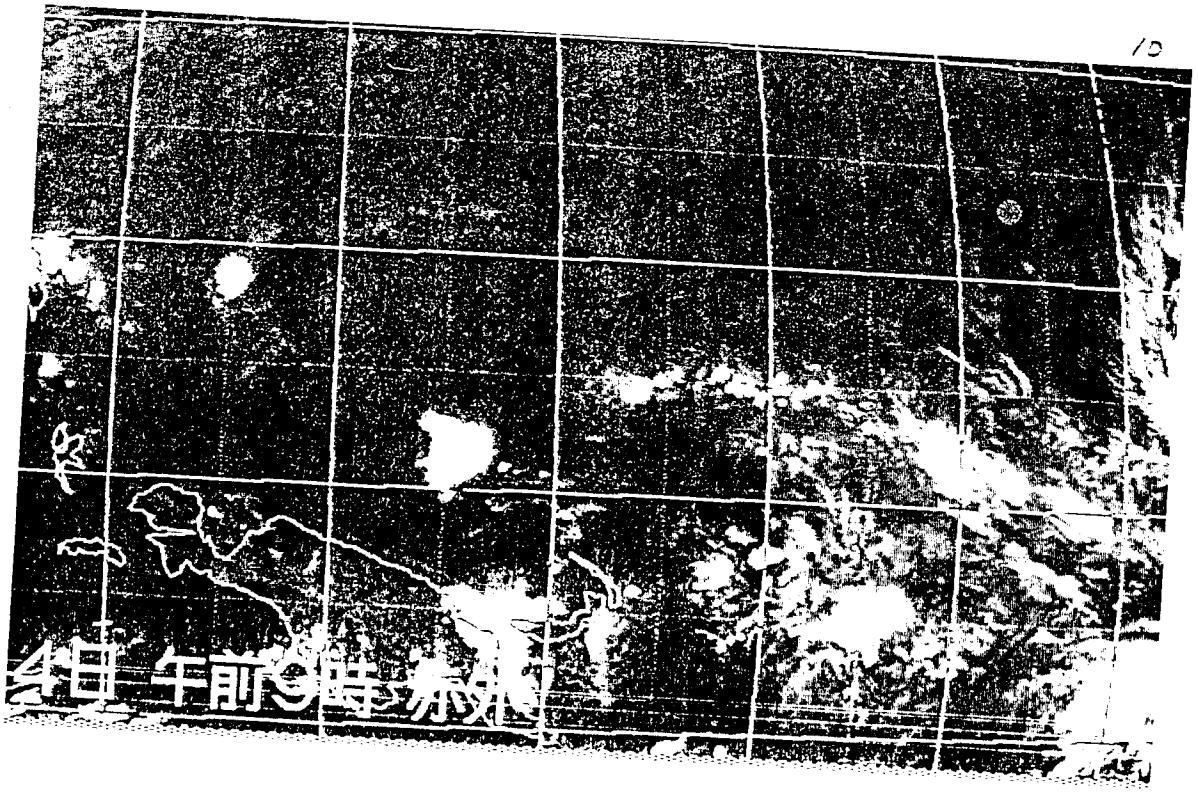
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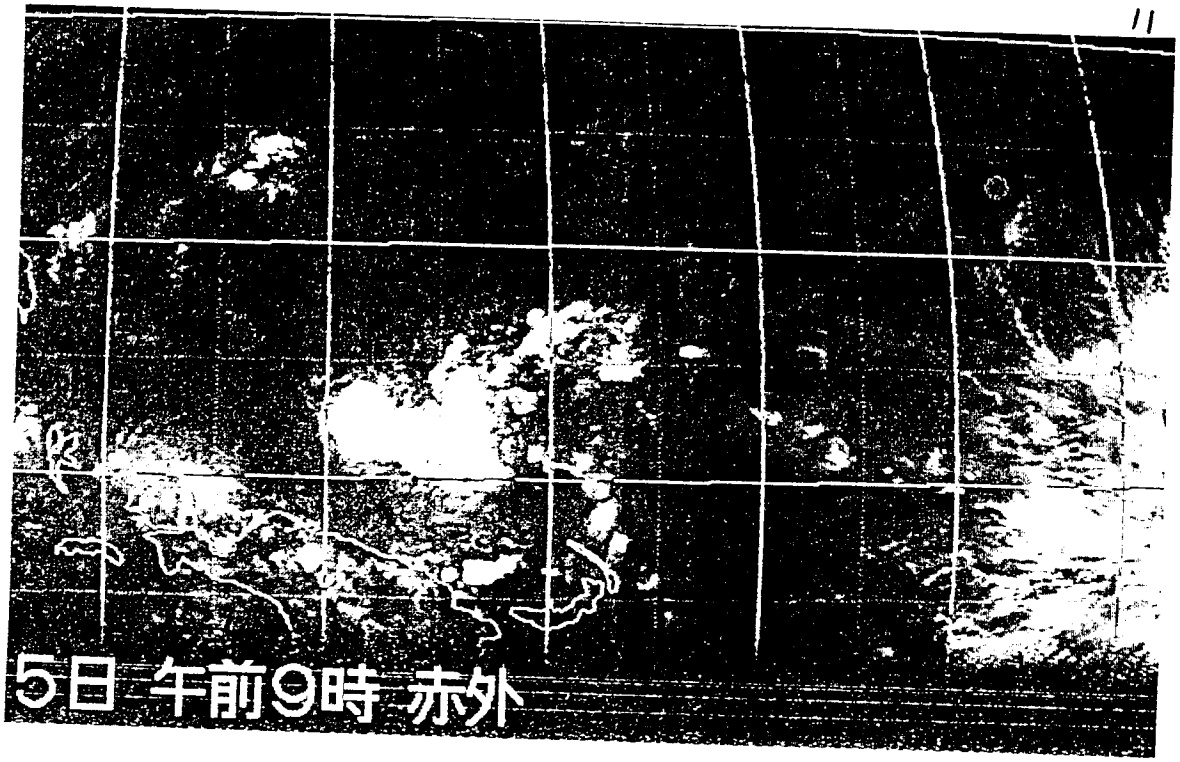

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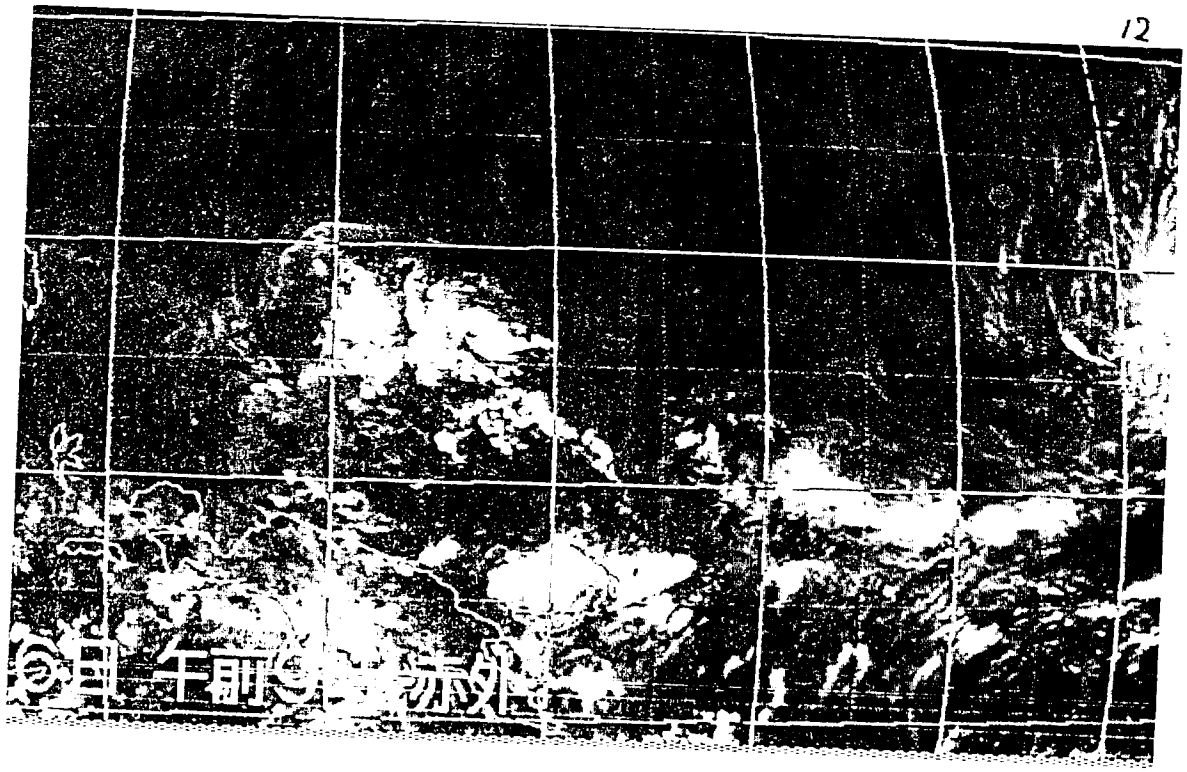

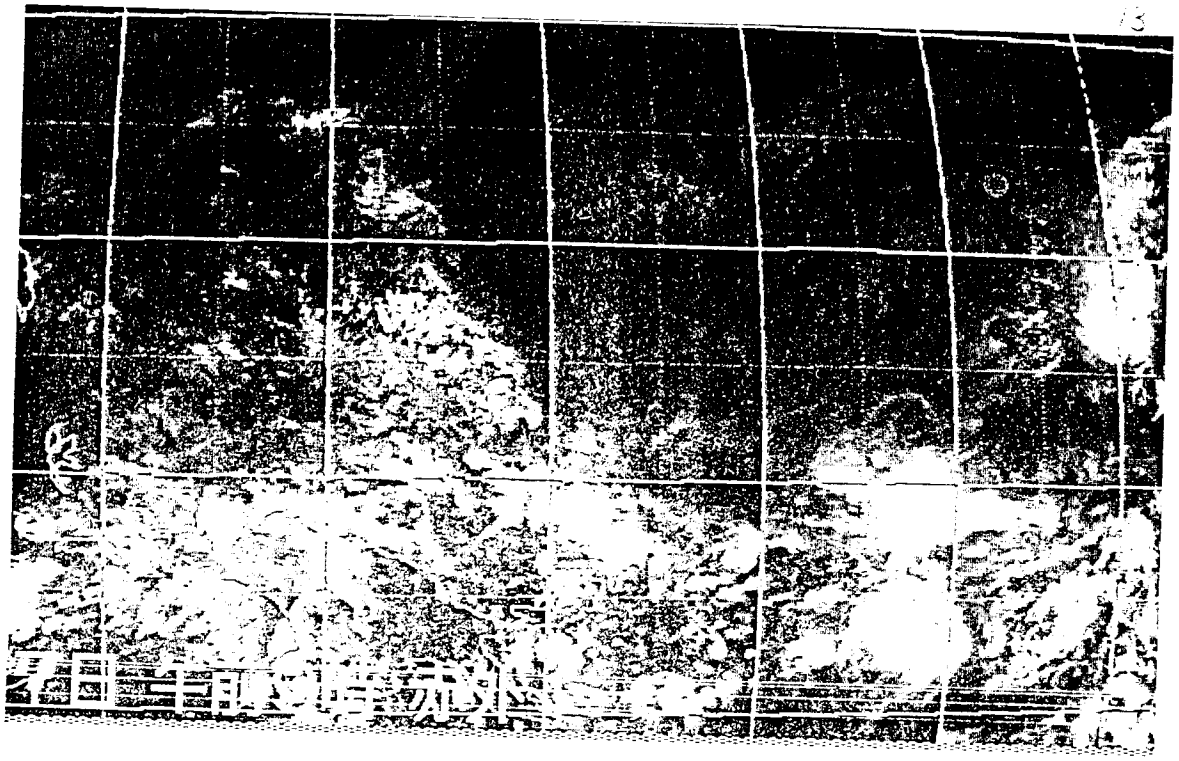

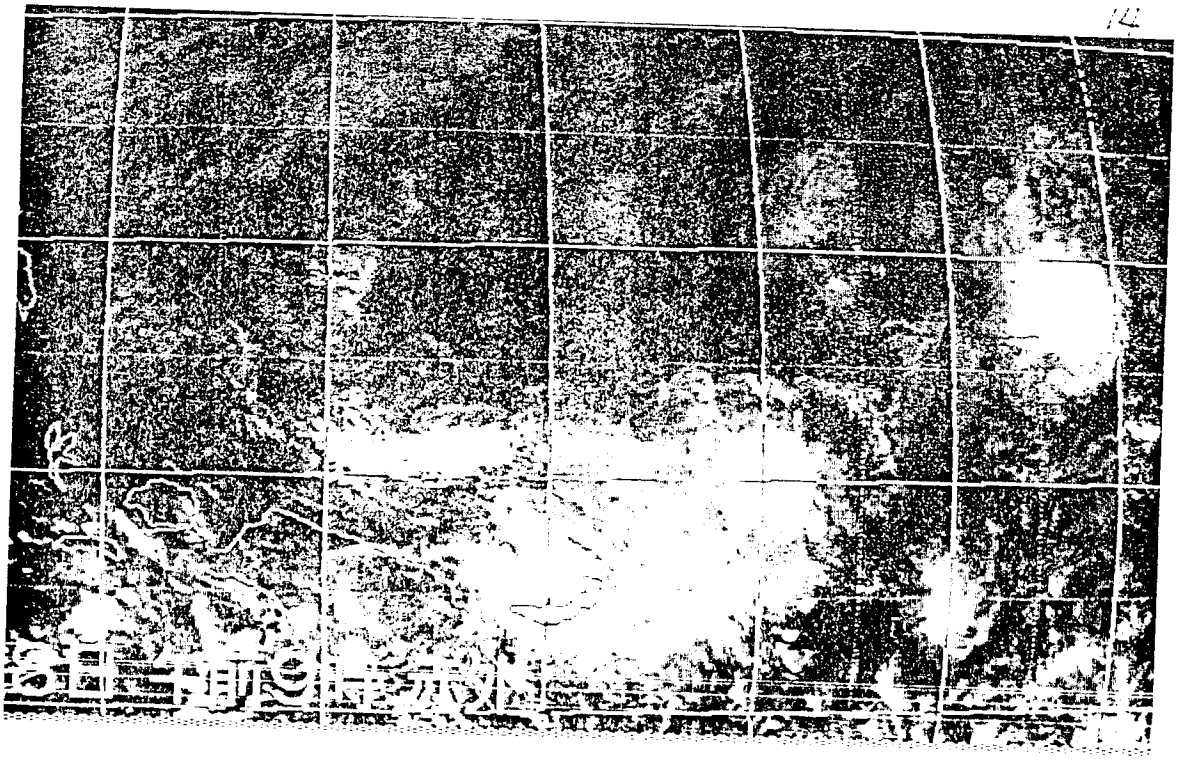

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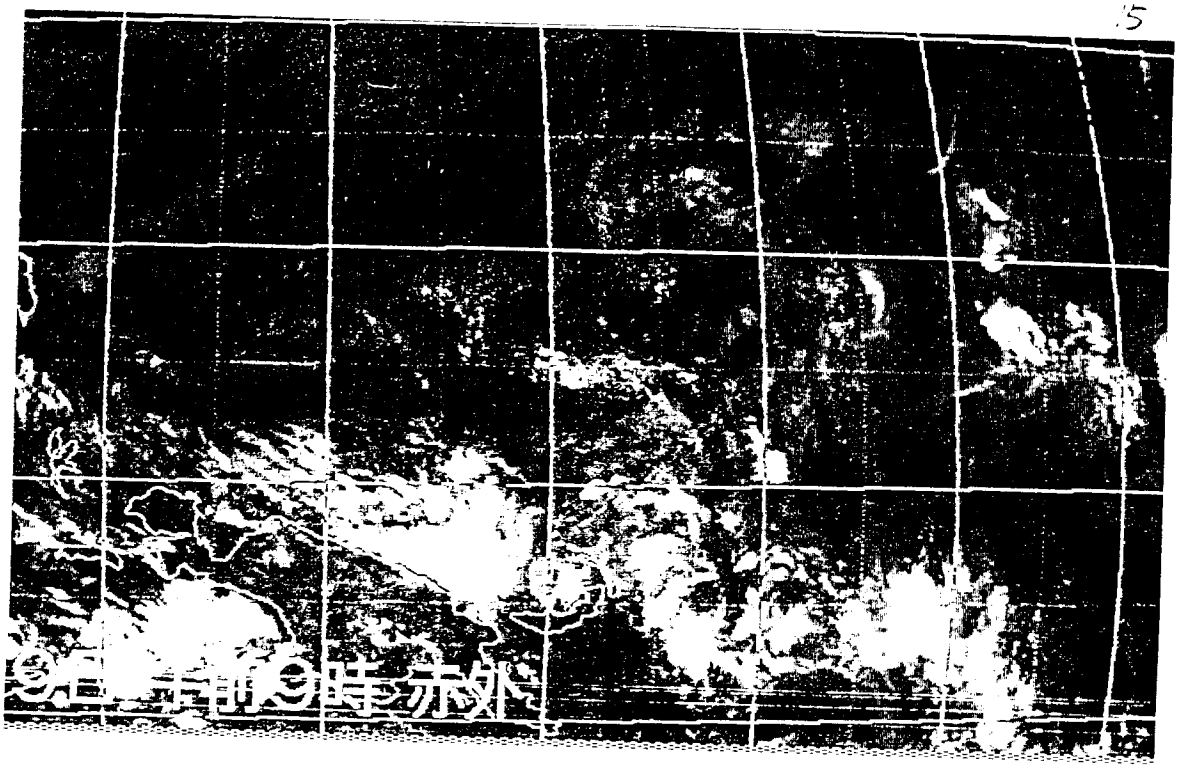
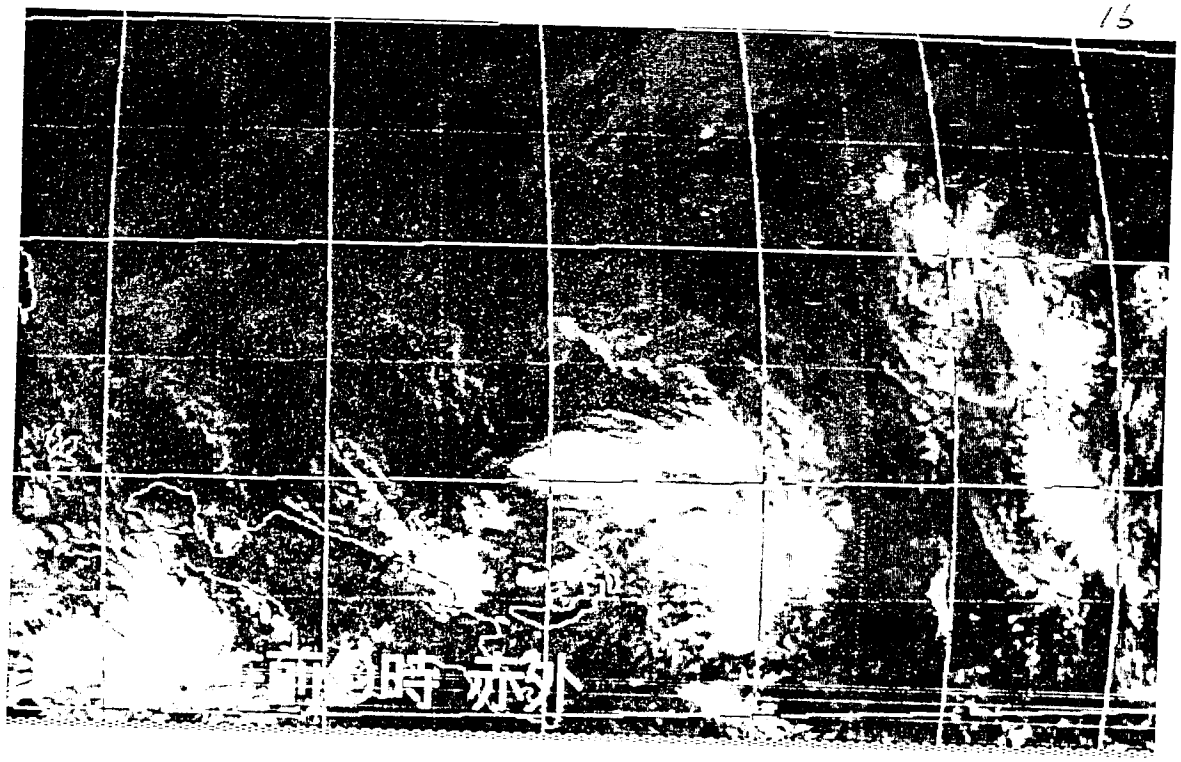


15日0時赤外

16



16日0時赤外

ブイ作業改良点 Improvements for mooring works.

日本海洋事業（株）
Nippin Mrine Enterprises co., ltd.
山本　博Yamamoto, Hiroshi
高尾宏一Takao, Koichi

ケブラーロープ等巻取機についてAbout reel winder.

・軸駆動用モーターからのチェーンが現状ではむき出しになっており、安全上好ましくないのでカバーを付ける必要がある。
Naked drive-chain is dangerous.

・リール脱着用油圧ジャッキを容易に固定できるよう、リールとジャッキのクリアランスも考えた上で形態を多少変更する必要がある。
An improvement in its bottom frame is necessary for the hydrolic jack.

・現在、軸固定用チャックの反対側の軸受けが、径の小さい軸用に固定されているが、径の太いものを使用する場合、軸と軸受けの当たりの問題と軸の水平の問題がある。これを是正するために、軸受け側を軸径に合わせた脱着可能なプレートにする等改良する必要がある。
We need some kinds of plates for the pipe rest which offer proper diameter to the pipes, and keep them horizontally.

手動巻取り・巻出し用リール架台についてAbout the reel stand.

・現状では軸受けが１カ所にしかないので、もう少し下に１カ所増設する。
We need one more paire of pipe rest some 30cm under present one.

その他

・ＡＤＣＰブイ用架台にキャスター付きの台を取り付ける。
A rest with casters is convenient for big ball buoy.
・Ａフレームクレーンのブロックに張力計を取り付け、必要に応じいつでも張力を監視できるようにする。
A tension meter is needed to monitor the tension of mooring lines while recovery and deployment if necessary.

TOCS KY9406 TIME TABLE
17/12/94 船内時刻 (-12=UTC)
10:00-15:40 ブイ資材積み込み
18/12/94 船内時刻 (-12=UTC)
観測準備
19/12/94 船内時刻 (-12=UTC)
荒天待機
20/12/94 船内時刻 (-12=UTC)
10:00 Majuro出航 ADCP,CO_2観測開始
13:00 端艇総練
14:00 観測計画打ち合わせ
21/12/94 船内時刻 (-12=UTC)
10:00 観測計画打ち合わせ（ATLAS係留について）
13:00 XBTテスト、CTD準備
15:00 ゾンデ初回テスト
22/12/94 船内時刻 (-12=UTC)
11:00 打ち合わせ
23/12/94 船内時刻 (-11=UTC)
06:00-11:27 01-59.8N,165-00.3E ATLAS 回収
14:23-17:42 01-59.74N,165-02.03E ATLAS 設置　水深4170m
18:04-18:35 CTD 観測開始　(C01)
24/12/94 船内時刻 (-11=UTC)
06:00-08:08 PROTEUS 海中部音響切り離し装置による位置だし (00-00.201N,165-02.213E)
13:15-16:31 00-00.28S,164-55.80E PROTEUS 設置　水深4388m
17:55- 19:00 ADCP比較航走試験
25/12/94 船内時刻 (-11=UTC)
5S,156Eに向けてCTD,ADCP,高層気象観測を行いながら航走
26/12/94 船内時刻 (-11=UTC)
5S,156Eに向けてCTD,ADCP,高層気象観測を行いながら航走
27/12/94 船内時刻 (-10=UTC)
08:00-10:12 5S,156E ATLAS 回収
13:33-15:21 05-00.083S,156-01.541E ATLAS 設置　水深1500m
28/12/94 船内時刻 (-10=UTC)
08:00-10:10 2-00S,156-00E ATLAS 修理
10:26-11:00 CTD (C11) 1レグ最後のCTD
18:00-19:30 セミナー　エルニーニョについて　米山、黒田
29/12/94 船内時刻 (-10=UTC)
9:00 1レグ最後の高層気象観測 (RS27)

30/12/94 船内時刻 (-10=UTC)
10:45 Kavieng 入港
燃料補給
31/12/94 船内時刻 (-10=UTC)
休養
1/1/95 船内時刻 (-10=UTC)
7:30 正月慶賀会
1/2/95 船内時刻 (-10=UTC)
9:45 Kavieng 出港 ADCP,CO_2観測開始
1/3/95 船内時刻 (-10=UTC)
9:32 高層気象観測再開 (RS28)
11:30-14:16 0,147E ADCP 回収 (12:13 切り離し)
15:30-17:42 0-00.12N,147-03.42E ATLAS 設置 水深4464m
1/4/95 船内時刻 (-10=UTC)
6:55-9:07 0-01.391S,146-57.170E ADCP 設置 水深4466m
147E測線のCTD観測
1/5/95 船内時刻 (-10=UTC)
0,146E-0,143E測線のCTD観測
1/6/95 船内時刻 (-10=UTC)
0,146E-0,143E測線のCTD観測後、02-40S,142Eに向けて航走、
142EのCTD測線に入る。
1/7/95 船内時刻 (-10=UTC)
11:30-13:13 0,142E ADCP 回収 (11:32 切り離し)
14:00-15:23 00-00.017SN,141-59.022E ADCP 設置 水深3390m
16:42-19:20 舶用ADCPと係留ブイADCPの比較試験
1/8/95 船内時刻 (-10=UTC)
142E測線のCTD観測
1/9/95 船内時刻 (-9=UTC)
3N,142E から4-50N,137Eにかけての測線のCTD観測
1/10/95 船内時刻 (-9=UTC)
4-50N,137Eからパラオにかけての測線のCTD観測
12:13 6-20N,136Eで最後のCTD観測 (C40)
15:00 最後の高層気象観測 (RS57)
1/11/95 船内時刻 (-9=UTC)
10:20 Palau入港
13:00-16:00 PMELブイ資材荷降ろし

TOCS KY9406 要約　（黒田）

1994年（平成6）12月17日にかいようはMajuroでPMELのブイ資材を積み込んだ。18日は観測機器の調整を行った。19日は台風Bobbieのため荒天待機。20日にMajuroを出港した。ADCP，CO_2観測を開始した。21日は5N,165Eには３mを越える波が予想され、その地点のATLASブイ作業をあきらめできるだけ早く南下し2N,165Eに向かうことに決定した。風は弱くなったもののうねりは３m近く航行にも苦労した。21日にはゾンデ観測を開始した。23日には、波高も２mを下回るようになり、2N,165Eにおいて早朝よりATLASブイの回収、設置を行った。24日には、0,165EにおいてPROTEUSブイの設置を行なった。同地点で回収の予定であったが、表面ブイはなくなっており、音響切り離し装置の信号から海中部の位置出しを行った。PMELもこの海中部を確実に回収するためには次回のNOAAの船舶による航海で行った方が良いとの意向であった。25日、26日は5S,156Eに向けて航走した。27日には、5S,156Eで炎天下、無風状態のなかATLASブイの回収、設置を行った。28日はATLASブイの修理（雨量計の交換、データ制御部の交換）を行い、１レグの最後のCTDを行った。29日には１レグ最後のゾンデ観測を行なった。30日にケビエンに入港しその日の内に燃料の補給をすることができた。1995年元旦はケビエンの岸壁で迎え、穏やかな晴天のもと熱帯林からのぼる初日の出を拝んだ。賄の心尽しの正月料理を楽しんだ。２日にはケビエンを出港し、ADCP，CO_2観測を開始し、0,147Eに向けて航走した。3日には、0,147Eで背の高い雲から吹き降ろす涼しい風の中ADCP係留系の回収、ATLASの設置をおこなった。4日には、ADCPの設置を行った。147E測線のCTDを行い採水による溶存酸素の測定を開始した。5日には146E-143Eの赤道上、６日には142EのCTD測線を行った。7日は赤道のADCPブイの回収、設置を行い、最後の係留ブイ作業を無事終えた。8日は3N,142EまでCTDを行い、９日からパラオに向けての測線でCTDを行った。10日には、最後のCTD、ゾンデ観測を行った。11日に青い海に緑のロックアイランドが映えるパラオに入港し、PMELのブイ資材の荷降ろしをおこなった。今回、結局インドネシアの許可がおりずそのEEZに入れませんでしたがその困難な交渉に、また航路変更でパラオ許可を得ていただいたがその交渉にあたっていただいた多くの方々に感謝します。船上ではいつものことながらブイ作業を安全に、確実に進めていただいた兵頭船長以下乗組員の方がたに感謝します。またPMELのブイ作業では高尾宏一、山本博氏に、JAMSTECのブイ作業では伊藤淳雄氏に、またオメガゾンデをやっていただいた林美鶴、中村貴也氏の海技部の方々に感謝します。PMELのMr.Shepherdにはは JAMSTECのブイについて助言を得ました。特に、岩田志氏はTOCSでは最後の航海になるということでありますが、JAPACS航海以来幾度となく作業支援をいただきここで感謝する次第であります。

TOCS K9406観測要約

今回の海洋の特徴についてまとめると以下のようになる。

海洋および気象データともエルニーニョ時の特徴を示していた。今回の165Eから142Eにかけて海上では西風成分が常に見られ、特に165E付近では台風にともない強い西風が連吹した。赤道に沿って表層の海流は東流が全域で卓越した。この航海に先立ってのレーザー航海では、日付変更線あたりに最も深い表層混合層(29C,95m)を観測している。またそれより東の165Wでも通常は赤道湧昇で低温となるが、30Cの高温な表層水を観測している。このTOCS航海でも最も東である、0,165Eで28Cが80mと西に較べ深くなっている。しかし20C等温線は128mで、Climate Diagnostics Bulletinの10月の報告にある150mに較べかなり浅くなっている。147Eから142Eの赤道沿いの測線を見ても130-140mに20C等温線があり、1994年４月の航海では170m位で平年並みあったことを考えれば、非常に薄くなっていたといえる。表層の塩分分布をみても165E付近で最も低塩分となっており、34psu以下の水が深度80mまで達している。これは、この海域で活発な降雨活動があったことを示している。以上のように、暖水が日付変更線より東に分布し、活発な対流活動をもたらし、その西側ではそれに吹き込む西風が卓越し、表層に東流をもたらすという典型的なエルニーニョの特徴を示したといえる。

CTDの各測線から、それぞれの特徴および水塊の分布について述べる。

142E測線上の赤道上に28C等温線が最も深くなっている。これは、西風によるエクマン輸送により赤道上に表層の暖かい水の収束が起こったことを意味する。これは舶用ADCPで計測された、東向きの強い流れとも一致する。しかし、先にも述べたように20C等温線は浅くなっており表層水全体としては熱量を失ったものと考えられる。

2-40Sから1-30Sの150m深、ポテンシャル密度25には35.5psuの高塩分水がありビチャーズ海峡を通ってきた南太平洋起源の水（TW:Tropical Water)である。溶存酸素(DO)は周囲の水よりも低い値（<3.4ml/l)を示す。この水の直下には、逆にDO値の高い(>3.4ml/l)南極中層水（AAIW:Antarctic Intermediate Water)と呼ばれる水が存在する。この、150m以深では、等密度線が岸に向かって(南に向かって)深くなっており、岸を左にみて北流するニューギニア沿岸潜流の存在を示唆する。この流れは、今度取り付けたRDIの舶用ADCPでも捕えられた。

先のTWと同様な水は、3Nの130m深、ポテンシャル密度24.5にも痕跡がみられるが、これは北赤道反流で西から運ばれたものと解釈される。その下には、低塩分(<34.6)、低DOのEPW:Equatorial Pacific Waterが存在する。TWとEPWの間では、0-30Nのあたりで顕著な塩分前線を形成している。

147E測線ではTWは、0-30Sあたりで、同じく150m深、ポテンシャル密度25.0にみられる。AAIWは南の1.5Sの300m深あたりに高DO値の水として見られる。

0,165Eから5S,156Eにかけての測線において、TWは、3S,160E から4S,157Eにかけての150m深、ポテンシャル密度24.5に35.8psuの非常に高い塩分を示す水として現われた。

ADCP係留ブイの流速データには、以下のような特徴がみられた。Climate Diagnostics BulletinのTAOの流速計ブイの日平均の表層流速データの東西成分には、いくつかのイベントが見られる。つまり、0,156Eの地点で1994年５月中旬、７月後半、９月初旬にそれぞれ、50cm/s、60cm/s、90cm/sの非常に強い東向流を観測しており、ほんの少しおくれて0,142Eに同様な日平均値での強化を観測している。この顕著な変動はわれわれの0,147Eおよび0,142Eの係留ブイには、以下のように現われた。

１回目のイベントとして５月８日前後から、両地点とも東向の50cm/sの日平均値を越える日が５日間程継続した。142Eでは、日平均で65cm/s、半日潮流の成分を含めると強いときでは１時間毎の測定値で80cm/sの値を示した。147Eでは、日平均で90cm/s、１時間毎の測定値で強いときでは100cm/sをも越える値を示した。

２回目は７月１３日前後から、142Eでは、30cm/sを越える日が４日間程継続した。147Eでは７月11日前後から始まって８月にかけても20-30cm/sの継続した。

3回目は９月２日から147Eでは東向の日平均値で50cm/sを越える日が６日間程継続し、瞬間値では80cm/sを越えた。しかし、142Eでは日平均値で10-15cm/sの弱い東向流のみを観測した。

つまり、春の５月のイベントでは142Eから165Eの西太平洋赤道域の全域で40cm/sを越える東向流が存在した。７月は165Eで強く出ている。９月には156Eを中心として、147Eから165Eまであらわれている。この９月のときの流速変動にともなって1994年のエルニーニョが始まった。

MEETING MEMO (9 Jan. '95)

◎ＴＯＣＳに関する改良点

・ATLAS、PROTEUSのブイ回収にはボートが必要か？（C/O）→ 必要！（黒田）
・シンカー上の１０ｍチェーンにはスタッド付きが必要か？（B/S）
→ 業者が間違って納入したものであり、本来スタッドレス使用である。（米山）
→ スタッド付きの場合は５ｍ＊２本とし、間にリングを入れる。
・先日のシンカーが不意にレッコされてしまった件について（黒田）
→ 吊り具のスプリングがいかれた様子はなかった。（B/S）
→ シンカーを完全に振り出して、ストーンフックのダブルを使用したらどうか。（Capt.）
→ 現在のままでテープを工夫する。
→ シンカーは取り扱いやすいものに換えられないか？（C/E）
→ 可能だが、レールシンカーは重量調整がしやすいので使用している。（米山）
→ 現在のままで良い。（B/S 他）
・シンカーレッコの時、ADCPとATLAS、PROTEUSの時とはウインチを使い分けの理由は？（No.1 Oiler）
・シンカー及びＷＯＣＥロゼッタの吊り上げ時にウインチ停止中でも重みですべり出てしまう（ウインチのブレーキ力が足りない）。
→ 業者又は日海事機器管理に見てもらう。
→ シンカー吊り上げ用には用いない。Ａフレーム５tonウインチを用いる。
・クロスビットによって係留索を滑らせる方法は問題はないか？（Capt.）
→ もう少し径の大きなビットの方が良い。（ドラムから出す方がベター）（B/S）
→ 運航部技術課に言う（黒田）
→ クロスビットは安全上問題はない。（C/O）
・ケブラー巻取り時、エンドローラーでロープを痛めることがあるので、Ａフレームのローラーを通した（B/S）
・巻取りウインチの位置はトモ側に置く。

◎大型海洋観測研究船でブイを行う場合

・大型海洋観測研究船は操縦性がかいようより劣り、オモテからスマルで孫ブイを引掛けてトモへ送る方法となろう。そのためにはどうしても孫ブイが必要となる。（Capt.）
・ADCPには孫ブイは取り付けられない → 音響ビーム内にロープが入ってしまう。
・エンドのガラス玉から回収するのは非常時と考えるべきで、これを通常の回収法としない。

◎春のレーザーとＴＯＣＳとの間に未回収の係留系（２基）の掃海を行う。（黒田）

・引掛けることも大事だが、上がってきてからの取り外し作業が非常に危険となる。
・回収時にシンカーを揚げながら巻いても安全か？そこが大事である。
・マニュアル通りの方法で事故が起こったら？ → どうするのか責任の在処を事前にはっきりさせておくべきだ。
・シンカーをつけたままの回収は危険である。