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MR98-K02

Preliminary Cruise Report

March 1999

Japan Marine Science and Technology Center

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1. Introduction

The equatorial Pacific has distinguished characteristics, those are it occupies a large region of the world's ocean and the warmest water of the planet exists there. The western equatorial Pacific contains so-called warm water pool. Nitrate is depleted there and primary production is small. In the central and eastern equatorial Pacific, vertical flux of nutrients is enhance due to Quasi-stationary upwelling caused by equatorial divergence and consequently chlorophyll a concentration and primary production rate increased along the equator. However, primary production and biomass are not as high as would be expected from the flux of nutrients could support. This is called high nutrient low chlorophyll situation. Since this east to west asymmetry is affected by ENSO event, there is a significant variability in physical characters on seasonal-interannual scale with impact to biogeochemistry, as well potentially with the similar scale of variability.

In order to investigate the mechanism of this biogeochemical variavility, Japan Marine Science and Technology Center (JAMSTEC) conducted biogeochemical observation cruise in the equatorial Pacific. Participants are from ;

- Central Research Institution of Electric Power Industries
- Dalhousie University
- Geological Survey of Japan
- Global Ocean Development (Technicians)
- Hokkaido University
- Kansai Environmental Engineering Center
- Kumamoto University
- Kyushu University
- Marine Works Japan (Technicians)
- Meteorological Research Institute
- Nagoya University
- National Institute of Radiological Sciences
- Research Institute of Innovative Technology for the Earth
- Seikai National Fisheries Research Institute
- Tokyo University

We made a comprehensive observation to investigate carbon cycle especially in a biological aspect. Our observation includes ;

- Hydrocast for physical, chemical and biological parameters such as saliniy, nutrients, dissolved inorganic carbon, plant pigments and so on..
- Atmospheric and oceanic CO_2 measurements.
- In situ and simulated in situ incubation for primary productivity and new productivity.

- Sediment trap moorings to observe export production.
- Distribution of phytoplankton and zooplankton.
- Etc.

We will conduct periodical and repeating observation to resolve a biogeochemical variation in a seasonal and inter-annual scale.

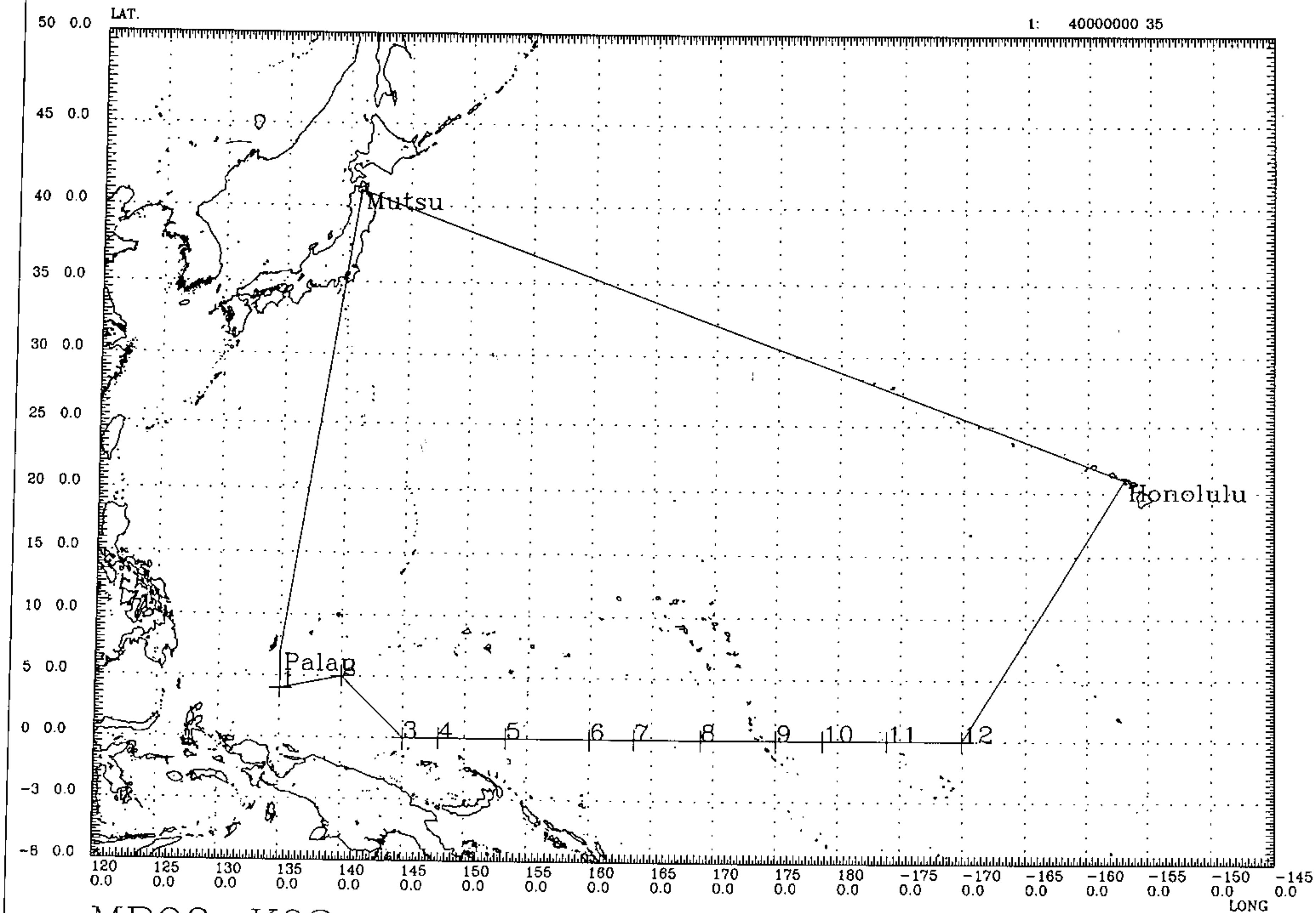
2. Outline of the cruise

2.1 Cruise summary

Ship	: MIRAI
Chief Scientist	:Takeshi KAWANO, Ocean Research Department, JAMSTEC
Cruise Code	: MR98-K02
Project title	: Bio-optical research
Period	: Dec. 20, 1998 - Feb. 1,1999
Ports of call	: 1) Sekinehama, Japan
	2) Hachinohe, Japan
	3) Krror, Palau
	4) Honolulu, U.S.A

2.2 Cruise Log and cruise Track

See tables and figure attached.



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0 0.0
-3 0.0
-6 0.0
Mutsu
Honolulu
Palau
3
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6
7
8
9
10
11
12
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180 0.0
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-170 0.0
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-160 0.0
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-150 0.0
-145 0.0
LONG

MR98-K02

Year	M	Day	H	Latitude Deg	min	Londitude Deg	min	Speed knot	S.Dir. Deg	W.Temp deg-C	Pressure (hPa)	Wind Dir Deg	Wind Spd m/sec	Rel.Wind Dir Deg	Rel.Wind.Spd m/sec	Air Temp eg-C STB	Dew Point deg-C STB	Humidity % STB	Air Temp eg-C PORT	Dew Point eg-C PORT	Humidity % PORT	S.W.Rad (kW)	L.W. Rad (kW)	Rain Rate (mm/h) Trad.	Rain Rate (mm/h) Opt.	Sig.W.Hight (m) Fore	Period (sec) F	Sig.W.Height (m) AFT	Period (sec) A
(JST)																													
1998	12	20	1	41	21.79	141	14.57	3.7	211	9.0	1005.4	305	10.4	83	10.4	0.2	−7.5	56	0.0	−8.0	55			0.0	0.1	0.24	8.10	0.24	5.62
1998	12	20	2	41	21.77	141	14.57	3.7	211	8.9	1004.5	305	9.8	83	9.9	0.2	−9.6	48	0.1	−9.8	47			0.0	0.1	0.24	8.10	0.24	5.62
1998	12	20	3	41	21.79	141	14.56	3.7	211	8.8	1004.2	305	9.6	83	9.7	−0.1	−8.9	52	−0.1	−8.8	52			0.2	0.0	0.28	7.69	0.38	5.99
1998	12	20	4	41	21.77	141	14.57	3.7	210	8.7	1004.1	316	11.8	96	11.5	−0.8	−8.1	58	−1.0	−8.2	58			0.0	0.1	0.28	7.69	0.38	5.99
1998	12	20	5	41	21.78	141	14.58	3.7	211	8.6	1005.1	327	12.8	107	12.2	−3.0	−4.3	91	−2.1	−5.2	79			1.4	0.0	0.28	7.69	0.38	5.99
1998	12	20	6	41	21.79	141	14.56	3.7	211	8.5	1005.9	306	11.5	86	11.4	−2.7	−4.7	86	−3.0	−7.0	74			1.4	0.0	0.32	8.57	0.48	6.46
1998	12	20	7	41	21.77	141	14.58	3.7	211	8.4	1006.8	310	11.2	90	11.1	−2.2	−6.1	75	−2.3	−7.7	67			0.3	0.1	0.32	8.57	0.48	6.46
1998	12	20	8	41	21.80	141	14.59	3.7	211	8.3	1007.8	322	7.6	96	7.1	−3.0	−4.4	91	−3.1	−5.8	82			6.6	0.2	0.32	8.57	0.48	6.46
1998	12	20	9	41	21.77	141	14.55	3.7	211	8.2	1008.8	307	10.4	86	10.4	−2.8	−5.1	84	−3.2	−7.1	75			2.3	0.2	0.32	7.65	0.48	6.01
1998	12	20	10	41	21.78	141	14.57	3.7	211	8.1	1010.0	316	12.1	95	11.8	−1.7	−6.0	72	−2.4	−8.6	63			0.0	0.0	0.32	7.65	0.48	6.01
1998	12	20	11	41	21.77	141	14.59	3.7	211	7.9	1010.4	307	10.2	86	10.2	−2.2	−7.1	69	−2.6	−9.2	61			0.0	0.0	0.32	7.65	0.48	6.01
1998	12	20	12	41	21.79	141	14.55	3.7	211	7.8	1011.4	314	9.3	91	9.0	−2.4	−7.5	68	−2.7	−8.6	64			0.0	0.0	0.23	8.29	0.29	5.94
1998	12	20	13	41	21.76	141	14.55	3.7	211	7.7	1012.0	315	6.4	87	6.3	−2.2	−8.2	64	−2.5	−9.3	60			0.0	0.0	0.23	8.29	0.29	5.94
1998	12	20	14	41	21.80	141	14.57	3.7	211	7.6	1012.5	295	4.5	62	5.0	−2.8	−8.9	63	−3.2	−9.7	61			0.0	0.0	0.23	8.29	0.29	5.94
1998	12	20	15	41	21.80	141	14.57	3.7	211	7.4	1013.0	315	4.6	79	4.5	−2.4	−7.9	66	−2.7	−8.5	65			0.0	0.1	0.17	6.47	0.22	6.03
1998	12	20	16	41	21.81	141	14.58	3.7	211	7.3	1013.4	315	2.9	64	3.1	−2.2	−8.8	61	−2.6	−9.5	59			0.0	0.0	0.17	6.47	0.22	6.03
1998	12	20	17	41	21.79	141	14.57	3.7	211	7.2	1013.8	324	3.1	70	3.0	−1.8	−8.6	60	−2.2	−9.2	59			0.0	0.3	0.17	6.47	0.22	6.03
1998	12	20	18	41	21.80	141	14.55	3.7	211	7.2	1013.1	316	3.4	72	3.5	−1.8	−6.9	68	−2.1	−7.1	69			0.1	0.1	0.19	5.35	0.22	5.27
1998	12	20	19	41	21.77	141	14.55	3.7	211	7.1	1012.7	311	6.9	84	6.8	−1.8	−6.1	72	−2.1	−6.4	73			0.5	0.0	0.19	5.35	0.22	5.27
1998	12	20	20	41	21.80	141	14.59	3.7	211	7.1	1012.9	310	5.2	77	5.3	−1.7	−6.1	72	−2.1	−6.7	71			0.7	0.0	0.19	5.35	0.22	5.27
1998	12	20	21	41	21.79	141	14.55	3.7	211	7.0	1013.2	306	5.1	73	5.3	−1.0	−6.9	64	−1.3	−7.2	64			0.0	0.0	0.19	7.51	0.23	5.76
1998	12	20	22	41	21.80	141	14.54	3.7	211	7.0	1013.1	308	5.5	77	5.6	−0.8	−7.7	60	−1.1	−7.9	60			0.0	0.0	0.19	7.51	0.23	5.76
1998	12	20	23	41	21.77	141	14.58	3.7	211	6.9	1013.7	314	7.0	87	6.8	−0.6	−7.3	61	−0.9	−7.4	61			0.0	0.0	0.19	7.51	0.23	5.76
1998	12	21	0	41	21.79	141	14.57	3.7	211	6.9	1014.1	300	5.9	71	6.2	−0.7	−6.6	65	−1.0	−6.7	65			0.1	0.0	0.19	7.46	0.22	6.06
1998	12	21	1	41	21.79	141	14.56	3.7	211	6.9	1013.6	303	7.5	78	7.6	−0.3	−6.5	63	−0.7	−6.7	64			0.3	0.1	0.19	7.46	0.22	6.06
1998	12	21	2	41	21.80	141	14.58	3.7	211	6.9	1012.7	306	8.0	81	8.0	0.4	−7.0	57	0.4	−7.0	58			0.1	0.3	0.19	7.46	0.22	6.06
1998	12	21	3	41	21.78	141	14.60	3.7	211	7.0	1012.1	300	10.1	79	10.3	0.6	−7.3	55	0.4	−7.5	56			0.0	0.1	0.25	7.41	0.32	5.34
1998	12	21	4	41	21.77	141	14.55	3.7	211	7.0	1011.8	311	9.3	89	9.2	1.1	−8.2	50	1.2	−8.0	51			0.0	0.0	0.25	7.41	0.32	5.34
1998	12	21	5	41	21.77	141	14.59	3.7	211	7.1	1012.2	298	7.4	73	7.7	1.0	−6.6	57	0.8	−6.7	58			0.0	0.0	0.25	7.41	0.32	5.34
1998	12	21	6	41	21.81	141	14.58	3.7	211	7.1	1012.7	295	7.3	70	7.7	0.9	−7.1	55	0.6	−7.5	55			0.0	0.0	0.22	8.51	0.27	5.93
1998	12	21	7	41	21.78	141	14.60	3.7	211	7.1	1013.1	302	8.2	78	8.4	0.6	−8.4	51	0.3	−8.5	51			0.0	0.0	0.22	8.51	0.27	5.93
1998	12	21	8	41	21.79	141	14.57	3.7	211	7.2	1013.1	307	6.1	79	6.1	0.4	−8.4	52	0.1	−8.5	52			0.0	0.0	0.22	8.51	0.27	5.93
1998	12	21	9	41	21.79	141	14.55	3.7	211	7.2	1012.5	297	11.1	76	11.4	0.6	−8.4	51	0.3	−8.4	52			0.0	0.0	0.24	8.35	0.27	5.84
1998	12	21	10	41	21.80	141	14.56	3.7	211	7.2	1012.9	306	8.9	83	8.9	0.6	−7.1	56	0.4	−7.1	57			0.0	0.0	0.24	8.35	0.27	5.84
1998	12	21	11	41	21.79	141	14.59	3.7	211	7.2	1012.9	307	7.7	82	7.7	1.0	−6.6	57	0.8	−6.6	58			0.0	0.0	0.24	8.35	0.27	5.84
1998	12	21	12	41	21.79	141	14.56	3.7	211	7.2	1012.8	304	9.9	82	9.9	1.7	−7.1	52	1.4	−7.1	53			0.0	0.0	0.21	6.87	0.31	6.16
1998	12	21	13	41	21.78	141	14.56	3.7	211	7.2	1012.9	303	8.0	79	8.2	1.9	−6.1	55	1.5	−6.4	56			0.0	0.0	0.21	6.87	0.31	6.16
1998	12	21	14	41	21.77	141	14.59	3.7	211	7.3	1013.0	307	7.5	82	7.6	1.6	−6.7	54	1.3	−6.9	54			0.0	0.0	0.21	6.87	0.31	6.16
1998	12	21	15	41	21.75	141	14.59	3.7	211	7.3	1012.8	306	5.8	76	6.0	1.8	−6.4	54	1.5	−6.6	55			0.0	0.0	0.16	7.20	0.24	6.67
1998	12	21	16	41	21.77	141	14.58	3.7	211	7.3	1012.9	305	5.8	75	6.0	1.7	−6.0	57	1.5	−6.4	56			0.0	0.0	0.16	7.20	0.24	6.67
1998	12	21	17	41	21.80	141	14.58	3.7	211	7.4	1012.9	307	4.5	71	4.7	2.1	−6.1	54	1.7	−6.4	55			0.0	0.0	0.16	7.20	0.24	6.67
1998	12	21	18	41	21.79	141	14.56	3.7	211	7.4	1012.2	311	7.8	86	7.7	2.5	−5.8	54	2.3	−5.9	55			0.0	0.0	0.17	7.33	0.20	6.86
1998	12	21	19	41	21.78	141	14.57	3.7	211	7.4	1011.6	303	7.4	77	7.6	2.4	−6.8	51	2.1	−6.9	52			0.0	0.0	0.17	7.33	0.20	6.86
1998	12	21	20	41	21.80	141	14.56	3.7	211	7.5	1011.6	309	6.4	81	6.4	2.2	−6.5	53	1.9	−6.8	53			0.0	0.0	0.17	7.33	0.20	6.86
1998	12	21	21	41	21.80	141	14.57	3.7	211	7.5	1011.8	306	4.9	72	5.1	1.8	−7.0	52	1.5	−7.2	52			0.0	0.0	0.19	6.67	0.23	6.02
1998	12	21	22	41	21.78	141	14.57	3.7	211	7.5	1011.6	294	4.5	61	5.1	1.6	−7.0	53	1.3	−7.2	53			0.0	0.0	0.19	6.67	0.23	6.02
1998	12	21	23	41	21.80	141	14.59	3.7	211	7.6	1011.4	309	6.3	81	6.3	2.7	−5.5	55	2.4	−5.9	55			0.0	0.0	0.19	6.67	0.23	6.02
1998	12	22	0	41	21.80	141	14.57	3.7	211	7.6	1011.5	308	5.2	76	5.3	2.6	−6.0	53	2.4	−6.2	53			0.0	0.1	0.18	8.32	0.20	6.18
1998	12	22	1	41	21.78	141	14.56	3.7	211	7.5	1011.0	315	5.1	82	5.0	3.6	−5.6	51	3.5	−5.9	50			0.0	0.1	0.18	8.32	0.20	6.18
1998	12	22	2	41	21.79	141	14.58	3.7	211	7.5	1010.0	304	7.2	77	7.3	4.1	−6.1	47	4.1	−6.2	47			0.0	0.2	0.18	8.32	0.20	6.18
1998	12	22	3	41	21.76	141	14.58	3.7	211	7.5	1009.4	301	7.5	76	7.7	4.8	−5.5	47	4.6	−5.6	48			0.0	0.0	0.20	8.29	0.20	5.41
1998	12	22	4	41	28.49	141	23.18	15.6	50	7.8	1008.9	292	10.6	288	9.9	4.6	−4.0	53	4.4	−3.9	55			0.0	0.2	0.20	8.29	0.20	5.41
1998	12	22	5	41	35.14	141	40.37	14.6	54	8.1	1008.8	299	9.7	284	9.0	3.8	−3.4	59	3.6	−3.4	60			0.0	0.1	0.20	8.29	0.20	5.41
1998	12	22	6	41	45.33	141	54.76	8.7	307	8.3	1009.2	320	8.8	333	13.1	2.6	−4.6	59	2.5	−4.5	60			0.0	0.1	1.05	10.60	1.35	10.79
1998	12	22	7	41	41.79	141	54.26	9.1	180	8.5	1009.5	303	7.8	86	6.6	3.1	−4.6	57	3.0	−4.6	57			0.0	0.0	1.05	10.60	1.35	10.79
1998	12	22	8	41	27.03	141	55.00	16.5	179	8.6	1009.1	294	12.2	72	11.7	4.3	−4.7	52	4.1	−4.9	52			0.0	0.0	1.05	10.60	1.35	10.79
1998	12	22	9	41	32.12	141	56.51	16.7	360	8.7	1009.0	298	12.8	322	18.5	4.1	−6.7	45	3.9	−7.5	43			0.0	0.2	1.00	5.46	1.40	4.89
1998	12	22	10	41	40.01	141	59.88	1.0	32	8.7	1009.3	310	9.8	279	9.9	3.3	−4.8	56	3.0	−4.9	56			0.0	0.0	1.00	5.46	1.40	4.89
1998	12	22	11	41	39.97	142	1.41	1.2	24	8.6	1009.3	298	9.8	274	9.9	3.3	−5.7	52	3.0	−5.6	54			0.0	0.0	1.00	5.46	1.40	4.89
1998	12	22	12	41	39.84	142	2.93	1.2	28	8.5	1009.5	295	9.5	273	9.6	2.9	−6.7	49	2.5	−6.9	50	0.00	0.22	0.0	0.0	1.29	4.91	1.20	4.82
1998	12	22	13	41	39.60	142	4.30	1.3	35	8.4	1009.6	300	9.9	274	9.9	2.8	−6.2	52	2.4	−6.3	52	0.00	0.23	0.0	0.0	1.29	4.91	1.20	4.82
1998	12	22	14	41	39.26	142	5.77	1.3	21	8.3	1009.6	291	10.5	273	10.5	3.1	−6.3	50	2.7	−6.0	53	0.00	0.22	0.0	0.0	1.29	4.91	1.20	4.82
1998	12	22	15	41	38.08	142	6.41	11.7	204	8.1	1009.5	294	12.8	42	13.6	3.0	−5.8	52	2.7	−6.0	53	0.00	0.22	0.0	0.0	1.51	5.43	1.14	5.32
1998	12	22	16	41	26.48	142	0.48	11.8	203	8.1	1010.2	314	12.5	82	11.8	3.1	−5.5	53	2.9	−5.3	55	0.00	0.26	0.0	0.1	1.51	5.43	1.14	5.32
1998	12	22	17	41	14.38	141	54.88	11.9	203	8.0	1010.5	289	12.5	60	14.4	4.1	−4.5	54	3.7	−4.6	55	0.00	0.27	0.0	0.0	1.51	5.43	1.14	5.32

1998	12	22	18	41	2.75	141	49.21	10.1	208	8.0	1010.9	307	12.5	76	12.6	4.1	-4.6	53	3.8	-4.7	54	0.00	0.24	0.0	0.0	1.37	9.49	0.48	7.67
1998	12	22	19	40	54.53	141	43.72	7.8	251	8.0	1011.3	294	11.6	23	15.0	4.0	-3.9	56	3.9	-3.6	58	0.00	0.28	0.0	0.1	1.37	9.49	0.48	7.67
1998	12	22	20	40	47.51	141	39.34	7.6	210	8.1	1011.8	285	12.9	59	14.5	4.0	-3.5	58	3.6	-3.7	59	0.00	0.22	0.0	0.0	1.37	9.49	0.48	7.67
1998	12	22	21	40	40.73	141	34.94	7.3	231	8.3	1012.8	287	11.1	54	12.8	3.4	-4.4	57	3.2	-4.2	58	0.00	0.25	0.0	0.0	1.06	9.40	0.65	10.67
1998	12	22	22	40	33.74	141	32.13	8.5	186	8.3	1013.7	266	6.7	52	8.4	3.1	-5.4	54	2.7	-5.3	56	0.01	0.25	0.0	0.2	1.06	9.40	0.65	10.67
1998	12	22	23	40	33.10	141	30.25	2.8	61	8.4	1014.6	273	5.6	222	4.5	2.9	-5.8	53	2.1	-6.3	54	0.16	0.24	0.0	0.0	1.06	9.40	0.65	10.67
1998	12	23	0	40	33.08	141	30.24	2.8	61	8.6	1014.8	267	5.9	214	4.7	3.7	-5.4	51	3.0	-5.7	53	0.29	0.25	0.0	0.0	0.20	6.90	0.22	5.79
1998	12	23	1	40	33.12	141	30.25	2.8	61	8.7	1014.1	270	4.3	221	3.2	5.6	-4.8	47	4.0	-5.4	50	0.39	0.24	0.0	0.0	0.20	6.90	0.22	5.79
1998	12	23	2	40	33.12	141	30.23	2.8	61	8.8	1013.2	282	4.3	238	3.4	6.4	-4.4	46	4.7	-5.4	48	0.26	0.25	0.0	0.0	0.20	6.90	0.22	5.79
1998	12	23	3	40	33.11	141	30.24	2.8	61	9.0	1012.2	308	4.7	265	4.4	4.9	-4.0	53	3.9	-4.2	55	0.14	0.28	0.0	0.1	0.17	6.04	0.23	6.39
1998	12	23	4	40	33.10	141	30.20	2.8	61	9.1	1012.0	318	4.2	278	4.1	4.8	-3.4	55	4.1	-3.3	59	0.12	0.28	0.0	0.0	0.17	6.04	0.23	6.39
1998	12	23	5	40	33.18	141	31.98	6.5	30	9.1	1012.2	277	3.9	230	1.5	4.4	-3.3	57	4.2	-3.1	59	0.10	0.25	0.0	0.2	0.17	6.04	0.23	6.39
1998	12	23	6	40	33.58	141	46.27	16.1	103	12.0	1012.1	285	6.3	358	2.3	5.2	-3.3	55	4.7	-3.1	57	0.11	0.23	0.0	0.0	0.86	10.03	1.29	10.93
1998	12	23	7	40	21.25	141	58.40	16.0	153	11.9	1012.3	294	6.2	48	5.4	4.7	-2.9	58	4.3	-2.6	61	0.01	0.22	0.0	0.0	0.86	10.03	1.29	10.93
1998	12	23	8	40	6.61	142	7.76	16.1	159	12.2	1012.1	324	7.3	59	2.5	5.2	-1.7	61	4.8	-1.7	63	0.00	0.25	0.0	0.0	0.86	10.03	1.29	10.93
1998	12	23	9	39	51.25	142	16.69	16.2	154	11.7	1012.1	338	6.7	359	2.0	5.9	-1.3	60	5.7	-1.3	61	0.00	0.29	0.0	0.0	1.24	18.17	1.74	20.79
1998	12	23	10	39	36.87	142	26.93	16.0	154	15.5	1011.7	145	1.9	0	9.1	7.3	-4.7	42	7.1	-4.7	43	0.00	0.27	0.0	0.0	1.24	18.17	1.74	20.79
1998	12	23	11	39	21.52	142	26.71	16.2	181	14.7	1011.5	304	2.7	16	7.4	7.6	-4.8	41	7.3	-4.8	42	0.00	0.28	0.0	0.0	1.24	18.17	1.74	20.79
1998	12	23	12	39	6.59	142	25.88	16.1	188	15.5	1011.3	292	8.3	53	10.0	7.8	-2.4	48	7.5	-2.5	49	0.00	0.25	0.0	0.0	0.97	13.51	0.78	13.18
1998	12	23	13	38	51.04	142	24.07	16.2	186	15.1	1011.1	296	9.8	62	10.4	7.6	-1.0	54	7.4	-1.1	55	0.00	0.24	0.0	0.0	0.97	13.51	0.78	13.18
1998	12	23	14	38	35.66	142	22.00	16.2	187	15.7	1010.6	309	6.9	51	7.5	7.5	-1.7	52	7.3	-1.4	54	0.00	0.23	0.0	0.0	0.97	13.51	0.78	13.18
1998	12	23	15	38	20.10	142	19.33	15.9	186	15.2	1010.2	311	10.6	76	9.0	7.8	-2.0	50	7.6	-2.0	51	0.00	0.28	0.0	0.0	1.65	16.41	1.02	17.26
1998	12	23	16	38	4.04	142	17.03	16.1	188	15.2	1010.2	319	11.3	84	8.6	8.1	0.1	57	7.9	0.0	57	0.00	0.27	0.0	0.0	1.65	16.41	1.02	17.26
1998	12	23	17	37	47.69	142	14.85	15.9	187	15.0	1010.1	327	9.8	81	6.5	8.4	-0.3	54	8.2	-0.4	55	0.00	0.29	0.0	0.0	1.65	16.41	1.02	17.26
1998	12	23	18	37	31.26	142	11.84	16.3	189	14.9	1009.6	335	7.9	66	4.9	8.5	0.0	55	8.2	-0.1	56	0.00	0.27	0.0	0.0	1.56	17.39	1.38	20.45
1998	12	23	19	37	15.08	142	9.41	16.2	187	15.9	1009.3	335	9.8	90	5.3	8.7	-0.1	54	8.5	0.0	55	0.00	0.28	0.0	0.0	1.56	17.39	1.38	20.45
1998	12	23	20	36	58.94	142	7.00	16.1	187	15.8	1009.8	5	7.7	4	0.8	9.0	0.1	54	8.7	0.0	55	0.00	0.26	0.0	0.0	1.56	17.39	1.38	20.45
1998	12	23	21	36	42.33	142	4.71	16.0	186	17.6	1010.0	352	11.2	128	4.0	9.7	1.6	57	9.7	2.5	61	0.00	0.29	0.0	0.0	2.19	19.30	1.86	20.45
1998	12	23	22	36	25.65	142	1.94	16.1	188	18.0	1010.5	336	12.7	111	7.3	9.9	2.5	60	10.2	3.2	62	0.01	0.24	0.0	0.0	2.19	19.30	1.86	20.45
1998	12	23	23	36	9.15	141	59.92	16.0	187	19.0	1011.2	339	14.4	122	8.1	10.5	1.6	54	10.9	3.3	60	0.11	0.26	0.0	0.0	2.19	19.30	1.86	20.45
1998	12	24	0	35	52.78	141	57.89	16.1	186	19.4	1012.2	344	15.8	136	8.8	10.1	1.5	55	10.7	2.1	56	0.23	0.27	0.0	0.0	3.58	29.29	2.21	23.82
1998	12	24	1	35	37.28	141	56.94	16.1	191	21.0	1011.6	338	18.4	123	12.5	11.0	3.5	60	11.9	4.8	62	0.45	0.24	0.0	0.1	3.58	29.29	2.21	23.82
1998	12	24	2	35	23.83	141	53.46	16.2	199	22.3	1011.5	346	17.9	123	12.0	10.8	2.4	56	11.5	3.5	58	0.62	0.28	0.0	0.2	3.58	29.29	2.21	23.82
1998	12	24	3	35	10.33	141	50.54	16.0	194	22.8	1011.6	351	19.4	141	12.4	11.2	3.1	58	11.5	3.8	59	0.51	0.28	0.0	0.1	5.94	22.16	4.17	21.90
1998	12	24	4	34	56.19	141	48.46	15.7	185	23.2	1011.7	345	16.8	138	10.0	11.8	1.9	51	12.4	3.1	53	0.14	0.25	0.0	0.2	5.94	22.16	4.17	21.90
1998	12	24	5	34	41.92	141	46.46	15.6	189	23.2	1012.1	344	16.1	131	9.5	11.7	1.9	51	12.3	3.8	56	0.13	0.26	0.0	0.0	5.94	22.16	4.17	21.90
1998	12	24	6	34	27.38	141	44.53	16.2	188	23.0	1012.8	354	16.7	153	9.1	11.7	0.6	47	11.6	0.4	46	0.26	0.26	0.0	0.1	4.88	21.54	3.96	23.46
1998	12	24	7	34	13.04	141	42.42	15.8	187	23.2	1013.4	1	15.8	171	7.8	12.0	-1.8	38	11.9	-1.0	41	0.02	0.25	0.0	0.1	4.88	21.54	3.96	23.46
1998	12	24	8	33	59.38	141	40.26	15.9	186	23.3	1013.8	356	15.4	157	7.7	12.5	2.3	50	12.2	1.9	49	0.00	0.27	0.0	0.2	4.88	21.54	3.96	23.46
1998	12	24	9	33	45.75	141	38.36	16.1	186	23.5	1014.9	8	13.5	186	5.6	12.5	1.9	48	12.4	1.7	48	0.00	0.28	0.0	0.1	5.21	19.77	4.64	21.59
1998	12	24	10	33	32.33	141	36.53	15.9	186	23.4	1014.8	14	13.3	198	5.4	13.7	2.5	47	13.3	3.3	51	0.00	0.24	0.0	0.0	5.21	19.77	4.64	21.59
1998	12	24	11	33	18.59	141	34.21	15.6	189	23.4	1015.3	3	12.0	159	4.3	13.6	1.3	43	13.2	2.6	48	0.00	0.25	0.0	0.1	5.21	19.77	4.64	21.59
1998	12	24	12	33	5.05	141	31.90	15.7	187	23.2	1015.8	10	11.6	188	3.8	13.8	1.6	44	13.5	1.4	44	0.00	0.28	0.0	0.0	4.61	20.40	3.90	19.03
1998	12	24	13	32	51.42	141	30.27	15.7	186	23.5	1015.7	26	11.0	239	4.3	14.2	3.8	49	13.8	3.5	50	0.00	0.27	0.0	0.0	4.61	20.40	3.90	19.03
1998	12	24	14	32	37.02	141	28.45	15.6	189	23.1	1015.6	21	9.7	231	2.6	14.6	5.8	55	14.3	5.7	56	0.00	0.27	0.0	0.0	4.61	20.40	3.90	19.03
1998	12	24	15	32	22.13	141	26.23	15.4	189	23.3	1016.2	16	10.0	199	2.3	14.9	4.6	50	14.6	4.8	52	0.00	0.29	0.0	0.0	4.61	20.16	3.79	19.16
1998	12	24	16	32	6.74	141	23.56	15.7	188	22.8	1016.3	24	8.2	276	2.4	15.2	2.8	43	15.0	3.4	46	0.00	0.30	0.0	0.0	4.61	20.16	3.79	19.16
1998	12	24	17	31	50.88	141	21.21	15.4	188	22.4	1016.2	58	10.7	278	8.3	14.9	6.2	56	14.6	6.4	58	0.00	0.29	0.0	0.0	4.61	20.16	3.79	19.16
1998	12	24	18	31	35.50	141	18.89	15.5	189	22.0	1016.5	49	8.1	293	5.7	14.8	5.4	53	14.7	5.5	54	0.00	0.31	0.0	0.0	4.31	18.87	3.36	17.40
1998	12	24	19	31	18.87	141	16.41	15.7	191	22.8	1016.2	50	7.8	294	5.5	14.8	5.4	53	14.7	5.5	54	0.00	0.31	0.0	0.0	4.31	18.87	3.36	17.40
1998	12	24	20	31	2.52	141	13.61	15.7	188	22.4	1016.9	34	8.6	276	3.9	13.6	7.3	65	13.4	7.5	67	0.00	0.33	1.6	1.3	4.31	18.87	3.36	17.40
1998	12	24	21	30	46.66	141	11.62	15.7	188	22.5	1017.2	37	11.7	250	6.3	14.2	8.7	69	13.5	8.6	72	0.00	0.32	2.5	1.8	3.35	18.48	2.56	16.04
1998	12	24	22	30	30.72	141	9.18	15.4	188	22.1	1017.4	61	7.4	302	7.0	15.6	7.8	60	15.4	7.9	61	0.06	0.30	0.9	0.8	3.35	18.48	2.56	16.04
1998	12	24	23	30	14.52	141	6.68	15.6	186	22.1	1017.6	80	5.3	323	8.2	16.1	5.9	51	16.3	6.1	51	0.29	0.29	0.0	0.0	3.35	18.48	2.56	16.04
1998	12	25	0	29	58.45	141	3.95	15.7	184	21.9	1018.5	63	6.3	312	7.3	16.8	6.6	51	16.8	7.0	53	0.39	0.27	0.0	0.1	3.63	18.74	3.12	19.31
1998	12	25	1	29	42.26	141	2.39	15.8	194	21.9	1018.1	66	7.8	302	7.9	17.4	6.8	50	17.6	7.4	51	0.51	0.27	0.0	0.0	3.63	18.74	3.12	19.31
1998	12	25	2	29	26.42	140	56.89	15.6	197	22.0	1016.9	63	7.9	295	6.3	17.6	5.9	46	17.8	6.5	47	0.57	0.27	0.0	0.0	3.63	18.74	3.12	19.31
1998	12	25	3	29	10.69	140	51.57	15.5	195	22.1	1016.2	65	7.6	298	6.5	17.9	5.9	45	18.2	6.6	47	0.60	0.26	0.0	0.1	4.23	20.70	3.10	20.95
1998	12	25	4	28	55.04	140	46.44	15.5	195	22.1	1015.9	57	5.7	317	5.4	18.5	7.0	47	18.1	7.0	48	0.57	0.27	0.0	0.0	4.23	20.70	3.10	20.95
1998	12	25	5	28	39.64	140	41.77	15.5	197	22.4	1015.7	61	6.5	307	5.6	18.6	6.1	44	18.2	6.4	46	0.45	0.27	0.0	0.0	4.23	20.70	3.10	20.95
1998	12	25	6	28	24.50	140	36.43	15.6	198	23.1	1015.7	49	6.0	315	4.3	18.8	7.5	48	18.4	7.5	49	0.30	0.27	0.0	0.0	3.59	20.48	3.12	20.97
1998	12	25	7	28	9.38	140	31.71	15.6	197	23.6	1015.5	61	8.1	292	6.1	18.7	9.8	56	18.4	9.8	57	0.06	0.29	0.0	0.0	3.59	20.48	3.12	20.97
1998	12	25	8	27	54.21	140	26.43	15.9	198	23.5	1015.6	63	7.4	300	6.1	18.8	9.5	55	18.6	9.6	56	0.00	0.32	0.0	0.0	3.59	20.48	3.12	20.97
1998	12	25	9	27	39.06	140	21.48	15.6	194	23.5	1015.8	65	9.4	287	7.6	19.3	11.0	59	19.1	11.1	60	0.00	0.32	0.0	0.0	3.16	20.05	2.77	18.00
1998	12	25	10	27	23.45	140	16.93	15.7	199	23.6	1016.3	80	6.5	311	7.6	18.5	11.8	65	18.4	11.6	64	0.00	0.33	0.0	0.0	3.16	20.05	2.77	18.00
1998	12	25	11	27	8.19	140	12.02	15.6	200	23.5	1016.3	51	8.3	284	4.6	18.6	13.3	71	18.5	13.3	72	0.00	0.32	0.1	0.3	3.16	20.05	2.77	18.00
1998	12	25	12	26	53.27	140	6.80	15.6	199	23.9	1016.2	63	7.9	294	6.1	18.2	13.7	75	18.2	14.1	77	0.00	0.33	0.1	0.2	3.94	19.94	3.22	19.02

1998	12	25	13	26	38.47	140	1.28	15.6	198	23.8	1015.6	37	9.6	250	3.3	18.8	14.8	78	18.4	14.7	79	0.00	0.29	0.1	0.1	3.94	19.94	3.22	19.02
1998	12	25	14	26	23.17	139	56.31	15.7	197	23.9	1014.8	27	8.5	265	2.0	19.1	15.5	79	18.9	15.4	80	0.00	0.34	0.1	0.3	3.94	19.94	3.22	19.02
1998	12	25	15	26	7.74	139	51.06	15.6	196	24.1	1014.2	65	4.7	325	6.1	19.7	14.4	71	19.6	14.4	72	0.00	0.28	0.0	0.0	2.80	18.57	2.15	16.24
1998	12	25	16	25	52.48	139	46.37	15.8	195	24.3	1014.3	68	5.7	316	6.4	19.8	15.3	75	19.6	15.3	76	0.00	0.28	0.0	0.0	2.80	18.57	2.15	16.24
1998	12	25	17	25	36.94	139	41.68	15.7	197	24.6	1014.2	58	3.4	338	6.1	20.4	14.8	70	20.3	14.9	71	0.00	0.32	0.0	0.1	2.80	18.57	2.15	16.24
1998	12	25	18	25	21.71	139	36.76	15.4	196	25.2	1014.1	338	4.1	28	5.5	20.6	14.1	66	20.2	14.2	68	0.00	0.28	0.0	0.0	3.08	19.69	2.17	19.87
1998	12	25	19	25	6.43	139	31.99	15.6	197	25.1	1014.1	333	6.8	55	5.8	21.0	13.9	64	20.9	14.1	65	0.00	0.28	0.0	0.0	3.08	19.69	2.17	19.87
1998	12	25	20	24	51.44	139	27.52	15.8	197	25.4	1014.5	340	8.6	76	5.4	21.3	14.1	63	21.1	14.2	65	0.00	0.28	0.0	0.0	3.08	19.69	2.17	19.87
1998	12	25	21	24	36.23	139	22.73	15.5	198	25.4	1015.2	331	6.7	55	6.0	21.3	13.8	62	21.1	13.9	64	0.00	0.28	0.0	0.0	2.81	20.98	1.77	18.06
1998	12	25	22	24	21.17	139	17.49	15.7	200	25.4	1015.6	345	6.4	52	4.7	21.2	12.8	59	21.3	12.6	58	0.07	0.28	0.0	0.1	2.81	20.98	1.77	18.06
1998	12	25	23	24	5.94	139	12.16	15.8	197	25.4	1015.9	342	5.2	38	4.9	21.8	12.3	55	22.0	12.6	55	0.30	0.30	0.0	0.0	2.81	20.98	1.77	18.06
1998	12	26	0	23	50.69	139	7.41	15.9	197	25.3	1016.4	0	5.7	33	3.2	22.4	12.8	54	23.0	13.1	54	0.45	0.29	0.0	0.3	2.90	21.33	1.76	18.53
1998	12	26	1	23	35.32	139	2.55	15.8	198	25.2	1016.0	346	6.3	48	4.4	23.0	13.0	53	23.6	13.2	52	0.57	0.28	0.0	0.0	2.90	21.33	1.76	18.53
1998	12	26	2	23	20.04	138	57.24	15.8	197	25.0	1015.8	3	4.5	17	4.2	23.4	13.3	53	23.9	13.8	53	0.66	0.28	0.0	0.0	2.90	21.33	1.76	18.53
1998	12	26	3	23	4.91	138	51.97	15.6	193	25.3	1015.1	351	5.0	29	4.1	23.5	13.3	53	24.1	13.8	53	0.70	0.28	0.0	0.1	2.87	20.34	1.55	19.03
1998	12	26	4	22	49.81	138	47.33	15.8	199	25.4	1014.1	353	6.3	47	3.8	23.5	14.1	55	24.0	14.4	55	0.21	0.26	0.0	0.0	2.87	20.34	1.55	19.03
1998	12	26	5	22	34.95	138	42.37	15.6	198	25.8	1014.3	348	7.3	64	4.1	23.6	14.4	57	23.8	14.5	56	0.56	0.29	0.0	0.0	2.87	20.34	1.55	19.03
1998	12	26	6	22	19.47	138	37.31	16.0	198	25.9	1014.6	350	6.9	56	3.9	23.9	14.4	55	23.8	14.4	56	0.13	0.28	0.0	0.2	2.25	19.95	1.57	18.03
1998	12	26	7	22	4.23	138	32.58	16.0	197	26.6	1014.9	358	8.2	80	2.8	23.8	15.2	59	23.7	15.2	59	0.21	0.30	0.0	0.1	2.25	19.95	1.57	18.03
1998	12	26	8	21	48.82	138	27.52	15.7	196	27.0	1015.0	0	9.1	107	2.7	23.5	15.0	59	23.4	14.8	59	0.02	0.29	0.0	0.1	2.25	19.95	1.57	18.03
1998	12	26	9	21	33.47	138	22.76	15.7	196	26.8	1015.3	14	7.8	48	0.7	23.3	14.8	59	23.2	14.9	60	0.00	0.31	0.0	0.1	3.28	21.04	1.96	19.32
1998	12	26	10	21	17.81	138	18.18	15.8	198	26.6	1015.7	8	8.3	93	1.3	23.7	15.0	58	23.4	14.8	58	0.00	0.30	0.0	0.1	3.28	21.04	1.96	19.32
1998	12	26	11	21	2.21	138	13.32	15.6	201	26.4	1015.9	22	8.5	217	0.5	23.7	15.9	62	23.6	15.7	62	0.00	0.30	0.0	0.0	3.28	21.04	1.96	19.32
1998	12	26	12	20	46.35	138	8.12	16.0	206	28.2	1016.1	47	8.7	270	3.3	24.0	16.0	61	23.7	16.1	62	0.00	0.32	0.0	0.0	2.05	19.41	2.11	19.12
1998	12	26	13	20	30.89	138	2.35	15.8	199	28.3	1015.7	44	8.2	279	3.5	24.0	15.7	60	23.8	15.7	61	0.00	0.30	0.0	0.0	2.05	19.41	2.11	19.12
1998	12	26	14	20	15.51	137	57.24	15.8	198	28.3	1015.4	45	8.9	273	3.9	24.5	17.1	63	24.2	17.1	65	0.00	0.31	0.0	0.0	2.05	19.41	2.11	19.12
1998	12	26	15	20	0.36	137	52.10	15.8	197	28.3	1015.5	41	8.4	277	3.5	24.5	16.6	61	24.4	16.8	63	0.00	0.33	0.0	0.2	2.59	20.88	2.04	18.34
1998	12	26	16	19	45.21	137	47.30	15.8	195	28.4	1014.8	42	9.7	261	4.2	24.7	16.8	62	24.5	17.0	63	0.00	0.30	0.0	0.1	2.59	20.88	2.04	18.34
1998	12	26	17	19	30.10	137	42.39	15.6	198	28.4	1014.0	41	10.5	250	4.5	24.8	17.7	65	24.5	17.4	64	0.00	0.31	0.0	0.1	2.59	20.88	2.04	18.34
1998	12	26	18	19	14.96	137	37.45	15.8	198	28.5	1014.1	44	10.5	255	5.0	25.1	18.8	68	24.8	18.6	68	0.00	0.31	0.0	0.2	2.82	20.26	2.36	18.93
1998	12	26	19	18	59.69	137	32.53	15.7	198	28.7	1014.0	42	10.5	252	4.6	25.3	19.2	69	25.0	19.2	70	0.00	0.34	0.0	0.1	2.82	20.26	2.36	18.93
1998	12	26	20	18	44.57	137	27.92	16.1	197	28.8	1014.0	46	10.9	255	5.5	25.7	19.7	69	25.2	19.5	71	0.00	0.33	0.0	0.2	2.82	20.26	2.36	18.93
1998	12	26	21	18	29.64	137	23.11	15.5	197	28.8	1014.5	49	11.3	256	6.2	25.9	20.0	70	25.6	20.0	71	0.00	0.34	0.0	0.0	2.95	22.50	2.57	18.54
1998	12	26	22	18	14.55	137	18.29	15.9	197	28.9	1015.0	55	11.8	260	7.3	26.1	20.4	71	25.7	20.2	72	0.07	0.34	0.0	0.1	2.95	22.50	2.57	18.54
1998	12	26	23	17	59.54	137	13.17	15.5	196	28.9	1015.7	54	12.0	259	7.4	26.6	20.9	71	26.5	20.7	70	0.15	0.35	0.0	0.1	2.95	22.50	2.57	18.54
1998	12	27	0	17	44.47	137	8.16	15.6	198	29.0	1015.9	58	11.6	265	7.7	27.3	21.6	71	27.4	21.5	70	0.42	0.36	0.0	0.1	3.21	20.17	2.69	15.63
1998	12	27	1	17	29.49	137	3.26	15.6	194	29.0	1014.9	53	13.0	254	8.1	28.0	22.6	73	28.5	22.3	69	0.44	0.33	0.0	0.0	3.21	20.17	2.69	15.63
1998	12	27	2	17	14.19	136	58.83	15.8	196	29.1	1013.9	58	12.2	262	8.1	28.2	22.8	72	29.0	22.7	69	0.84	0.37	0.0	0.0	3.21	20.17	2.69	15.63
1998	12	27	3	16	59.05	136	53.95	15.6	200	29.1	1013.5	57	12.4	257	7.8	28.4	23.2	73	28.9	23.0	71	0.35	0.36	0.0	0.1	4.06	21.45	3.49	20.25
1998	12	27	4	16	44.05	136	48.81	15.6	198	29.1	1012.1	61	12.9	263	9.0	27.7	23.5	78	28.0	23.5	77	0.22	0.36	0.0	0.1	4.06	21.45	3.49	20.25
1998	12	27	5	16	29.02	136	44.10	15.7	197	29.1	1011.3	46	11.5	248	5.8	27.5	24.7	85	27.5	24.5	84	0.33	0.36	0.1	0.0	4.06	21.45	3.49	20.25
1998	12	27	6	16	14.10	136	39.06	15.9	197	29.1	1011.2	57	11.9	261	7.5	26.6	24.6	89	26.4	24.8	91	0.19	0.37	3.5	1.9	2.25	17.82	2.26	16.18
1998	12	27	7	15	59.15	136	34.38	15.6	199	29.2	1011.1	82	11.3	287	10.5	27.0	24.3	85	26.8	24.5	87	0.12	0.36	0.0	0.1	2.25	17.82	2.26	16.18
1998	12	27	8	15	44.54	136	29.32	15.8	196	29.2	1011.3	84	11.6	287	11.0	27.4	24.4	84	27.2	24.6	86	0.03	0.36	0.1	0.1	2.25	17.82	2.26	16.18
1998	12	27	9	15	29.81	136	24.54	15.6	197	29.2	1011.3	74	10.7	284	9.3	27.3	24.5	85	27.0	24.5	86	0.00	0.33	0.0	0.2	2.73	19.49	2.39	16.26
1998	12	27	10	15	14.59	136	19.68	15.7	198	29.2	1012.2	88	9.5	299	10.3	27.6	24.4	83	27.4	24.5	84	0.00	0.33	0.0	0.1	2.73	19.49	2.39	16.26
1998	12	27	11	14	59.29	136	14.66	15.5	196	29.2	1012.6	89	10.6	295	11.1	28.0	24.0	79	27.8	24.1	81	0.00	0.32	0.0	0.0	2.73	19.49	2.39	16.26
1998	12	27	12	14	44.10	136	9.25	15.6	197	29.2	1012.8	90	10.6	297	11.4	28.2	23.9	78	27.9	24.1	80	0.00	0.32	0.0	0.0	3.16	19.88	2.00	13.11
1998	12	27	13	14	28.84	136	4.55	15.5	193	29.2	1013.0	95	9.3	307	11.5	28.0	23.3	75	27.9	23.4	77	0.00	0.34	0.0	0.1	3.16	19.88	2.00	13.11
1998	12	27	14	14	13.52	136	0.09	15.5	194	29.2	1012.7	97	9.8	305	11.9	27.9	22.2	71	27.7	22.3	73	0.00	0.31	0.0	0.0	3.16	19.88	2.00	13.11
1998	12	27	15	13	58.53	135	54.80	15.4	198	29.2	1012.5	94	11.5	297	12.5	27.7	21.8	70	27.6	21.8	71	0.00	0.30	0.0	0.0	3.42	20.80	2.19	12.83
1998	12	27	16	13	43.57	135	50.06	15.6	196	29.2	1012.2	86	11.1	291	11.1	28.0	21.2	67	27.8	21.2	68	0.00	0.31	0.0	0.1	3.42	20.80	2.19	12.83
1998	12	27	17	13	28.60	135	45.26	15.7	197	29.2	1011.4	83	11.0	289	10.6	28.0	20.7	65	27.7	20.8	66	0.00	0.32	0.0	0.2	3.42	20.80	2.19	12.83
1998	12	27	18	13	13.41	135	40.22	15.9	199	29.2	1010.9	77	10.7	286	9.5	27.8	20.8	66	27.6	20.9	67	0.00	0.33	0.0	0.2	2.45	19.58	2.01	13.87
1998	12	27	19	12	58.22	135	35.31	15.6	198	29.2	1010.6	68	10.4	280	8.0	27.7	21.4	69	27.4	21.5	70	0.00	0.32	0.0	0.0	2.45	19.58	2.01	13.87
1998	12	27	20	12	42.99	135	30.24	15.7	198	29.2	1010.4	58	11.2	267	7.2	27.7	22.0	71	27.4	22.0	72	0.00	0.32	0.0	0.2	2.45	19.58	2.01	13.87
1998	12	27	21	12	27.64	135	25.16	15.8	197	29.2	1010.7	58	10.8	270	7.0	27.9	22.7	74	27.7	22.8	75	0.00	0.33	0.0	0.0	3.31	19.98	2.09	13.98
1998	12	27	22	12	12.36	135	20.32	15.8	194	29.2	1011.2	57	11.1	269	7.4	27.9	23.5	77	27.4	23.4	79	0.05	0.32	0.0	0.0	3.31	19.98	2.09	13.98
1998	12	27	23	11	57.09	135	15.51	15.6	197	29.3	1011.6	58	11.0	270	7.5	28.1	23.8	77	28.0	23.8	78	0.26	0.35	0.0	0.1	3.31	19.98	2.09	13.98
1998	12	28	0	11	41.86	135	10.81	15.8	195	29.3	1011.5	54	11.6	262	7.3	28.8	24.5	78	29.0	24.2	76	0.32	0.34	0.0	0.0	3.02	19.18	2.77	19.96
1998	12	28	1	11	26.73	135	6.05	15.7	195	29.3	1011.3	62	11.9	270	8.6	29.3	24.3	75	29.5	24.2	73	0.30	0.34	0.0	0.1	3.02	19.18	2.77	19.96
1998	12	28	2	11	11.62	135	1.03	15.6	198	29.3	1010.4	62	12.5	266	8.9	29.3	24.3	74	29.5	24.2	73	0.23	0.35	0.0	0.0	3.02	19.18	2.77	19.96
1998	12	28	3	10	56.27	134	55.70	15.7	196	29.3	1010.0	65	12.6	268	9.4	29.3	24.5	76	29.6	24.5	74	0.65	0.35	0.1	0.3	2.98	20.91	2.71	17.25
1998	12	28	4	10	40.83	134	50.46	15.7	194	29.4	1008.8	58	10.2	275	7.0	29.5	25.2	77	29.7	25.2	77	0.68	0.33	0.0	0.0	2.98	20.91	2.71	17.25
1998	12	28	5	10	26.63	134	45.86	11.9	194	29.4	1008.3	70	9.5	276	7.9	29.5	24.7	75	29.5	24.7	75	0.50	0.34	0.0	0.1	2.98	20.91	2.71	17.25
1998	12	28	6	10	12.10	134	41.31	15.5	196	29.4	1007.7	84	10.9	291	10.8	29.3	24.1	73	29.3	24.3	74	0.42	0.36	0.0	0.0	3.29	19.44	2.77	14.98
1998	12	28	7	9	57.23	134	36.48	15.4	197	29.6	1008.0	71	10.4	284	8.8	29.4	23.5	70	29.4	23.6	71	0.15	0.36	0.0	0.2	3.29	19.44	2.77	14.98

1998	12	28	8	9	45.41	134	32.44	11.7	195	29.7	1008.4	89	9.9	289	10.0	28.3	23.6	76	28.2	23.7	77	0.03	0.36	0.1	0.3	3.29	19.44	2.77	14.98
1998	12	28	9	9	33.95	134	28.71	11.8	194	29.5	1008.8	64	10.0	269	7.7	28.6	24.2	77	28.4	24.3	79	0.00	0.35	0.0	0.1	3.27	13.91	2.41	12.29
1998	12	28	10	9	22.48	134	25.29	12.1	195	29.5	1009.4	45	10.4	243	6.1	27.4	24.7	85	27.1	24.8	87	0.00	0.33	0.0	0.1	3.27	13.91	2.41	12.29
1998	12	28	11	9	10.96	134	21.44	11.9	194	29.6	1010.0	40	8.5	248	3.9	27.7	25.5	88	27.5	25.7	90	0.00	0.35	0.0	0.1	3.27	13.91	2.41	12.29
1998	12	28	12	9	0.23	134	18.01	11.1	194	29.6	1010.3	68	8.8	275	7.1	28.6	24.5	79	28.5	24.7	80	0.00	0.37	0.0	0.0	2.86	14.76	1.89	11.71
1998	12	28	13	8	49.31	134	17.67	11.1	175	29.6	1009.9	67	9.7	286	9.6	28.2	24.8	82	28.0	25.0	83	0.00	0.34	0.0	0.0	2.86	14.76	1.89	11.71
1998	12	28	14	8	39.09	134	17.74	10.0	175	29.6	1009.9	85	9.8	297	11.0	28.0	24.4	81	27.9	24.5	82	0.00	0.33	0.1	0.1	2.86	14.76	1.89	11.71
1998	12	28	15	8	27.72	134	17.91	10.7	178	29.6	1009.5	86	7.4	307	9.3	28.1	24.9	83	28.0	25.0	84	0.00	0.35	0.0	0.0	2.65	13.13	1.91	10.31
1998	12	28	16	8	16.77	134	17.93	10.7	177	29.6	1008.6	73	11.7	283	11.6	28.4	24.0	77	28.4	24.1	78	0.00	0.34	0.0	0.0	2.65	13.13	1.91	10.31
1998	12	28	17	8	5.98	134	18.05	10.7	178	29.5	1007.6	68	10.3	281	9.8	28.2	24.2	79	28.0	24.4	81	0.00	0.34	0.0	0.1	2.65	13.13	1.91	10.31
1998	12	28	18	7	55.15	134	18.09	10.9	178	29.5	1007.0	61	10.6	274	9.5	28.5	24.1	77	28.2	24.2	79	0.00	0.33	0.0	0.1	2.66	14.60	2.07	14.51
1998	12	28	19	7	44.47	134	18.06	10.9	180	29.5	1007.0	61	11.2	270	9.7	28.6	23.7	75	28.4	23.9	77	0.00	0.33	0.0	0.1	2.66	14.60	2.07	14.51
1998	12	28	20	7	34.92	134	18.94	8.2	105	29.4	1006.8	68	11.3	329	14.8	28.7	23.8	75	28.5	24.2	77	0.00	0.37	0.0	0.0	2.66	14.60	2.07	14.51
1998	12	28	21	7	33.20	134	26.02	1.7	62	29.4	1007.2	66	10.4	344	13.0	28.2	23.4	75	28.2	23.4	76	0.00	0.32	0.0	0.0	1.15	7.72	1.16	6.91
1998	12	28	22	7	26.87	134	26.58	16.0	219	29.4	1007.9	56	6.2	317	3.4	27.6	23.9	80	27.6	23.8	80	0.09	0.32	0.0	0.1	1.15	7.72	1.16	6.91
1998	12	28	23	7	19.81	134	27.43	0.2	309	29.4	1009.0	52	3.1	92	3.1	28.5	23.7	75	28.6	24.1	77	0.35	0.34	0.0	0.2	1.15	7.72	1.16	6.91
1998	12	29	0	7	19.83	134	27.41	0.2	307	29.6	1009.5	51	5.8	103	5.7	29.3	23.1	69	29.7	23.5	70	0.56	0.36	0.0	0.0	0.12	9.29	0.15	7.54
1998	12	29	1	7	19.81	134	27.39	0.2	307	29.7	1008.9	45	5.4	97	5.4	29.1	23.9	74	30.0	24.3	72	0.87	0.38	0.0	0.1	0.12	9.29	0.15	7.54
1998	12	29	2	7	19.82	134	27.41	0.2	307	29.8	1008.4	57	6.7	109	6.7	29.2	22.9	69	30.3	23.4	67	0.34	0.33	0.0	0.0	0.12	9.29	0.15	7.54
1998	12	29	3	7	19.82	134	27.40	0.2	307	29.9	1007.2	74	6.5	126	6.4	29.5	23.0	68	31.0	23.6	65	0.21	0.33	0.0	0.1	0.11	10.04	0.15	8.99
1998	12	29	4	7	19.83	134	27.40	0.2	307	29.9	1006.3	66	7.5	119	7.4	29.8	23.3	68	31.5	23.7	64	0.91	0.34	0.0	0.0	0.11	10.04	0.15	8.99
1998	12	29	5	7	19.84	134	27.41	0.2	307	30.0	1006.0	70	7.1	122	7.0	29.8	23.1	67	31.3	23.5	64	0.27	0.34	0.0	0.0	0.11	10.04	0.15	8.99
1998	12	29	6	7	19.82	134	27.41	0.2	307	30.0	1005.8	63	7.2	115	7.2	29.6	23.0	68	30.7	23.4	65	0.55	0.35	0.0	0.1	0.14	6.82	0.16	4.75
1998	12	29	7	7	19.83	134	27.41	0.2	307	30.1	1005.7	71	8.4	122	8.4	29.7	22.3	65	30.6	22.7	63	0.33	0.33	0.0	0.0	0.14	6.82	0.16	4.75
1998	12	29	8	7	19.84	134	27.41	0.2	307	30.1	1006.2	68	6.8	120	6.7	29.5	22.1	65	30.2	22.3	63	0.12	0.32	0.0	0.0	0.14	6.82	0.16	4.75
1998	12	29	9	7	19.83	134	27.41	0.2	307	30.2	1006.3	67	5.7	119	5.6	28.9	22.5	68	28.9	22.5	68	0.00	0.33	0.0	0.2	0.12	6.95	0.14	5.48
1998	12	29	10	7	19.83	134	27.43	0.2	307	30.3	1006.9	54	4.3	106	4.3	28.5	22.7	71	28.3	22.7	72	0.00	0.33	0.0	0.0	0.12	6.95	0.14	5.48
1998	12	29	11	7	19.83	134	27.40	0.2	307	30.3	1007.7	58	4.0	109	3.9	28.4	22.7	71	28.2	22.7	72	0.00	0.34	0.0	0.0	0.12	6.95	0.14	5.48
1998	12	29	12	7	19.83	134	27.39	0.2	307	30.3	1008.0	58	3.2	109	3.2	28.4	22.6	71	28.0	22.7	73	0.00	0.33	0.0	0.1	0.06	9.27	0.12	8.55
1998	12	29	13	7	19.82	134	27.41	0.2	307	30.4	1008.0	62	1.6	94	1.6	27.4	23.4	79	27.0	23.3	80	0.00	0.33	0.0	0.2	0.06	9.27	0.12	8.55
1998	12	29	14	7	19.83	134	27.41	0.2	307	30.4	1007.8	58	4.7	109	4.6	27.6	23.7	79	27.3	23.8	81	0.00	0.33	0.0	0.1	0.06	9.27	0.12	8.55
1998	12	29	15	7	19.81	134	27.44	0.2	307	30.4	1007.7	42	3.4	93	3.4	27.4	24.0	82	27.1	24.0	83	0.00	0.36	0.0	0.0	0.10	14.13	0.10	8.54
1998	12	29	16	7	19.82	134	27.42	0.2	307	30.3	1007.0	55	4.8	106	4.7	27.6	22.4	74	27.3	22.5	75	0.00	0.33	0.0	0.2	0.10	14.13	0.10	8.54
1998	12	29	17	7	19.82	134	27.39	0.2	307	30.3	1006.1	55	4.7	107	4.6	28.1	22.1	70	27.7	22.0	72	0.00	0.33	0.0	0.0	0.10	14.13	0.10	8.54
1998	12	29	18	7	19.82	134	27.38	0.2	307	30.3	1005.7	57	4.6	109	4.6	27.9	21.9	70	27.5	22.0	72	0.00	0.33	0.0	0.2	0.09	8.30	0.10	6.70
1998	12	29	19	7	19.81	134	27.39	0.2	307	30.2	1006.1	52	2.8	103	2.8	27.8	22.0	71	27.5	21.9	72	0.00	0.33	0.0	0.1	0.09	8.30	0.10	6.70
1998	12	29	20	7	19.83	134	27.40	0.2	307	30.2	1006.5	27	4.8	79	4.8	27.7	22.4	73	27.5	22.4	74	0.00	0.36	0.0	0.2	0.09	8.30	0.10	6.70
1998	12	29	21	7	19.82	134	27.39	0.2	307	30.1	1007.5	69	5.9	120	5.9	24.5	21.7	84	24.3	21.9	87	0.00	0.36	3.5	3.1	0.15	8.82	0.19	9.13
1998	12	29	22	7	19.86	134	27.41	0.2	307	30.0	1007.6	54	2.4	105	2.4	25.5	23.4	88	25.2	23.4	90	0.15	0.35	0.0	0.1	0.15	8.82	0.19	9.13
1998	12	29	23	7	19.83	134	27.41	0.2	307	29.9	1008.2	35	3.5	87	3.5	26.6	24.1	86	26.5	24.4	88	0.23	0.35	0.0	0.2	0.15	8.82	0.19	9.13
1998	12	30	0	7	19.82	134	27.38	0.1	307	29.8	1009.1	62	5.6	115	5.6	27.6	24.0	81	28.1	24.6	81	0.32	0.35	0.0	0.1	0.08	8.77	0.08	5.54
1998	12	30	1	7	19.84	134	27.38	0.0	307	29.8	1008.2	70	2.9	121	2.8	28.2	25.0	83	28.9	25.7	83	0.49	0.35	0.2	0.3	0.08	8.77	0.08	5.54
1998	12	30	2	7	19.84	134	27.42	0.0	307	29.7	1008.1	60	6.7	112	6.7	26.5	23.2	82	26.7	23.5	82	0.10	0.36	0.5	0.2	0.08	8.77	0.08	5.54
1998	12	30	3	7	19.83	134	27.42	0.0	307	29.7	1007.4	37	6.2	90	6.2	26.9	24.2	85	26.9	24.7	88	1.28	0.38	0.8	1.0	0.11	10.61	0.11	6.75
1998	12	30	4	7	19.83	134	27.41	0.1	307	29.7	1006.3	62	6.6	115	6.6	26.6	23.5	83	26.7	24.0	85	0.14	0.36	0.6	0.6	0.11	10.61	0.11	6.75
1998	12	30	5	7	19.79	134	27.37	0.1	307	29.6	1005.6	66	5.3	118	5.3	26.5	23.8	85	26.5	24.2	87	0.31	0.36	0.5	0.4	0.11	10.61	0.11	6.75
1998	12	30	6	7	25.68	134	25.74	15.8	9	29.7	1005.1	82	6.4	32	11.5	27.3	24.3	84	27.2	24.5	85	0.06	0.36	0.1	0.1	0.34	7.06	0.37	8.40
1998	12	30	7	7	33.29	134	23.08	15.6	271	29.6	1005.1	52	10.6	86	7.9	28.0	24.1	79	27.6	24.4	83	0.02	0.37	2.2	1.2	0.34	7.06	0.37	8.40
1998	12	30	8	7	24.77	134	11.31	15.8	221	29.8	1005.6	115	8.0	309	9.9	26.6	24.1	86	26.6	24.0	86	0.01	0.37	1.3	0.7	0.34	7.06	0.37	8.40
1998	12	30	9	7	12.69	134	1.64	15.8	208	29.9	1006.0	59	7.6	292	2.7	26.4	24.1	88	26.2	24.2	89	0.00	0.36	6.4	4.3	2.51	21.28	1.72	17.87
1998	12	30	10	6	57.16	134	2.17	15.6	180	29.8	1006.8	47	7.9	295	6.4	26.6	24.0	86	26.4	24.3	88	0.00	0.37	3.3	1.8	2.51	21.28	1.72	17.87
1998	12	30	11	6	42.26	134	6.03	15.1	161	29.9	1007.4	81	11.9	311	15.3	26.0	23.7	87	25.9	23.9	89	0.01	0.36	1.1	0.3	2.51	21.28	1.72	17.87
1998	12	30	12	6	27.49	134	10.96	15.6	161	30.1	1007.6	58	7.8	310	9.8	27.1	24.2	84	26.9	24.1	85	0.00	0.34	2.3	0.7	2.46	12.09	2.73	11.58
1998	12	30	13	6	12.85	134	15.83	15.1	162	30.1	1007.8	117	9.7	336	16.2	26.6	23.8	85	26.4	24.1	87	0.00	0.37	2.8	2.6	2.46	12.09	2.73	11.58
1998	12	30	14	5	58.63	134	20.55	15.5	162	30.0	1007.6	100	7.4	331	13.2	26.6	22.3	77	26.4	22.7	80	0.00	0.37	1.3	0.3	2.46	12.09	2.73	11.58
1998	12	30	15	5	44.72	134	25.17	15.3	162	30.0	1006.5	133	2.1	354	9.8	26.4	23.2	83	26.3	23.3	84	0.00	0.36	0.3	0.2	2.95	13.41	2.35	11.19
1998	12	30	16	5	30.86	134	29.58	15.5	159	29.8	1005.4	96	5.9	333	11.7	26.8	23.2	80	26.7	23.7	84	0.00	0.34	0.0	0.2	2.95	13.41	2.35	11.19
1998	12	30	17	5	17.03	134	34.32	15.6	159	29.8	1005.1	101	2.4	347	9.4	26.8	23.7	83	26.8	24.0	85	0.00	0.34	0.0	0.0	2.95	13.41	2.35	11.19
1998	12	30	18	5	3.25	134	39.42	15.4	165	29.7	1004.1	69	6.3	321	9.9	27.6	23.9	80	27.5	24.1	82	0.00	0.34	0.0	0.0	2.29	13.33	2.26	11.35
1998	12	30	19	4	49.43	134	43.91	15.5	162	29.6	1004.2	76	5.2	329	9.8	27.8	23.5	78	27.7	23.9	80	0.00	0.34	0.0	0.1	2.29	13.33	2.26	11.35
1998	12	30	20	4	35.81	134	48.59	15.4	162	29.5	1005.3	91	5.6	332	11.1	28.0	23.8	78	27.8	24.0	80	0.00	0.34	0.0	0.0	2.29	13.33	2.26	11.35
1998	12	30	21	4	22.04	134	53.07	15.4	165	29.6	1005.9	107	5.8	337	12.2	28.1	23.1	74	28.0	23.3	76	0.00	0.34	0.0	0.1	2.65	14.83	2.29	12.37
1998	12	30	22	4	11.73	134	55.94	15.5	161	29.6	1006.7	107	5.2	339	11.8	28.5	23.0	72	28.4	23.1	73	0.08	0.34	0.0	0.1	2.65	14.83	2.29	12.37
1998	12	30	23	3	58.25	134	59.50	15.6	209	29.5	1007.1	109	4.9	332	10.1	28.9	24.3	76	28.9	24.1	75	0.41	0.36	0.0	0.0	2.65	14.83	2.29	12.37
1998	12	31	0	3	59.56	134	58.42	2.0	49	29.5	1008.2	110	4.9	53	5.4	29.1	24.3	76	28.8	24.4	77	0.37	0.34	0.0	0.0	2.16	8.24	2.01	8.65
1998	12	31	1	4	1.99	134	59.80	1.9	45	29.5	1007.6	114	4.7	68	4.9	29.1	24.2	75	28.8	24.2	76	0.41	0.35	0.0	0.1	2.16	8.24	2.01	8.65
1998	12	31	2	4	2.27	135	0.57	0.9	91	29.6	1007.9	124	3.8	31	4.1	29.3	24.3	74	29.4	24.3	74	0.53	0.36	0.0	0.1	2.16	8.24	2.01	8.65

1998	12	31	3	4	2.95	135	1.25	0.8	90	29.6	1006.7	157	6.5	63	6.7	28.1	23.7	77	27.8	23.6	78	0.40	0.36	0.0	0.0	1.94	8.27	1.93	8.32
1998	12	31	4	4	3.80	135	1.38	1.2	44	29.6	1006.3	61	8.6	16	8.8	27.1	22.9	78	27.1	23.0	78	0.19	0.35	0.0	0.1	1.94	8.27	1.93	8.32
1998	12	31	5	4	4.98	135	0.82	1.5	154	29.6	1005.3	32	3.9	250	3.6	26.9	25.4	92	27.0	24.4	86	0.93	0.37	7.3	5.0	1.94	8.27	1.93	8.32
1998	12	31	6	4	4.97	135	0.80	1.1	145	29.7	1004.5	40	3.1	265	3.0	29.1	22.8	69	28.6	23.0	72	0.61	0.34	0.0	0.1	1.84	8.57	2.22	8.57
1998	12	31	7	4	5.06	135	0.69	1.4	145	29.7	1004.8	67	4.6	289	4.8	28.5	23.5	74	28.3	23.8	77	0.46	0.35	0.0	0.0	1.84	8.57	2.22	8.57
1998	12	31	8	4	4.83	135	0.49	1.7	159	29.7	1005.1	61	3.6	275	3.6	28.1	24.0	79	27.8	24.2	81	0.12	0.33	0.0	0.3	1.84	8.57	2.22	8.57
1998	12	31	9	4	4.77	135	0.23	1.6	160	29.6	1005.3	59	4.8	270	4.7	28.0	23.8	78	27.8	24.2	81	0.00	0.33	0.0	0.0	1.80	9.39	2.04	8.97
1998	12	31	10	4	4.80	135	0.24	1.5	158	29.6	1006.0	46	7.1	253	6.8	28.0	24.3	81	27.6	24.4	83	0.00	0.34	0.0	0.1	1.80	9.39	2.04	8.97
1998	12	31	11	4	7.08	135	7.91	15.1	81	29.8	1006.0	56	6.5	349	13.9	28.2	24.1	78	28.1	24.2	79	0.00	0.35	0.0	0.2	1.80	9.39	2.04	8.97
1998	12	31	12	4	10.98	135	22.78	14.7	84	30.1	1006.8	58	7.4	347	14.6	28.0	24.1	79	27.8	24.2	81	0.00	0.34	0.0	0.0	1.88	6.85	1.93	7.29
1998	12	31	13	4	13.07	135	37.62	14.8	90	30.0	1007.2	58	5.9	346	13.0	27.7	23.9	80	27.6	23.9	80	0.00	0.35	0.0	0.0	1.88	6.85	1.93	7.29
1998	12	31	14	4	14.56	135	52.32	14.9	90	30.0	1007.3	53	5.5	344	12.6	27.8	24.2	81	27.7	24.3	82	0.00	0.35	0.0	0.0	1.88	6.85	1.93	7.29
1998	12	31	15	4	16.48	136	7.16	15.0	84	30.1	1006.8	52	5.5	347	12.6	27.8	23.8	79	27.7	23.9	80	0.00	0.34	0.0	0.0	1.96	7.29	1.72	7.10
1998	12	31	16	4	18.74	136	22.05	14.8	84	30.1	1006.1	90	4.5	2	12.2	28.0	23.9	79	27.8	24.1	81	0.00	0.34	0.0	0.0	1.96	7.29	1.72	7.10
1998	12	31	17	4	20.82	136	36.61	14.9	85	30.2	1005.5	89	4.7	1	12.4	28.0	23.7	78	27.9	23.7	78	0.00	0.33	0.0	0.0	1.96	7.29	1.72	7.10
1998	12	31	18	4	22.91	136	51.08	14.9	85	30.1	1004.9	86	4.4	0	12.0	28.0	24.1	79	27.9	24.0	80	0.00	0.34	0.0	0.1	2.03	6.89	1.84	7.39
1998	12	31	19	4	25.35	137	5.73	15.0	82	30.2	1004.7	98	4.5	6	12.0	28.2	24.4	80	28.0	24.3	80	0.00	0.34	0.0	0.0	2.03	6.89	1.84	7.39
1998	12	31	20	4	27.95	137	20.63	15.0	83	30.2	1004.9	94	5.5	5	13.0	28.3	23.8	77	28.1	23.8	78	0.00	0.34	0.0	0.0	2.03	6.89	1.84	7.39
1998	12	31	21	4	30.43	137	35.48	14.4	80	30.2	1005.3	85	5.9	1	13.4	28.5	23.7	75	28.3	23.8	76	0.01	0.34	0.0	0.0	1.68	6.85	1.68	6.85
1998	12	31	22	4	33.50	137	50.34	14.6	79	30.2	1006.1	105	5.8	11	13.0	28.8	24.1	76	28.7	24.2	77	0.09	0.35	0.0	0.0	1.68	6.85	1.68	6.85
1998	12	31	23	4	36.84	138	5.31	14.4	80	30.2	1006.9	114	6.2	16	13.1	28.9	24.2	76	28.8	24.3	77	0.17	0.35	0.0	0.1	1.68	6.85	1.68	6.85
1999	1	1	0	4	39.77	138	20.45	14.7	79	30.2	1007.2	106	5.8	11	13.1	29.3	24.3	75	29.2	24.4	76	0.67	0.35	0.0	0.0	1.80	6.77	1.68	6.87
1999	1	1	1	4	42.89	138	35.61	14.8	77	30.2	1007.3	104	6.0	12	13.2	29.6	24.4	74	29.6	24.4	74	0.83	0.34	0.0	0.0	1.80	6.77	1.68	6.87
1999	1	1	2	4	46.17	138	50.74	15.0	78	30.2	1007.3	80	4.4	0	12.0	28.8	23.3	72	28.2	23.4	75	0.59	0.35	0.1	0.0	1.80	6.77	1.68	6.87
1999	1	1	3	4	49.12	139	5.39	15.0	78	30.2	1006.2	91	6.2	6	13.7	29.8	24.4	73	29.5	24.4	74	0.75	0.35	0.1	0.0	1.65	6.39	1.58	6.74
1999	1	1	4	4	51.84	139	21.48	14.9	79	30.2	1005.2	114	4.0	11	11.2	29.2	24.1	74	28.8	24.3	77	0.87	0.35	0.5	0.4	1.65	6.39	1.58	6.74
1999	1	1	5	4	54.93	139	36.82	14.7	79	30.3	1004.5	92	5.6	6	13.0	29.9	24.4	73	29.8	24.6	74	0.18	0.33	0.0	0.0	1.65	6.39	1.58	6.74
1999	1	1	6	4	58.09	139	52.11	14.8	78	30.3	1004.3	86	4.3	2	11.8	29.9	24.2	71	29.6	24.3	74	0.55	0.34	0.0	0.0	1.58	6.29	1.44	6.22
1999	1	1	7	5	0.47	140	0.52	0.6	70	30.2	1004.6	73	5.9	0	6.8	29.3	23.8	72	29.0	23.7	74	0.33	0.36	0.0	0.2	1.58	6.29	1.44	6.22
1999	1	1	8	5	0.85	140	1.31	3.4	60	30.2	1005.1	76	6.6	42	7.2	28.9	23.9	75	28.8	23.9	75	0.04	0.34	0.0	0.0	1.58	6.29	1.44	6.22
1999	1	1	9	5	1.18	140	2.08	1.9	71	30.1	1005.6	67	4.2	357	5.0	28.8	23.6	74	28.5	23.6	75	0.00	0.34	0.0	0.1	1.81	8.73	1.52	8.53
1999	1	1	10	5	1.24	140	2.66	0.3	70	30.1	1006.0	65	7.2	354	7.4	28.4	24.2	78	28.2	24.2	79	0.00	0.35	0.0	0.1	1.81	8.73	1.52	8.53
1999	1	1	11	5	1.50	140	3.92	0.3	70	30.1	1006.6	82	5.8	11	6.1	28.5	23.8	76	28.2	23.9	77	0.00	0.33	0.0	0.0	1.81	8.73	1.52	8.53
1999	1	1	12	5	1.72	140	4.84	0.3	70	30.1	1006.8	78	6.9	8	7.1	28.5	23.6	75	28.3	23.6	76	0.00	0.33	0.0	0.1	1.76	8.46	1.66	8.39
1999	1	1	13	5	2.03	140	5.84	0.2	80	30.1	1006.9	86	6.6	5	6.7	28.6	23.7	75	28.4	23.6	76	0.00	0.33	0.0	0.0	1.76	8.46	1.66	8.39
1999	1	1	14	5	2.16	140	6.61	0.1	75	30.1	1006.6	74	6.6	355	6.8	28.4	24.0	77	28.2	24.1	78	0.00	0.33	0.0	0.0	1.76	8.46	1.66	8.39
1999	1	1	15	5	2.34	140	7.46	0.2	76	30.1	1006.3	76	6.7	0	6.9	28.5	23.5	74	28.4	23.5	75	0.00	0.33	0.0	0.0	1.63	8.25	1.61	8.52
1999	1	1	16	5	2.67	140	8.12	0.5	55	30.1	1005.6	76	6.6	20	6.8	28.4	23.5	75	28.2	23.6	76	0.00	0.33	0.0	0.0	1.63	8.25	1.61	8.52
1999	1	1	17	5	2.86	140	8.10	0.6	50	30.1	1004.9	68	5.1	14	5.4	28.4	23.6	76	28.1	23.7	77	0.00	0.34	0.0	0.0	1.63	8.25	1.61	8.52
1999	1	1	18	5	3.19	140	8.26	0.3	50	30.0	1004.4	66	5.6	15	5.8	28.3	23.9	77	28.0	23.8	78	0.00	0.34	0.0	0.0	1.49	8.09	1.43	8.50
1999	1	1	19	5	4.12	140	8.16	1.2	1	30.1	1004.4	71	5.3	65	5.5	28.4	24.2	78	28.4	24.1	78	0.00	0.34	0.0	0.0	1.49	8.09	1.43	8.50
1999	1	1	20	5	5.13	140	8.23	0.5	45	30.1	1004.7	63	6.0	17	6.2	28.3	24.1	78	28.1	24.0	78	0.00	0.34	0.0	0.1	1.49	8.09	1.43	8.50
1999	1	1	21	5	4.89	140	7.44	1.2	209	30.0	1005.4	105	6.1	262	6.0	27.0	24.5	87	26.8	24.6	88	0.01	0.37	0.7	0.6	1.36	8.31	1.66	8.52
1999	1	1	22	5	4.33	140	6.82	2.1	209	30.0	1006.0	138	10.6	294	11.0	26.8	23.5	82	26.7	23.6	83	0.06	0.37	0.0	0.2	1.36	8.31	1.66	8.52
1999	1	1	23	5	3.52	140	6.08	1.8	249	30.1	1006.6	82	10.5	222	9.9	26.6	24.6	89	26.1	24.5	91	0.30	0.37	0.1	0.1	1.36	8.31	1.66	8.52
1999	1	2	0	5	2.98	140	6.36	2.2	124	30.1	1006.8	90	5.4	335	6.4	27.3	24.0	83	27.1	24.4	85	0.22	0.37	0.0	0.1	1.63	8.19	1.78	9.10
1999	1	2	1	5	2.19	140	6.28	1.3	224	30.0	1007.0	74	10.2	211	9.7	27.8	23.8	79	27.7	24.0	80	0.24	0.35	0.0	0.0	1.63	8.19	1.78	9.10
1999	1	2	2	5	2.01	140	5.78	0.7	239	30.0	1006.1	102	8.2	226	7.9	27.7	24.1	81	27.7	24.0	80	0.27	0.35	0.0	0.1	1.63	8.19	1.78	9.10
1999	1	2	3	5	1.68	140	5.05	1.0	239	30.0	1005.3	94	8.0	218	7.5	28.1	24.3	80	28.0	24.3	81	0.36	0.35	0.0	0.0	1.47	7.55	1.92	7.27
1999	1	2	4	5	1.51	140	4.69	1.2	240	30.0	1004.3	93	6.5	217	6.1	28.7	24.9	80	28.6	24.7	79	0.49	0.35	0.0	0.2	1.47	7.55	1.92	7.27
1999	1	2	5	5	0.89	140	5.23	0.9	106	30.1	1003.8	94	8.4	349	8.8	29.0	24.0	75	28.6	24.2	77	0.39	0.35	0.0	0.0	1.47	7.55	1.92	7.27
1999	1	2	6	5	0.34	140	6.48	1.6	85	30.0	1003.1	91	7.9	1	8.6	28.2	23.8	77	27.9	23.9	79	0.20	0.35	0.0	0.0	1.78	7.69	1.77	7.73
1999	1	2	7	5	0.11	140	7.56	0.2	80	30.0	1003.2	96	9.7	16	9.9	28.1	23.5	76	28.2	23.6	76	0.24	0.34	0.0	0.0	1.78	7.69	1.77	7.73
1999	1	2	8	5	0.24	140	8.78	1.0	30	30.0	1003.7	94	8.4	29	8.7	28.4	22.7	72	28.1	22.9	73	0.05	0.35	0.0	0.0	1.78	7.69	1.77	7.73
1999	1	2	9	4	54.36	140	14.42	15.6	139	30.1	1004.2	91	7.6	338	14.4	28.2	24.4	80	28.0	24.4	81	0.00	0.35	0.0	0.3	1.70	8.07	1.59	6.43
1999	1	2	10	4	42.59	140	25.33	15.6	140	30.1	1004.7	80	5.8	336	12.1	28.2	24.8	82	28.2	25.0	83	0.00	0.37	0.3	0.2	1.70	8.07	1.59	6.43
1999	1	2	11	4	30.95	140	36.07	15.8	139	30.1	1005.5	112	5.2	349	12.9	28.0	24.8	83	28.0	24.9	83	0.00	0.36	0.5	0.2	1.70	8.07	1.59	6.43
1999	1	2	12	4	19.32	140	46.73	15.6	140	30.2	1005.4	112	6.7	348	14.3	27.8	24.8	84	27.7	24.8	85	0.00	0.35	0.4	0.2	1.76	8.74	1.69	9.17
1999	1	2	13	4	7.78	140	57.30	15.5	139	30.1	1005.6	138	6.4	0	14.4	28.3	23.4	75	28.2	23.5	76	0.00	0.35	0.0	0.0	1.76	8.74	1.69	9.17
1999	1	2	14	3	56.13	141	7.72	15.7	139	30.1	1006.0	146	7.0	3	15.0	27.9	23.5	77	27.8	23.7	79	0.00	0.35	0.0	0.0	1.76	8.74	1.69	9.17
1999	1	2	15	3	44.52	141	17.98	15.6	140	30.0	1005.3	167	8.4	14	15.9	28.3	24.6	80	28.2	24.7	81	0.00	0.36	0.0	0.2	1.72	9.55	1.51	7.68
1999	1	2	16	3	32.99	141	28.08	15.4	139	30.1	1004.0	200	13.0	39	18.2	26.3	23.9	87	26.2	24.2	89	0.00	0.37	3.0	2.0	1.72	9.55	1.51	7.68
1999	1	2	17	3	22.00	141	38.39	15.6	137	30.0	1003.3	216	11.2	48	14.9	27.0	23.3	81	26.6	23.6	83	0.00	0.35	2.1	0.1	1.72	9.55	1.51	7.68
1999	1	2	18	3	11.33	141	49.06	15.7	137	30.0	1003.3	221	8.0	42	11.9	26.9	23.2	80	26.7	23.5	83	0.00	0.35	0.7	0.0	1.68	8.12	1.25	7.64
1999	1	2	19	3	0.57	141	59.89	15.8	136	30.0	1003.6	233	5.8	38	9.5	27.0	22.8	78	26.9	23.0	79	0.00	0.35	0.0	0.0	1.68	8.12	1.25	7.64
1999	1	2	20	2	49.72	142	10.58	15.9	137	30.0	1004.4	243	2.5	17	7.8	26.9	23.3	80	26.7	23.4	82	0.00	0.35	0.0	0.1	1.68	8.12	1.25	7.64
1999	1	2	21	2	38.94	142	21.28	15.9	137	29.8	1005.1	143	1.1	0	9.1	27.0	23.5	82	26.8	23.7	83	0.02	0.33	0.0	0.1	1.56	8.22	1.23	6.65

1999	1	2	22	2	28.19	142	31.93	15.8	137	29.8	1006.3	154	1.2	2	9.1	27.2	24.1	83	27.2	24.1	83	0.14	0.34	0.0	0.2	1.56	8.22	1.23	6.65
1999	1	2	23	2	17.65	142	42.47	15.4	136	29.9	1006.9	104	4.5	348	11.9	26.4	23.9	86	26.3	24.2	88	0.07	0.35	0.4	0.5	1.56	8.22	1.23	6.65
1999	1	3	0	2	5.16	142	49.74	15.8	121	29.9	1007.2	147	4.7	0	12.6	28.1	24.6	82	28.0	25.0	84	0.70	0.35	5.8	3.2	1.75	14.08	1.15	10.64
1999	1	3	1	1	56.05	143	1.39	15.6	129	30.0	1006.9	152	4.6	8	12.4	27.6	24.1	81	27.6	24.7	84	0.81	0.35	2.7	1.0	1.75	14.08	1.15	10.64
1999	1	3	2	1	46.40	143	12.93	15.5	134	30.1	1006.3	140	5.1	3	13.1	29.2	24.2	75	29.0	24.7	78	0.87	0.34	0.0	0.0	1.75	14.08	1.15	10.64
1999	1	3	3	1	36.23	143	23.96	15.6	134	30.0	1005.9	150	4.7	6	12.6	29.0	23.9	74	29.0	24.0	75	0.77	0.34	0.0	0.0	1.21	9.00	1.02	6.33
1999	1	3	4	1	26.14	143	34.61	15.6	133	30.2	1004.9	163	4.6	11	12.2	29.2	23.7	72	29.1	23.7	73	0.87	0.34	0.0	7.7	1.21	9.00	1.02	6.33
1999	1	3	5	1	15.56	143	45.07	15.5	135	30.2	1004.4	154	4.5	7	12.4	29.4	23.5	71	28.9	23.5	73	0.80	0.34	0.0	0.0	1.21	9.00	1.02	6.33
1999	1	3	6	1	5.26	143	55.95	15.5	133	30.0	1004.2	158	5.1	9	12.9	28.8	23.8	75	28.7	23.7	75	0.27	0.34	0.0	0.0	1.22	9.42	0.91	6.82
1999	1	3	7	0	54.93	144	6.69	15.8	138	30.1	1004.2	158	4.4	7	12.2	28.9	23.8	74	28.5	23.8	76	0.20	0.33	0.0	0.0	1.22	9.42	0.91	6.82
1999	1	3	8	0	44.39	144	16.88	15.6	138	30.0	1005.0	149	4.3	4	12.3	28.5	23.3	74	28.1	23.3	75	0.05	0.33	0.0	0.0	1.22	9.42	0.91	6.82
1999	1	3	9	0	33.66	144	27.11	15.4	138	30.1	1006.0	138	3.6	0	11.5	28.3	22.9	72	28.2	22.9	73	0.00	0.34	0.0	0.1	1.10	10.75	0.83	7.86
1999	1	3	10	0	22.78	144	37.35	15.8	137	30.1	1006.2	123	3.7	356	11.7	28.2	22.9	73	28.1	22.9	74	0.00	0.33	0.0	0.0	1.10	10.75	0.83	7.86
1999	1	3	11	0	11.67	144	48.24	15.6	138	30.1	1006.6	106	3.4	351	11.0	28.3	23.2	74	28.2	23.2	75	0.00	0.36	0.0	0.1	1.10	10.75	0.83	7.86
1999	1	3	12	0	0.75	144	59.19	12.5	135	30.1	1006.9	106	4.6	349	12.1	28.3	23.1	74	28.2	23.2	75	0.00	0.33	0.0	0.0	1.09	9.43	0.81	6.68
1999	1	3	13	0	0.42	144	59.92	0.7	90	30.1	1007.0	104	4.6	13	4.9	28.2	23.4	75	28.0	23.4	76	0.00	0.34	0.0	0.2	1.09	9.43	0.81	6.68
1999	1	3	14	0	0.41	144	59.83	0.5	110	30.1	1006.7	97	3.9	349	4.2	28.1	23.8	77	27.9	23.8	78	0.00	0.35	0.0	0.0	1.09	9.43	0.81	6.68
1999	1	3	15	0	0.55	144	59.95	0.8	90	30.1	1006.3	115	4.6	23	5.0	28.2	23.7	77	28.1	23.7	77	0.00	0.34	0.0	0.0	0.94	8.88	0.92	8.86
1999	1	3	16	0	0.95	145	0.06	0.6	90	30.1	1005.8	98	3.7	8	3.9	28.2	23.3	75	28.0	23.4	76	0.00	0.34	0.0	0.0	0.94	8.88	0.92	8.86
1999	1	3	17	0	1.49	144	59.91	0.3	70	30.1	1005.2	98	3.7	27	3.9	28.0	23.3	76	27.8	23.4	77	0.00	0.35	0.0	0.1	0.94	8.88	0.92	8.86
1999	1	3	18	0	1.60	144	59.85	0.5	110	30.1	1005.0	98	5.5	347	5.8	28.0	23.3	76	27.8	23.3	76	0.00	0.34	0.0	0.1	0.97	8.46	1.05	8.38
1999	1	3	19	0	1.42	145	0.08	0.6	111	30.1	1005.2	91	5.3	341	5.6	28.0	23.2	75	27.9	23.4	77	0.00	0.33	0.0	0.0	0.97	8.46	1.05	8.38
1999	1	3	20	0	1.19	145	0.36	0.7	108	30.1	1005.5	104	4.3	357	4.6	28.0	23.4	76	27.8	23.4	77	0.00	0.33	0.0	0.0	0.97	8.46	1.05	8.38
1999	1	3	21	0	0.32	145	0.52	1.6	180	30.1	1006.1	98	6.0	287	6.2	28.2	23.6	76	28.0	23.6	77	0.04	0.34	0.0	0.0	1.02	8.50	1.08	8.64
1999	1	3	22	-1	99.25	144	59.93	1.2	90	30.1	1007.0	80	6.5	339	7.0	27.7	23.7	79	27.5	24.1	82	0.17	0.35	0.0	0.0	1.02	8.50	1.08	8.64
1999	1	3	23	-1	99.31	145	1.35	2.5	110	30.1	1007.6	83	4.3	342	5.4	29.2	24.4	75	29.0	24.8	78	0.60	0.35	0.0	0.0	1.02	8.50	1.08	8.64
1999	1	4	0	-1	98.76	145	1.48	0.5	120	30.1	1007.6	138	6.2	359	6.7	29.4	24.0	73	29.4	24.3	74	0.78	0.34	0.0	0.0	1.16	8.49	1.17	8.32
1999	1	4	1	0	0.26	145	1.17	0.5	80	30.1	1007.2	87	9.1	5	9.3	27.2	23.2	79	27.3	23.3	79	0.32	0.35	0.0	0.1	1.16	8.49	1.17	8.32
1999	1	4	2	0	0.65	145	1.35	1.0	124	30.1	1006.8	163	4.9	38	5.2	27.6	24.4	82	27.6	25.0	86	0.28	0.34	0.8	0.6	1.16	8.49	1.17	8.32
1999	1	4	3	0	0.43	145	1.15	0.2	125	30.2	1005.7	135	4.2	9	4.6	29.4	24.3	74	29.3	24.5	75	0.91	0.34	0.0	0.2	1.13	8.18	0.95	8.07
1999	1	4	4	0	0.12	145	1.17	0.9	113	30.2	1004.8	119	5.1	4	5.6	29.3	23.6	72	28.7	23.7	74	0.50	0.33	0.0	0.0	1.13	8.18	0.95	8.07
1999	1	4	5	0	0.04	145	1.48	0.6	110	30.2	1004.7	97	8.2	347	8.4	26.2	22.7	81	25.9	22.5	81	0.16	0.37	2.0	0.7	1.13	8.18	0.95	8.07
1999	1	4	6	-1	99.90	145	2.04	0.7	108	30.2	1004.4	114	3.8	5	4.2	28.4	23.9	76	27.7	23.9	80	0.46	0.35	0.0	0.2	1.28	7.82	1.09	8.12
1999	1	4	7	-1	99.72	145	2.39	0.7	108	30.2	1004.9	106	5.4	359	5.8	28.9	24.2	76	28.2	24.4	80	0.24	0.33	0.0	0.1	1.28	7.82	1.09	8.12
1999	1	4	8	-1	99.68	145	2.73	0.7	78	30.2	1005.1	95	8.6	6	8.8	27.4	22.4	74	27.1	22.5	76	0.04	0.35	0.0	0.0	1.28	7.82	1.09	8.12
1999	1	4	9	0	0.07	145	2.98	0.5	80	30.1	1005.8	89	5.1	8	5.3	27.6	22.5	74	27.4	22.5	75	0.00	0.33	0.0	0.1	1.29	7.55	1.05	8.18
1999	1	4	10	0	0.51	145	3.15	0.7	70	30.1	1006.2	87	4.8	16	5.1	28.0	23.6	77	27.7	23.7	79	0.00	0.33	0.0	0.0	1.29	7.55	1.05	8.18
1999	1	4	11	0	0.90	145	3.10	0.5	69	30.1	1006.8	94	6.6	23	6.9	28.4	23.6	75	28.2	23.6	76	0.00	0.33	0.0	0.0	1.29	7.55	1.05	8.18
1999	1	4	12	0	1.30	145	2.82	0.5	70	30.1	1006.9	85	6.3	14	6.6	28.4	24.2	78	28.4	24.2	78	0.00	0.35	0.0	0.0	1.27	7.99	0.97	8.26
1999	1	4	13	0	1.47	145	2.82	0.2	91	30.1	1006.8	76	5.4	347	5.7	28.0	24.3	80	28.0	24.4	81	0.00	0.34	0.0	0.0	1.27	7.99	0.97	8.26
1999	1	4	14	0	0.94	145	11.92	15.4	94	29.9	1006.8	85	7.5	355	15.4	28.1	24.1	79	28.1	24.4	80	0.00	0.33	2.6	0.7	1.27	7.99	0.97	8.26
1999	1	4	15	0	0.19	145	26.93	15.2	89	30.0	1006.3	87	8.2	356	16.0	28.6	22.8	71	28.3	23.0	73	0.00	0.32	0.0	0.0	1.13	5.65	1.11	5.33
1999	1	4	16	0	0.17	145	41.71	15.3	93	29.9	1005.4	90	8.4	359	16.2	28.6	22.7	70	28.6	23.0	72	0.00	0.32	0.0	0.0	1.13	5.65	1.11	5.33
1999	1	4	17	0	0.07	145	56.71	15.5	94	29.8	1005.0	90	7.9	358	15.7	28.4	22.6	71	28.2	22.9	73	0.00	0.32	0.0	0.0	1.13	5.65	1.11	5.33
1999	1	4	18	0	0.32	146	11.52	15.3	94	29.7	1004.6	85	7.2	355	15.0	28.4	22.8	72	28.3	23.2	74	0.00	0.32	0.0	0.0	1.32	5.81	1.23	5.62
1999	1	4	19	0	0.06	146	26.55	15.4	95	29.7	1004.9	91	7.6	359	15.4	28.5	23.6	75	28.5	23.8	76	0.00	0.32	0.0	0.1	1.32	5.81	1.23	5.62
1999	1	4	20	0	0.33	146	41.71	14.9	90	29.8	1005.6	89	8.3	0	16.1	28.5	23.4	74	28.5	23.6	75	0.00	0.32	0.0	0.1	1.32	5.81	1.23	5.62
1999	1	4	21	0	0.07	146	56.40	15.3	93	29.8	1006.2	86	7.9	357	15.7	28.8	23.1	71	28.8	23.4	73	0.09	0.32	0.0	0.0	1.32	5.67	1.24	5.74
1999	1	4	22	-1	99.85	147	11.13	15.3	89	29.8	1007.0	97	8.7	4	16.4	29.2	21.9	65	28.9	22.2	67	0.37	0.33	0.0	0.0	1.32	5.67	1.24	5.74
1999	1	4	23	0	0.24	147	25.75	15.4	89	29.8	1007.2	93	8.5	2	16.3	29.8	22.3	64	29.6	22.5	66	0.59	0.32	0.0	0.0	1.32	5.67	1.24	5.74
1999	1	5	0	-1	99.97	147	40.59	15.4	88	29.9	1007.2	94	7.8	3	15.6	30.1	22.5	64	29.8	22.6	65	0.79	0.32	0.0	0.0	1.41	5.22	1.23	5.56
1999	1	5	1	0	0.00	147	53.31	0.5	79	29.9	1006.7	87	8.4	359	10.4	30.5	22.0	60	29.9	22.2	63	0.92	0.32	0.0	0.2	1.41	5.22	1.23	5.56
1999	1	5	2	0	0.00	147	53.09	0.6	74	30.0	1006.1	90	8.2	16	8.5	30.6	21.8	60	30.6	22.0	60	0.98	0.33	0.0	0.1	1.41	5.22	1.23	5.56
1999	1	5	3	-1	99.95	147	52.87	0.8	75	30.0	1004.8	93	7.3	19	7.6	30.5	21.5	59	30.9	21.5	58	0.91	0.32	0.0	0.1	1.63	7.51	1.22	7.71
1999	1	5	4	-1	99.91	148	6.42	15.3	87	30.1	1003.8	107	6.9	9	14.4	30.5	22.2	61	30.4	22.2	62	0.85	0.32	0.0	0.2	1.63	7.51	1.22	7.71
1999	1	5	5	0	0.19	148	21.40	15.1	89	30.2	1003.2	119	6.4	14	13.8	30.2	21.3	59	30.2	21.3	59	0.67	0.32	0.0	0.0	1.63	7.51	1.22	7.71
1999	1	5	6	0	0.10	148	36.04	15.3	89	30.2	1003.5	117	6.0	13	13.4	30.1	21.9	61	30.0	21.8	62	0.49	0.32	0.0	0.1	1.24	5.44	1.05	5.49
1999	1	5	7	0	0.14	148	50.97	15.3	89	30.2	1003.7	115	5.7	11	13.1	29.7	22.4	65	29.5	22.3	66	0.24	0.32	0.0	0.1	1.24	5.44	1.05	5.49
1999	1	5	8	0	0.15	149	5.87	15.2	89	30.2	1004.4	114	5.6	11	13.1	29.1	22.4	67	29.0	22.3	68	0.02	0.32	0.0	0.0	1.24	5.44	1.05	5.49
1999	1	5	9	0	0.32	149	20.81	15.3	89	30.1	1004.9	114	6.7	11	14.2	28.8	22.2	68	28.6	22.2	68	0.00	0.33	0.0	0.2	1.19	5.66	1.02	5.43
1999	1	5	10	0	0.48	149	35.90	15.4	88	30.0	1005.6	120	6.0	13	13.3	28.8	21.9	66	28.7	21.9	67	0.00	0.31	0.0	0.2	1.19	5.66	1.02	5.43
1999	1	5	11	0	0.67	149	50.95	15.5	89	30.0	1006.1	112	6.0	11	13.6	28.7	22.5	69	28.6	22.4	70	0.00	0.32	0.0	0.0	1.19	5.66	1.02	5.43
1999	1	5	12	0	2.33	150	5.58	15.3	89	30.0	1006.3	119	5.7	23	11.9	28.5	22.5	70	28.5	22.6	70	0.00	0.31	0.0	0.1	1.17	6.04	1.03	6.60
1999	1	5	13	0	1.67	150	20.09	10.0	94	30.0	1006.4	110	5.4	7	12.1	28.6	22.5	70	28.5	22.5	70	0.00	0.32	0.0	0.0	1.17	6.04	1.03	6.60
1999	1	5	14	0	1.06	150	34.27	15.5	92	30.0	1006.3	96	4.4	1	12.4	28.5	22.6	71	28.6	22.7	71	0.00	0.32	0.0	0.0	1.17	6.04	1.03	6.60
1999	1	5	15	0	0.84	150	49.39	15.6	92	30.0	1005.7	101	4.8	4	12.7	28.7	22.8	70	28.6	22.8	71	0.00	0.32	0.0	0.0	1.01	5.96	0.96	6.11
1999	1	5	16	0	0.57	151	4.58	15.6	93	30.1	1005.2	93	4.7	0	12.6	28.5	22.6	71	28.5	22.7	71	0.00	0.33	0.0	0.0	1.01	5.96	0.96	6.11

1999	1	5	17	0	0.23	151	19.65	15.6	94	30.1	1004.7	103	5.1	4	13.0	28.5	21.6	66	28.4	21.9	68	0.00	0.32	0.0	0.1	1.01	5.96	0.96	6.11
1999	1	5	18	0	0.01	151	34.66	15.6	92	30.1	1004.6	110	4.9	7	12.7	28.4	22.0	68	28.4	22.0	69	0.00	0.31	0.0	0.1	1.16	7.02	0.99	6.48
1999	1	5	19	0	0.01	151	49.83	15.4	92	30.1	1004.9	105	5.3	5	13.2	28.4	22.0	68	28.3	22.1	69	0.00	0.32	0.0	0.0	1.16	7.02	0.99	6.48
1999	1	5	20	0	0.06	152	4.87	15.5	92	30.1	1005.5	118	5.0	10	12.6	28.5	22.1	68	28.4	22.1	69	0.01	0.32	0.0	0.0	1.16	7.02	0.99	6.48
1999	1	5	21	0	0.26	152	19.86	15.5	92	30.2	1006.2	114	4.9	8	12.6	29.0	22.2	67	28.8	22.1	67	0.22	0.33	0.0	0.0	1.08	6.96	0.99	7.20
1999	1	5	22	0	0.59	152	34.80	15.6	92	30.3	1006.3	124	4.2	11	11.8	29.4	22.4	66	29.4	22.5	67	0.44	0.33	0.0	0.1	1.08	6.96	0.99	7.20
1999	1	5	23	0	0.88	152	49.75	15.7	93	30.5	1006.6	135	4.4	15	11.7	29.5	22.7	67	29.6	22.8	67	0.48	0.33	0.0	0.0	1.08	6.96	0.99	7.20
1999	1	6	0	0	0.30	153	3.64	15.6	93	30.4	1006.2	145	6.1	22	12.7	29.2	23.1	70	29.2	23.3	71	0.80	0.34	0.9	0.5	1.09	7.35	0.97	7.85
1999	1	6	1	-1	99.94	153	15.82	1.0	100	30.5	1006.3	135	5.8	30	7.6	29.8	22.3	64	30.2	22.5	64	1.01	0.34	0.0	0.0	1.09	7.35	0.97	7.85
1999	1	6	2	-1	99.93	153	15.90	0.9	90	30.6	1005.2	128	5.9	36	6.3	30.3	22.5	63	30.4	22.9	64	0.96	0.34	0.0	0.0	1.09	7.35	0.97	7.85
1999	1	6	3	0	0.11	153	16.14	9.4	94	30.6	1004.2	129	6.0	27	7.9	30.6	22.0	60	30.5	22.2	62	0.91	0.33	0.0	0.1	1.20	8.57	1.00	9.21
1999	1	6	4	0	0.05	153	30.56	15.3	89	30.6	1003.6	145	6.0	23	12.4	30.1	22.5	64	30.1	22.6	64	0.84	0.34	0.0	0.1	1.20	8.57	1.00	9.21
1999	1	6	5	0	0.00	153	45.42	15.4	89	30.5	1002.8	131	6.1	18	13.2	28.8	22.7	70	28.7	22.8	71	0.30	0.34	0.5	0.5	1.20	8.57	1.00	9.21
1999	1	6	6	0	0.00	154	0.15	15.5	88	30.4	1003.1	135	6.2	20	12.9	28.3	22.7	72	28.4	22.9	72	0.24	0.34	0.0	0.0	1.01	6.23	0.91	5.92
1999	1	6	7	0	0.42	154	14.88	15.5	89	30.4	1003.6	125	6.4	15	13.6	28.6	23.6	74	28.7	23.6	74	0.11	0.35	0.0	0.0	1.01	6.23	0.91	5.92
1999	1	6	8	0	0.51	154	29.41	15.6	89	30.3	1004.3	131	6.3	18	13.4	28.7	22.4	69	28.6	22.5	70	0.00	0.33	0.0	0.0	1.01	6.23	0.91	5.92
1999	1	6	9	0	0.53	154	43.87	15.5	89	30.4	1004.9	124	6.3	16	13.6	28.7	22.4	69	28.7	22.4	69	0.00	0.33	0.0	0.1	1.10	6.01	0.98	6.29
1999	1	6	10	0	0.49	154	58.52	15.4	89	30.2	1006.0	121	6.4	14	13.8	28.7	22.6	70	28.6	22.5	70	0.00	0.33	0.0	0.2	1.10	6.01	0.98	6.29
1999	1	6	11	0	0.27	155	13.31	15.5	89	30.2	1006.4	124	6.0	14	13.4	28.6	22.8	71	28.6	22.8	71	0.00	0.33	0.0	0.1	1.10	6.01	0.98	6.29
1999	1	6	12	0	0.01	155	27.57	9.7	89	30.1	1006.5	108	7.1	10	13.2	28.6	21.5	66	28.5	21.6	66	0.00	0.35	0.0	0.0	1.18	6.47	1.02	6.69
1999	1	6	13	-1	99.89	155	41.94	15.4	89	30.2	1006.5	114	6.5	11	14.1	28.4	22.5	71	28.3	22.5	71	0.00	0.33	0.0	0.0	1.18	6.47	1.02	6.69
1999	1	6	14	-1	99.96	155	56.93	15.4	89	30.1	1006.4	121	7.1	15	14.5	28.4	22.0	68	28.4	22.0	68	0.00	0.34	0.0	0.0	1.18	6.47	1.02	6.69
1999	1	6	15	0	0.62	156	11.64	15.5	92	30.0	1005.7	131	7.5	21	14.4	28.2	21.8	68	28.2	21.8	68	0.00	0.32	0.0	0.2	1.20	6.56	1.23	7.79
1999	1	6	16	0	0.50	156	26.25	15.6	92	30.0	1004.9	129	6.8	17	14.0	28.0	22.2	71	28.1	22.2	71	0.00	0.32	0.0	0.1	1.20	6.56	1.23	7.79
1999	1	6	17	0	0.58	156	40.77	15.5	92	30.0	1004.7	132	7.9	21	14.9	28.0	21.7	69	27.9	21.9	70	0.00	0.32	0.0	0.0	1.20	6.56	1.23	7.79
1999	1	6	18	0	0.73	156	55.19	15.4	93	29.9	1005.0	138	7.6	22	14.3	27.9	22.0	71	27.8	22.1	71	0.00	0.32	0.0	0.2	1.25	7.12	1.14	7.53
1999	1	6	19	0	0.79	157	9.69	15.6	95	29.8	1005.2	141	7.2	22	13.9	27.8	21.4	68	27.8	21.5	69	0.00	0.32	0.0	0.1	1.25	7.12	1.14	7.53
1999	1	6	20	0	0.49	157	24.18	15.6	95	29.7	1005.5	151	7.7	28	13.8	27.8	21.8	70	27.7	22.0	71	0.06	0.35	0.0	0.1	1.25	7.12	1.14	7.53
1999	1	6	21	0	0.21	157	38.67	15.5	94	29.5	1006.4	142	7.4	22	14.0	28.1	21.5	67	28.1	21.4	67	0.12	0.32	0.0	0.1	1.18	6.34	1.08	6.74
1999	1	6	22	0	0.19	157	53.36	15.5	92	29.4	1007.5	139	7.6	23	14.3	28.4	21.2	65	28.6	21.5	66	0.56	0.32	0.0	0.2	1.18	6.34	1.08	6.74
1999	1	6	23	0	1.35	158	7.90	15.4	90	29.4	1007.0	148	8.1	29	14.0	28.5	21.4	65	28.6	21.7	66	0.62	0.32	0.0	0.1	1.18	6.34	1.08	6.74
1999	1	7	0	0	0.52	158	21.22	9.7	95	29.4	1007.0	134	6.6	21	12.1	28.7	21.5	65	28.9	21.5	65	0.91	0.32	0.0	0.0	1.07	6.65	0.91	5.36
1999	1	7	1	0	0.38	158	35.27	15.4	92	29.4	1006.4	140	5.8	21	12.5	28.9	21.5	64	29.1	21.6	64	0.97	0.32	0.0	0.1	1.07	6.65	0.91	5.36
1999	1	7	2	0	0.61	158	50.09	15.4	93	29.5	1005.4	141	6.0	21	12.7	28.9	22.2	67	29.0	22.3	67	0.92	0.32	0.0	0.0	1.07	6.65	0.91	5.36
1999	1	7	3	0	0.38	159	4.79	15.2	95	29.5	1004.8	148	5.6	22	12.0	29.1	21.1	62	29.0	21.2	63	0.88	0.32	0.0	6.4	1.10	6.55	0.98	5.68
1999	1	7	4	0	0.25	159	19.41	15.2	90	29.6	1004.4	139	5.8	21	12.4	28.8	21.7	66	28.8	21.7	66	0.79	0.32	0.0	0.2	1.10	6.55	0.98	5.68
1999	1	7	5	0	0.35	159	34.18	15.2	92	29.6	1004.5	129	5.4	15	12.6	28.7	22.0	67	28.9	22.0	66	0.66	0.34	0.0	0.0	1.10	6.55	0.98	5.68
1999	1	7	6	0	0.49	159	48.99	15.3	92	29.4	1005.1	117	5.1	10	12.6	28.6	22.1	68	28.5	22.0	68	0.37	0.34	0.0	0.0	1.10	6.01	1.02	5.90
1999	1	7	7	0	0.18	160	0.01	0.7	100	29.3	1005.8	117	5.2	17	5.4	28.3	21.6	67	28.2	21.7	68	0.06	0.31	0.0	0.1	1.10	6.01	1.02	5.90
1999	1	7	8	0	0.22	159	59.72	0.5	131	29.3	1006.4	122	6.4	353	6.7	27.9	21.9	70	27.8	22.0	71	0.00	0.32	0.0	0.2	1.10	6.01	1.02	5.90
1999	1	7	9	0	0.43	159	59.73	0.7	110	29.2	1007.5	117	5.5	7	5.9	27.8	22.1	71	27.7	22.1	71	0.00	0.32	0.0	0.2	1.27	8.27	1.15	8.25
1999	1	7	10	0	0.80	159	59.62	0.7	110	29.2	1007.9	125	4.5	14	4.9	27.8	22.4	73	27.6	22.4	73	0.00	0.32	0.0	0.0	1.27	8.27	1.15	8.25
1999	1	7	11	0	1.00	159	59.65	0.5	114	29.2	1008.0	143	5.6	26	5.9	27.6	22.4	73	27.5	22.4	74	0.00	0.32	0.0	0.1	1.27	8.27	1.15	8.25
1999	1	7	12	0	1.14	159	59.81	0.3	114	29.2	1007.8	136	6.4	20	6.6	27.6	22.6	75	27.4	22.5	75	0.00	0.33	0.0	0.1	1.21	7.73	1.16	7.19
1999	1	7	13	0	1.38	159	59.85	0.4	115	29.2	1007.8	138	7.5	23	7.6	27.6	22.6	75	27.3	22.6	76	0.00	0.32	0.0	0.2	1.21	7.73	1.16	7.19
1999	1	7	14	0	1.72	159	59.79	1.1	107	29.2	1007.0	143	6.2	38	6.5	27.5	22.7	75	27.3	22.7	76	0.00	0.32	0.0	0.1	1.21	7.73	1.16	7.19
1999	1	7	15	0	2.26	159	59.60	0.5	120	29.2	1006.3	155	6.2	39	6.4	27.4	22.7	76	27.3	22.8	76	0.00	0.32	0.0	0.1	1.18	7.70	1.06	7.86
1999	1	7	16	0	2.81	159	59.45	0.6	113	29.1	1006.1	147	6.3	32	6.5	27.5	22.6	75	27.3	22.6	75	0.00	0.33	0.0	0.2	1.18	7.70	1.06	7.86
1999	1	7	17	0	3.31	159	59.44	0.7	113	29.1	1006.1	141	6.7	27	6.9	27.5	22.8	75	27.4	22.8	76	0.00	0.33	0.0	0.0	1.18	7.70	1.06	7.86
1999	1	7	18	0	3.91	159	59.43	0.4	112	29.1	1006.4	142	7.2	28	7.4	27.5	22.8	76	27.3	22.9	77	0.00	0.35	0.0	0.1	1.20	7.58	1.05	7.04
1999	1	7	19	0	4.31	159	59.27	1.1	222	29.1	1006.8	127	7.9	358	8.1	27.6	22.8	75	27.3	22.8	76	0.00	0.32	0.0	0.1	1.20	7.58	1.05	7.04
1999	1	7	20	0	3.48	159	57.88	1.5	181	29.1	1007.5	135	7.6	321	8.5	27.6	23.3	78	27.6	23.2	77	0.09	0.34	0.0	0.0	1.20	7.58	1.05	7.04
1999	1	7	21	0	2.65	159	56.73	1.0	156	29.1	1008.0	135	7.6	314	8.1	28.1	23.2	75	28.1	23.4	76	0.30	0.33	0.0	0.1	1.17	7.39	1.31	7.65
1999	1	7	22	0	3.46	159	57.63	2.5	120	29.1	1009.0	135	8.0	13	9.2	28.5	23.2	73	28.6	23.3	73	0.60	0.35	0.0	0.2	1.17	7.39	1.31	7.65
1999	1	7	23	0	4.09	159	57.72	0.9	130	29.1	1008.7	138	7.6	37	7.9	28.9	23.8	74	28.9	23.9	74	0.54	0.34	0.0	0.1	1.17	7.39	1.31	7.65
1999	1	8	0	0	4.26	159	57.82	0.9	99	29.2	1008.4	128	7.9	19	8.6	28.8	23.2	72	29.3	23.1	69	0.90	0.33	0.0	0.1	1.18	6.70	1.25	7.14
1999	1	8	1	0	4.84	159	58.13	0.8	100	29.2	1008.3	114	7.2	14	7.6	29.4	22.7	67	29.7	22.6	66	0.92	0.33	0.0	0.0	1.18	6.70	1.25	7.14
1999	1	8	2	0	3.39	159	58.02	2.8	159	29.2	1007.6	106	6.0	316	6.9	29.9	23.0	67	29.2	23.1	70	0.90	0.33	0.0	0.1	1.18	6.70	1.25	7.14
1999	1	8	3	0	3.29	159	57.92	0.9	111	29.3	1006.9	109	5.1	7	5.6	30.1	23.3	67	29.6	23.3	69	0.98	0.35	0.0	0.1	1.45	7.51	1.18	7.40
1999	1	8	4	0	3.00	159	58.36	2.1	107	29.3	1006.3	90	6.4	345	7.4	29.2	23.5	72	28.4	23.5	75	0.70	0.35	0.0	0.3	1.45	7.51	1.18	7.40
1999	1	8	5	0	2.95	159	58.31	1.0	100	29.3	1006.2	82	6.6	342	7.1	29.1	22.7	69	28.4	22.9	72	0.43	0.34	0.0	0.1	1.45	7.51	1.18	7.40
1999	1	8	6	0	2.86	159	58.14	1.4	129	29.2	1006.6	78	7.2	330	7.6	28.4	23.3	74	28.1	23.2	75	0.16	0.35	0.0	0.0	1.46	7.30	1.30	7.93
1999	1	8	7	0	3.22	159	56.53	1.1	60	29.2	1007.2	80	8.4	21	8.9	28.0	23.2	75	27.8	23.0	75	0.04	0.34	0.0	0.1	1.46	7.30	1.30	7.93
1999	1	8	8	0	3.99	159	56.17	0.4	80	29.1	1008.1	80	8.2	0	8.6	28.0	22.1	71	27.8	22.2	72	0.00	0.33	0.0	0.1	1.46	7.30	1.30	7.93
1999	1	8	9	0	3.97	160	4.51	15.3	95	29.1	1008.4	82	7.6	353	15.3	27.9	21.5	68	27.7	21.5	69	0.00	0.32	0.0	0.0	1.38	5.82	1.19	6.44
1999	1	8	10	0	2.99	160	18.84	15.4	94	29.0	1009.3	81	6.6	353	14.4	27.6	22.1	72	27.5	22.1	73	0.00	0.32	0.0	0.0	1.38	5.82	1.19	6.44
1999	1	8	11	0	2.01	160	33.35	15.4	95	28.8	1009.5	85	7.3	355	15.1	27.5	22.1	72	27.4	22.1	73	0.00	0.31	0.0	0.1	1.38	5.82	1.19	6.44

1999	1	8	12	0	0.60	160	47.02	10.2	95	28.5	1009.8	84	6.5	353	12.0	27.4	21.4	70	27.3	21.5	70	0.00	0.32	0.0	0.2	1.33	5.67	1.22	5.79
1999	1	8	13	0	0.56	161	0.42	15.2	90	28.5	1009.8	88	5.5	0	13.3	27.2	21.7	72	27.1	21.7	73	0.00	0.31	0.0	0.0	1.33	5.67	1.22	5.79
1999	1	8	14	0	0.67	161	14.67	15.4	89	28.5	1009.3	76	4.9	355	12.7	27.0	21.8	73	27.0	21.9	74	0.00	0.31	0.0	0.1	1.33	5.67	1.22	5.79
1999	1	8	15	0	0.54	161	29.18	15.5	92	28.4	1008.2	74	5.9	352	13.6	26.9	21.9	74	26.8	21.9	75	0.00	0.31	0.0	0.0	1.44	6.49	1.26	7.11
1999	1	8	16	0	0.15	161	43.63	15.2	90	28.4	1007.8	71	7.1	351	14.8	26.8	21.4	72	26.6	21.4	73	0.00	0.31	0.0	0.1	1.44	6.49	1.26	7.11
1999	1	8	17	0	0.20	161	58.18	15.2	89	28.4	1008.0	61	7.1	346	14.5	26.8	21.1	71	26.6	21.2	72	0.00	0.31	0.0	0.1	1.44	6.49	1.26	7.11
1999	1	8	18	0	0.27	162	12.82	15.4	90	28.4	1008.4	63	6.8	348	14.3	26.7	20.1	67	26.6	20.2	68	0.00	0.30	0.0	0.1	1.42	7.47	1.22	6.66
1999	1	8	19	0	0.39	162	27.48	15.4	91	28.3	1009.0	73	6.1	352	13.8	26.4	20.5	70	26.3	20.7	71	0.00	0.30	0.0	0.0	1.42	7.47	1.22	6.66
1999	1	8	20	0	0.19	162	42.01	15.5	91	28.3	1009.4	61	6.6	346	14.0	26.6	20.6	70	26.5	20.6	70	0.15	0.32	0.4	0.0	1.42	7.47	1.22	6.66
1999	1	8	21	0	0.00	162	56.52	15.3	90	28.3	1009.9	64	7.3	347	14.8	27.1	20.0	65	26.9	20.0	66	0.39	0.32	0.0	0.0	1.30	6.59	1.18	7.43
1999	1	8	22	0	0.12	163	10.88	15.4	90	28.7	1010.3	50	6.5	342	13.5	27.8	19.2	59	27.6	19.2	60	0.63	0.31	0.0	0.2	1.30	6.59	1.18	7.43
1999	1	8	23	0	0.25	163	24.89	15.4	92	28.7	1010.3	50	5.2	343	12.3	28.1	19.4	59	27.9	19.5	60	0.84	0.32	0.0	0.0	1.30	6.59	1.18	7.43
1999	1	9	0	0	0.00	163	36.14	1.0	110	28.8	1009.7	36	6.0	307	7.3	27.8	20.1	63	28.4	20.3	61	0.95	0.32	0.0	0.1	1.50	9.54	1.40	8.48
1999	1	9	1	0	0.12	163	35.96	1.3	90	28.9	1009.2	51	4.4	325	4.9	29.3	19.5	56	28.1	19.4	60	0.98	0.31	0.0	0.0	1.50	9.54	1.40	8.48
1999	1	9	2	0	0.27	163	35.40	0.6	90	29.0	1008.1	56	4.4	330	4.8	29.3	19.9	57	28.1	19.8	61	0.94	0.31	0.0	0.0	1.50	9.54	1.40	8.48
1999	1	9	3	0	0.33	163	45.45	15.4	94	29.1	1007.1	51	3.1	349	10.4	28.8	19.5	57	28.0	19.6	60	0.85	0.31	0.0	0.0	1.45	9.04	1.45	9.38
1999	1	9	4	-1	99.95	163	59.66	15.5	91	29.2	1007.0	75	2.9	356	10.7	28.9	19.5	57	28.0	19.6	60	0.70	0.31	0.0	0.0	1.45	9.04	1.45	9.38
1999	1	9	5	0	0.13	164	13.98	15.4	91	29.3	1007.1	91	2.2	0	10.1	28.6	20.1	60	27.9	20.2	63	0.50	0.32	0.0	0.0	1.45	9.04	1.45	9.38
1999	1	9	6	0	0.59	164	28.42	15.3	91	29.4	1007.5	90	2.6	0	10.5	28.3	20.0	61	27.7	20.0	63	0.26	0.31	0.0	0.0	1.68	10.44	1.76	11.20
1999	1	9	7	0	0.98	164	43.18	15.5	94	29.2	1008.0	84	4.0	357	11.9	27.6	19.9	63	27.3	20.0	65	0.03	0.31	0.0	0.0	1.68	10.44	1.76	11.20
1999	1	9	8	-1	99.95	164	57.94	15.1	90	29.0	1008.8	75	4.6	352	12.3	27.3	19.9	64	27.2	20.0	65	0.00	0.31	0.0	0.1	1.68	10.44	1.76	11.20
1999	1	9	9	0	0.69	165	12.97	15.5	90	28.9	1009.5	92	4.7	0	12.6	27.2	20.3	66	27.0	20.4	67	0.00	0.31	0.0	0.2	1.42	9.26	1.25	8.00
1999	1	9	10	0	0.10	165	28.16	15.4	92	28.8	1010.2	82	5.4	355	13.2	27.2	19.9	65	27.1	20.0	65	0.00	0.32	0.0	0.1	1.42	9.26	1.25	8.00
1999	1	9	11	0	0.17	165	43.36	15.7	91	28.6	1010.4	100	4.7	3	12.6	27.0	20.0	66	26.9	20.1	66	0.00	0.32	0.0	0.0	1.42	9.26	1.25	8.00
1999	1	9	12	0	0.01	165	58.13	9.8	92	28.5	1010.1	149	3.1	19	8.3	26.9	20.3	67	26.7	20.2	68	0.00	0.33	0.0	0.1	1.34	7.93	1.25	7.40
1999	1	9	13	0	0.01	166	12.95	15.6	90	28.4	1009.8	122	4.9	12	12.4	27.0	20.2	67	26.8	20.1	67	0.00	0.33	0.0	0.0	1.34	7.93	1.25	7.40
1999	1	9	14	0	0.14	166	28.29	15.6	90	28.4	1009.0	128	5.0	14	12.4	26.7	20.9	70	26.6	20.8	71	0.00	0.32	0.0	0.2	1.34	7.93	1.25	7.40
1999	1	9	15	0	0.10	166	43.55	15.6	90	28.4	1008.4	138	5.1	18	12.0	26.4	20.5	70	26.4	20.5	70	0.00	0.32	0.0	0.0	1.13	7.93	1.09	8.19
1999	1	9	16	-1	99.99	166	58.95	15.7	92	28.3	1008.0	150	5.0	21	11.5	26.4	20.2	69	26.3	20.2	69	0.00	0.32	0.0	0.1	1.13	7.93	1.09	8.19
1999	1	9	17	0	0.07	167	14.33	15.7	91	28.3	1008.0	163	4.7	25	10.6	26.4	20.7	71	26.3	20.8	72	0.00	0.34	0.0	0.0	1.13	7.93	1.09	8.19
1999	1	9	18	-1	99.82	167	29.60	15.7	90	28.3	1008.2	160	5.2	27	11.0	26.4	20.8	71	26.3	20.9	72	0.00	0.33	0.0	0.0	1.23	9.77	1.08	9.42
1999	1	9	19	-1	99.92	167	44.87	15.7	90	28.2	1008.3	173	5.5	32	10.3	26.3	21.0	72	26.2	21.0	73	0.01	0.33	0.0	0.0	1.23	9.77	1.08	9.42
1999	1	9	20	0	0.03	168	0.07	15.8	90	28.1	1008.9	167	5.1	28	10.5	26.5	21.2	73	26.4	21.2	73	0.09	0.34	0.0	0.0	1.23	9.77	1.08	9.42
1999	1	9	21	0	0.16	168	15.19	15.8	91	28.0	1009.5	176	5.0	30	9.8	26.8	21.7	73	26.7	21.8	74	0.37	0.35	0.0	0.0	1.41	11.04	1.04	9.85
1999	1	9	22	0	0.85	168	30.42	15.7	89	27.9	1010.0	173	4.6	28	9.8	27.1	21.8	73	27.1	21.9	73	0.45	0.36	0.0	0.0	1.41	11.04	1.04	9.85
1999	1	9	23	0	1.25	168	45.62	15.8	92	27.7	1010.0	170	4.2	24	9.8	27.0	22.0	74	27.0	22.0	74	0.25	0.36	0.0	0.0	1.41	11.04	1.04	9.85
1999	1	10	0	-1	99.69	168	55.92	0.9	120	27.8	1009.7	159	4.7	43	6.1	27.8	22.5	73	27.8	22.6	74	0.43	0.33	0.0	0.2	1.12	9.64	1.14	10.51
1999	1	10	1	-1	99.31	168	56.08	1.4	120	27.8	1009.2	107	5.8	348	6.4	26.4	22.5	79	26.3	22.5	80	0.14	0.35	0.2	0.1	1.12	9.64	1.14	10.51
1999	1	10	2	-1	99.19	169	2.31	15.7	87	27.8	1008.5	124	5.3	14	12.7	27.1	22.6	77	27.1	22.5	76	0.39	0.34	0.1	0.2	1.12	9.64	1.14	10.51
1999	1	10	3	-1	99.98	169	17.11	15.5	90	27.8	1008.1	112	6.9	11	14.5	27.1	22.0	74	27.2	22.0	73	0.47	0.36	0.0	0.0	1.07	8.26	0.98	6.97
1999	1	10	4	0	0.31	169	31.64	15.5	90	27.6	1008.0	125	6.7	16	13.9	27.0	22.0	74	27.2	21.9	73	0.72	0.35	0.0	0.0	1.07	8.26	0.98	6.97
1999	1	10	5	0	0.53	169	45.99	15.2	91	27.6	1008.3	124	6.5	15	13.8	26.6	22.0	76	26.6	21.9	76	0.16	0.36	0.0	0.1	1.07	8.26	0.98	6.97
1999	1	10	6	0	0.76	170	0.09	15.5	93	27.5	1009.3	116	6.7	11	14.3	26.4	21.5	75	26.2	21.4	75	0.07	0.31	0.0	6.8	1.22	7.60	1.02	6.30
1999	1	10	7	0	0.54	170	14.26	15.3	92	27.5	1009.8	125	7.4	16	14.7	26.1	20.5	71	25.9	20.5	72	0.00	0.31	0.0	0.1	1.22	7.60	1.02	6.30
1999	1	10	8	0	0.63	170	28.39	15.4	92	27.5	1010.4	121	6.2	13	13.6	26.1	20.4	71	25.9	20.4	72	0.00	0.31	0.0	0.0	1.22	7.60	1.02	6.30
1999	1	10	9	0	0.81	170	42.66	15.5	93	27.5	1011.1	125	6.2	14	13.6	26.1	20.9	73	26.0	20.8	73	0.00	0.33	0.0	0.1	1.29	8.39	1.14	7.99
1999	1	10	10	0	1.05	170	57.07	15.4	92	27.4	1011.3	121	7.2	14	14.7	26.0	20.4	71	25.9	20.3	72	0.00	0.31	0.0	0.0	1.29	8.39	1.14	7.99
1999	1	10	11	0	0.62	171	10.82	9.4	96	27.3	1011.1	122	6.7	14	12.1	26.0	20.2	70	26.0	20.1	70	0.00	0.30	0.0	0.1	1.29	8.39	1.14	7.99
1999	1	10	12	0	0.22	171	24.54	15.5	92	27.2	1010.5	112	6.0	8	13.8	25.8	20.0	70	25.6	19.9	71	0.00	0.30	0.0	0.1	1.24	8.38	1.03	7.11
1999	1	10	13	0	0.43	171	38.93	15.7	92	27.2	1009.9	112	5.4	8	13.2	25.7	19.8	70	25.6	19.8	70	0.00	0.30	0.0	0.2	1.24	8.38	1.03	7.11
1999	1	10	14	0	0.47	171	52.94	15.6	92	27.2	1009.4	114	5.4	9	13.2	25.5	19.4	69	25.4	19.3	69	0.00	0.30	0.0	0.0	1.24	8.38	1.03	7.11
1999	1	10	15	0	0.19	172	6.63	15.6	92	27.3	1008.9	135	5.8	17	12.9	25.4	19.4	70	25.2	19.4	70	0.00	0.30	0.0	0.0	1.07	8.26	0.94	6.75
1999	1	10	16	0	0.01	172	20.16	15.7	90	27.4	1008.8	135	5.8	19	12.8	25.6	18.5	65	25.4	18.5	66	0.00	0.30	0.0	0.0	1.07	8.26	0.94	6.75
1999	1	10	17	0	0.27	172	33.67	15.6	92	27.4	1008.8	138	6.2	21	13.1	25.4	19.4	69	25.3	19.5	70	0.00	0.30	0.0	0.0	1.07	8.26	0.94	6.75
1999	1	10	18	0	0.03	172	47.12	15.6	93	27.4	1009.2	134	6.3	18	13.4	25.5	19.2	68	25.4	19.2	69	0.00	0.31	0.0	0.0	1.07	7.61	0.96	7.33
1999	1	10	19	0	0.10	173	0.62	15.6	91	27.4	1009.8	142	6.1	21	12.8	25.6	19.7	70	25.5	19.7	70	0.08	0.31	0.0	0.0	1.07	7.61	0.96	7.33
1999	1	10	20	0	0.02	173	14.27	15.7	92	27.5	1010.6	109	6.4	8	14.3	26.0	19.8	69	25.9	19.7	69	0.32	0.31	0.0	0.0	1.07	7.61	0.96	7.33
1999	1	10	21	0	0.43	173	27.88	15.4	88	27.5	1011.1	113	6.2	11	13.9	26.4	20.2	69	26.4	20.1	68	0.36	0.30	0.0	7.0	0.94	6.23	0.75	5.38
1999	1	10	22	0	0.39	173	41.56	15.6	90	27.5	1011.4	109	5.5	8	13.3	26.8	20.2	67	26.9	20.2	67	0.78	0.31	0.0	0.1	0.94	6.23	0.75	5.38
1999	1	10	23	0	0.78	173	55.13	10.0	91	27.6	1010.8	112	4.4	8	11.1	27.0	20.3	67	27.1	20.3	66	0.93	0.31	0.0	0.0	0.94	6.23	0.75	5.38
1999	1	11	0	0	0.14	174	7.76	15.6	90	27.7	1010.3	121	4.4	11	11.9	26.9	20.7	69	27.0	20.7	68	0.99	0.31	0.0	0.1	1.42	9.60	1.16	8.38
1999	1	11	1	0	0.28	174	21.90	15.4	93	27.7	1009.4	132	4.5	14	11.8	27.0	20.7	69	27.3	20.6	67	0.97	0.32	0.0	7.1	1.42	9.60	1.16	8.38
1999	1	11	2	0	0.04	174	36.04	15.4	94	27.8	1008.7	123	4.6	11	12.1	27.3	20.7	67	27.3	20.6	67	0.88	0.31	0.0	0.0	1.42	9.60	1.16	8.38
1999	1	11	3	-1	99.96	174	50.10	15.5	94	27.7	1008.5	105	4.8	5	12.6	27.3	21.0	69	26.8	21.0	70	0.73	0.31	0.0	0.0	1.71	11.61	1.36	9.65
1999	1	11	4	0	0.07	174	59.59	0.6	90	27.2	1008.3	103	5.0	12	5.5	27.1	21.5	72	26.8	21.3	72	0.57	0.32	0.0	0.2	1.71	11.61	1.36	9.65
1999	1	11	5	0	0.11	174	58.77	0.8	110	27.3	1009.0	102	4.8	353	5.2	27.6	21.5	69	26.4	21.4	74	0.34	0.32	0.0	0.1	1.71	11.61	1.36	9.65
1999	1	11	6	0	0.94	174	58.15	1.5	51	27.0	1009.9	94	5.6	40	6.1	26.2	21.0	73	26.0	21.2	75	0.05	0.33	0.0	0.1	1.70	11.10	1.41	11.97

1999	1	11	7	0	1.66	174	57.58	2.0	90	27.0	1010.5	97	6.1	7	7.1	25.8	20.9	75	25.4	20.9	76	0.00	0.32	0.0	0.1	1.70	11.10	1.41	11.97
1999	1	11	8	0	1.76	174	57.93	1.9	90	26.9	1011.0	90	6.8	0	7.7	25.7	20.7	74	25.4	20.7	75	0.00	0.32	0.0	0.1	1.70	11.10	1.41	11.97
1999	1	11	9	0	1.84	174	58.27	1.7	90	26.9	1011.5	90	7.4	0	8.4	25.6	20.8	75	25.3	20.7	76	0.00	0.31	0.0	0.0	1.64	11.44	1.44	12.04
1999	1	11	10	0	1.96	174	58.33	1.7	90	26.9	1011.9	90	6.7	0	7.6	25.4	20.9	76	25.2	20.9	77	0.00	0.32	0.0	0.0	1.64	11.44	1.44	12.04
1999	1	11	11	0	1.94	174	58.69	1.7	90	26.8	1012.0	93	6.6	3	7.5	25.3	20.9	76	25.1	20.9	78	0.00	0.32	0.0	0.0	1.64	11.44	1.44	12.04
1999	1	11	12	0	1.98	174	58.74	1.1	91	26.8	1011.9	94	6.4	4	7.2	25.2	21.1	78	25.0	21.0	79	0.00	0.33	0.0	0.0	1.95	12.05	1.64	11.80
1999	1	11	13	0	2.31	174	57.27	0.2	79	26.8	1010.9	89	6.0	5	6.3	25.2	21.2	79	24.9	21.1	80	0.00	0.32	0.0	0.1	1.95	12.05	1.64	11.80
1999	1	11	14	0	2.65	174	56.09	0.6	91	26.8	1010.4	91	5.8	1	6.0	25.1	20.7	77	24.8	20.7	78	0.00	0.31	0.0	0.0	1.95	12.05	1.64	11.80
1999	1	11	15	0	3.01	174	55.07	0.8	80	26.8	1009.9	80	5.8	0	6.1	25.0	20.7	77	24.7	20.7	79	0.00	0.31	0.0	0.0	1.88	11.81	1.63	11.49
1999	1	11	16	0	3.24	174	54.75	1.8	99	26.8	1009.4	80	4.5	346	5.3	24.7	20.9	79	24.6	20.9	80	0.00	0.31	0.0	0.0	1.88	11.81	1.63	11.49
1999	1	11	17	0	2.78	174	55.13	2.2	100	26.7	1009.5	80	4.8	343	5.7	24.7	20.8	79	24.5	20.8	80	0.00	0.31	0.0	0.1	1.88	11.81	1.63	11.49
1999	1	11	18	0	2.36	174	55.54	1.7	99	26.7	1009.9	74	5.1	338	5.9	24.7	20.8	79	24.6	20.9	80	0.00	0.31	0.0	0.2	1.73	10.10	1.57	10.97
1999	1	11	19	0	2.36	174	56.11	2.8	90	26.7	1010.0	83	4.9	354	6.4	24.9	20.9	78	24.7	20.8	79	0.09	0.32	0.0	0.1	1.73	10.10	1.57	10.97
1999	1	11	20	0	2.30	174	56.40	1.1	100	26.7	1010.5	73	5.8	337	6.3	25.7	21.1	76	25.4	21.3	78	0.33	0.33	0.0	6.9	1.73	10.10	1.57	10.97
1999	1	11	21	0	2.68	174	55.76	1.4	26	26.7	1010.6	71	5.9	76	6.1	26.1	21.3	75	25.5	21.1	77	0.39	0.33	0.0	0.0	1.70	10.51	1.51	11.21
1999	1	11	22	0	3.56	174	54.82	1.3	91	26.7	1010.9	68	5.3	13	5.9	26.4	21.3	73	25.8	21.5	77	0.81	0.32	0.0	0.1	1.70	10.51	1.51	11.21
1999	1	11	23	0	3.71	174	54.65	2.4	75	26.8	1010.3	73	4.8	358	5.6	27.4	21.0	68	26.4	21.1	73	0.94	0.32	0.0	0.0	1.70	10.51	1.51	11.21
1999	1	12	0	0	3.83	174	54.66	1.2	90	26.9	1010.5	77	5.3	342	5.9	27.4	20.8	67	26.3	20.7	71	0.38	0.31	0.0	0.1	1.56	10.46	1.53	10.86
1999	1	12	1	0	3.65	174	54.73	1.3	90	26.9	1009.9	85	4.7	355	5.3	28.0	20.7	65	26.8	20.7	69	0.97	0.32	0.0	0.0	1.56	10.46	1.53	10.86
1999	1	12	2	0	3.48	174	54.82	1.4	90	27.1	1009.2	93	4.4	2	5.1	28.0	20.7	65	27.0	20.5	68	0.96	0.34	0.0	0.0	1.56	10.46	1.53	10.86
1999	1	12	3	0	3.41	174	54.92	1.2	85	27.1	1009.0	90	4.4	5	5.1	27.7	20.8	66	27.1	20.7	68	0.72	0.32	0.0	0.1	1.59	10.68	1.41	10.83
1999	1	12	4	0	3.25	174	54.94	1.1	85	27.2	1008.9	77	5.2	352	5.8	27.1	20.6	68	26.3	20.6	71	0.21	0.31	0.0	0.1	1.59	10.68	1.41	10.83
1999	1	12	5	0	3.11	174	54.99	1.4	84	27.1	1008.8	90	5.2	4	5.9	27.0	20.7	68	26.4	20.6	70	0.33	0.32	0.0	0.2	1.59	10.68	1.41	10.83
1999	1	12	6	0	2.97	174	57.58	11.1	88	27.0	1010.0	85	5.2	356	10.2	26.1	20.3	70	25.7	20.3	72	0.08	0.32	0.0	0.0	1.50	10.39	1.15	8.98
1999	1	12	7	0	1.44	175	11.37	15.6	95	26.8	1010.9	101	4.0	2	11.9	25.5	20.3	73	25.2	20.3	74	0.00	0.31	0.0	0.1	1.50	10.39	1.15	8.98
1999	1	12	8	0	0.07	175	25.71	15.5	90	26.6	1011.4	94	3.8	1	11.8	25.3	20.6	76	25.0	20.6	77	0.00	0.31	0.0	0.1	1.50	10.39	1.15	8.98
1999	1	12	9	0	0.00	175	40.36	15.4	88	26.6	1012.2	86	4.9	359	12.8	25.3	20.7	76	25.1	20.7	77	0.00	0.31	0.0	0.0	1.34	8.69	1.19	8.63
1999	1	12	10	0	0.06	175	55.08	15.4	90	26.5	1011.9	88	4.3	0	12.2	25.1	21.5	81	24.9	21.6	82	0.00	0.31	0.0	0.0	1.34	8.69	1.19	8.63
1999	1	12	11	0	0.00	176	8.95	9.4	89	26.4	1011.8	83	4.4	357	9.4	25.1	21.5	80	24.9	21.3	81	0.00	0.31	0.0	0.1	1.34	8.69	1.19	8.63
1999	1	12	12	0	0.20	176	22.48	15.4	89	26.3	1011.3	97	4.3	3	12.2	24.9	21.6	82	24.7	21.7	84	0.00	0.31	0.0	0.1	1.54	9.30	1.41	8.88
1999	1	12	13	0	0.22	176	37.14	15.4	92	26.2	1010.5	110	4.5	7	12.3	24.7	22.2	86	24.6	22.3	87	0.00	0.36	0.0	0.1	1.54	9.30	1.41	8.88
1999	1	12	14	-1	99.83	176	50.98	15.0	92	26.0	1010.0	110	5.0	8	12.6	24.7	22.1	86	24.6	22.2	87	0.00	0.31	0.0	0.0	1.54	9.30	1.41	8.88
1999	1	12	15	0	0.36	177	4.38	15.3	89	26.0	1009.2	110	6.9	10	14.5	24.6	21.8	84	24.4	21.8	86	0.00	0.31	0.0	0.0	1.49	9.81	1.44	10.73
1999	1	12	16	0	0.44	177	17.78	15.4	94	25.9	1009.2	101	6.6	4	14.5	24.5	21.7	84	24.4	21.7	85	0.00	0.31	0.0	0.0	1.49	9.81	1.44	10.73
1999	1	12	17	0	0.29	177	31.08	15.4	90	25.9	1009.7	109	6.2	9	14.0	24.6	21.6	84	24.4	21.6	85	0.00	0.31	0.0	0.0	1.49	9.81	1.44	10.73
1999	1	12	18	0	0.36	177	44.42	15.5	93	25.9	1010.3	111	5.7	7	13.5	24.7	21.7	83	24.6	21.7	84	0.00	0.31	0.0	0.0	1.40	9.82	1.26	8.95
1999	1	12	19	0	0.12	177	57.90	15.5	91	25.9	1010.4	106	5.0	6	12.9	24.8	21.9	84	24.6	21.8	84	0.14	0.32	0.0	0.0	1.40	9.82	1.26	8.95
1999	1	12	20	-1	99.95	178	11.38	15.6	91	25.9	1011.1	111	6.3	9	14.1	25.4	22.1	82	25.2	21.9	82	0.33	0.34	0.0	0.0	1.40	9.82	1.26	8.95
1999	1	12	21	-1	99.74	178	24.51	15.4	88	26.2	1011.8	118	6.6	13	14.0	25.8	22.0	80	25.7	22.0	80	0.60	0.33	0.0	0.1	1.21	8.10	1.02	7.68
1999	1	12	22	0	0.03	178	37.46	15.6	87	26.2	1011.5	122	6.4	16	13.7	25.7	22.1	80	25.9	22.1	80	0.99	0.36	0.0	0.0	1.21	8.10	1.02	7.68
1999	1	12	23	-1	99.97	178	47.81	1.3	80	26.3	1010.8	96	6.2	11	8.6	26.6	22.0	76	26.6	21.9	75	0.95	0.33	0.0	0.0	1.21	8.10	1.02	7.68
1999	1	13	0	-1	99.86	178	46.50	1.3	80	26.4	1010.2	103	6.4	22	7.0	26.7	21.8	75	26.8	21.9	75	0.66	0.36	0.0	0.1	1.23	8.72	1.10	9.00
1999	1	13	1	-1	99.91	178	53.16	15.4	90	26.5	1009.7	111	6.2	11	13.7	26.7	21.7	74	26.8	21.6	73	0.92	0.33	0.0	0.0	1.23	8.72	1.10	9.00
1999	1	13	2	-1	99.78	179	6.24	15.4	88	26.6	1008.8	104	5.9	7	13.6	26.8	21.3	72	26.8	21.1	71	0.81	0.32	0.0	0.0	1.23	8.72	1.10	9.00
1999	1	13	3	-1	99.82	179	19.58	15.1	88	26.6	1008.3	105	5.8	7	13.5	26.8	21.3	72	26.6	21.2	72	0.67	0.32	0.0	7.4	1.31	7.02	1.12	6.79
1999	1	13	4	-1	99.85	179	32.95	15.2	86	26.8	1008.1	103	6.1	8	13.7	26.7	21.1	71	26.5	21.0	72	0.47	0.32	0.0	0.0	1.31	7.02	1.12	6.79
1999	1	13	5	-1	99.91	179	46.42	15.3	86	26.7	1008.5	107	5.7	9	13.3	26.3	21.0	73	26.1	20.9	73	0.28	0.33	0.0	0.3	1.31	7.02	1.12	6.79
1999	1	13	6	0	0.04	179	59.95	15.2	87	26.6	1009.2	95	6.6	4	14.4	25.9	21.1	75	25.5	21.1	76	0.03	0.31	0.0	0.0	1.19	6.42	1.05	7.49
1999	1	13	7	0	0.16	-180	46.34	14.5	90	26.6	1009.8	103	6.6	8	12.4	25.5	21.3	78	25.2	21.2	78	0.00	0.32	0.0	0.2	1.19	6.42	1.05	7.49
1999	1	13	8	-1	99.99	-180	60.01	15.3	86	26.6	1010.7	101	7.0	7	14.7	25.5	21.2	77	25.2	21.2	78	0.00	0.31	0.0	0.1	1.19	6.42	1.05	7.49
1999	1	13	9	0	0.23	-180	73.70	15.3	88	26.5	1011.5	120	7.7	16	15.0	25.5	21.3	78	25.3	21.2	78	0.00	0.33	0.0	0.1	1.26	6.20	1.07	6.58
1999	1	13	10	0	0.16	-180	87.44	15.2	88	26.5	1011.8	118	7.9	15	15.3	25.6	21.5	78	25.3	21.4	79	0.00	0.32	0.0	0.0	1.26	6.20	1.07	6.58
1999	1	13	11	0	0.07	-179	41.03	11.6	88	26.5	1011.6	119	7.5	16	14.5	25.5	21.3	78	25.2	21.3	79	0.00	0.32	0.0	0.0	1.26	6.20	1.07	6.58
1999	1	13	12	-1	99.98	-179	53.70	15.2	88	26.5	1011.3	124	7.9	18	14.9	25.2	21.5	80	25.0	21.5	81	0.00	0.32	0.0	0.0	1.27	5.64	1.03	6.42
1999	1	13	13	-1	99.84	-179	67.52	15.3	88	26.4	1010.8	121	7.6	16	14.9	25.0	21.8	83	24.8	21.8	84	0.00	0.35	0.0	0.0	1.27	5.64	1.03	6.42
1999	1	13	14	-1	99.86	-179	81.16	15.4	86	26.4	1010.0	117	7.8	16	15.1	25.0	21.2	80	24.8	21.2	80	0.00	0.34	0.0	0.1	1.27	5.64	1.03	6.42
1999	1	13	15	0	0.03	-179	94.91	15.4	87	26.3	1009.4	112	7.7	12	15.2	24.9	21.2	80	24.7	21.1	80	0.00	0.31	0.0	0.0	1.27	6.93	1.07	7.36
1999	1	13	16	0	0.14	-178	48.79	15.3	86	26.3	1009.5	102	7.8	8	15.6	24.8	21.0	80	24.5	20.9	80	0.00	0.32	0.0	0.0	1.27	6.93	1.07	7.36
1999	1	13	17	0	0.14	-178	62.70	15.5	88	26.3	1010.0	106	7.1	9	14.8	24.8	21.1	80	24.6	21.1	81	0.00	0.35	0.0	0.0	1.27	6.93	1.07	7.36
1999	1	13	18	-1	99.70	-178	76.49	15.4	84	26.3	1010.3	108	7.7	11	15.3	24.8	21.1	80	24.4	21.0	82	0.01	0.32	0.0	0.1	1.15	5.87	1.06	6.51
1999	1	13	19	0	0.02	-178	90.12	15.5	85	26.3	1011.0	104	7.1	9	14.8	25.0	21.3	80	24.7	20.9	79	0.26	0.35	0.0	0.2	1.15	5.87	1.06	6.51
1999	1	13	20	0	0.07	-177	43.63	15.3	87	26.3	1011.4	111	7.1	11	14.6	25.2	21.3	79	25.0	21.3	80	0.43	0.33	0.0	0.0	1.15	5.87	1.06	6.51
1999	1	13	21	-1	99.96	-177	57.56	15.2	86	26.2	1011.7	110	6.7	11	14.3	25.4	21.4	78	25.3	21.3	79	0.69	0.32	0.0	0.1	1.33	6.66	1.27	7.77
1999	1	13	22	0	0.16	-177	71.26	15.4	86	26.2	1011.8	101	6.1	7	13.8	25.7	21.3	77	25.5	21.3	78	0.87	0.33	0.0	0.0	1.33	6.66	1.27	7.77
1999	1	13	23	0	0.11	-177	82.66	2.3	60	26.2	1010.9	85	5.7	4	9.2	26.0	21.6	77	25.7	21.6	78	0.60	0.32	0.0	0.0	1.33	6.66	1.27	7.77
1999	1	14	0	-1	99.79	-177	82.00	1.3	70	26.2	1010.6	90	5.6	19	6.2	26.2	21.7	76	26.3	21.6	75	0.44	0.33	0.0	0.1	1.53	8.35	1.22	8.85
1999	1	14	1	-1	99.67	-177	86.89	15.3	85	26.2	1009.9	95	5.9	5	13.7	26.2	21.7	76	26.0	21.5	76	0.88	0.33	0.0	0.0	1.53	8.35	1.22	8.85

1999	1	14	2	0	0.12	-176	40.55	15.2	86	26.1	1009.2	116	6.6	14	13.9	25.4	21.6	80	25.5	21.5	79	0.38	0.36	0.0	0.0	1.53	8.35	1.22	8.85
1999	1	14	3	-1	99.89	-176	54.43	15.2	89	25.9	1008.8	120	6.9	14	14.2	25.3	21.7	81	25.4	21.7	80	0.37	0.32	0.0	0.0	1.23	6.81	1.13	8.21
1999	1	14	4	0	0.04	-176	68.30	15.2	87	25.7	1008.9	107	7.3	10	14.8	25.2	21.6	80	25.1	21.5	81	0.43	0.34	0.0	0.0	1.23	6.81	1.13	8.21
1999	1	14	5	0	0.35	-176	79.76	14.8	89	25.6	1009.2	91	7.6	1	15.2	25.2	21.2	79	24.6	21.1	81	0.10	0.31	0.0	0.0	1.23	6.81	1.13	8.21
1999	1	14	6	-1	99.98	-176	95.70	15.1	90	25.4	1010.1	97	7.4	4	15.2	24.5	20.8	80	24.2	20.9	82	0.00	0.31	0.0	0.0	1.33	6.81	1.13	6.49
1999	1	14	7	0	0.15	-175	49.44	15.5	89	25.4	1011.1	96	7.3	3	15.1	24.5	21.1	81	24.3	21.0	82	0.00	0.33	0.0	0.1	1.33	6.81	1.13	6.49
1999	1	14	8	0	0.11	-175	63.05	15.1	91	25.3	1012.2	97	6.7	3	14.4	24.5	21.2	82	24.3	21.2	83	0.00	0.31	0.0	0.0	1.33	6.81	1.13	6.49
1999	1	14	9	-1	99.94	-175	76.79	15.2	89	25.3	1012.6	98	6.9	4	14.8	24.3	21.0	82	24.0	21.1	84	0.00	0.32	0.0	0.1	1.34	6.97	1.20	6.53
1999	1	14	10	-1	99.96	-175	89.89	10.7	90	25.2	1012.9	95	6.7	3	12.3	24.2	20.7	81	23.9	20.8	83	0.00	0.31	0.0	0.1	1.34	6.97	1.20	6.53
1999	1	14	11	0	0.02	-174	43.77	15.4	90	25.2	1012.6	95	5.6	3	13.4	24.1	20.9	83	23.8	21.0	84	0.00	0.31	0.0	0.2	1.34	6.97	1.20	6.53
1999	1	14	12	0	0.06	-174	57.93	15.5	90	25.2	1012.2	95	5.3	3	13.2	24.0	20.9	83	23.8	20.9	84	0.00	0.32	0.0	0.1	1.49	7.07	1.25	7.23
1999	1	14	13	0	0.11	-174	72.07	15.3	89	25.2	1011.1	98	5.9	4	13.8	23.7	20.6	83	23.4	20.6	84	0.00	0.30	0.0	0.0	1.49	7.07	1.25	7.23
1999	1	14	14	0	0.30	-174	86.31	15.2	90	25.1	1010.5	89	6.1	0	14.0	23.5	20.7	84	23.3	20.7	86	0.00	0.31	0.0	0.1	1.49	7.07	1.25	7.23
1999	1	14	15	0	0.43	-173	40.78	15.3	91	25.0	1010.1	77	5.9	353	13.6	23.5	20.8	85	23.4	20.8	86	0.00	0.30	0.0	0.0	1.44	6.75	1.29	7.47
1999	1	14	16	0	0.23	-173	55.77	15.2	91	24.9	1010.5	79	6.1	355	14.0	23.5	20.9	85	23.3	20.9	86	0.00	0.31	0.0	0.0	1.44	6.75	1.29	7.47
1999	1	14	17	0	0.18	-173	70.69	15.4	92	24.9	1011.0	91	6.0	0	13.9	23.5	20.9	86	23.2	20.9	87	0.00	0.31	0.0	0.0	1.44	6.75	1.29	7.47
1999	1	14	18	0	0.31	-173	85.71	15.3	91	24.8	1011.4	85	6.4	357	14.3	23.5	21.1	86	23.4	21.1	87	0.04	0.31	0.0	7.4	1.40	6.24	1.33	7.07
1999	1	14	19	0	0.25	-172	40.58	15.5	93	24.9	1012.1	84	5.4	356	13.3	24.0	21.3	85	23.7	21.3	86	0.24	0.32	0.0	0.0	1.40	6.24	1.33	7.07
1999	1	14	20	0	0.11	-172	55.41	15.5	93	25.0	1012.2	98	4.8	2	12.7	24.4	22.0	86	24.1	21.7	87	0.58	0.34	0.0	0.0	1.40	6.24	1.33	7.07
1999	1	14	21	0	0.06	-172	70.40	15.5	92	25.1	1012.1	90	5.4	359	13.3	24.9	21.9	84	24.5	21.9	86	0.78	0.32	0.0	0.0	1.32	7.34	1.17	7.32
1999	1	14	22	-1	99.97	-172	85.05	9.9	93	25.1	1011.6	93	5.0	0	11.9	25.2	22.2	83	24.7	22.2	86	0.72	0.34	0.0	0.1	1.32	7.34	1.17	7.32
1999	1	14	23	-1	99.95	-172	99.23	15.4	91	25.2	1011.0	93	6.1	1	14.1	25.6	22.1	81	24.8	22.1	85	0.71	0.33	0.0	0.1	1.32	7.34	1.17	7.32
1999	1	15	0	0	0.12	-171	53.80	15.5	90	25.3	1010.2	94	5.6	3	13.4	25.7	22.2	81	25.1	22.1	84	0.92	0.33	0.0	0.0	1.34	7.49	1.19	6.88
1999	1	15	1	0	0.19	-171	68.45	15.4	92	25.3	1009.4	97	6.4	2	14.2	25.8	22.1	80	25.1	22.0	83	0.83	0.33	0.0	7.7	1.34	7.49	1.19	6.88
1999	1	15	2	-1	99.48	-171	82.85	15.1	93	25.3	1008.6	102	7.6	4	15.5	25.7	21.9	79	25.2	21.8	81	0.75	0.34	0.0	0.0	1.34	7.49	1.19	6.88
1999	1	15	3	-1	99.96	-171	94.94	0.9	90	25.3	1007.9	106	7.2	13	9.4	25.3	22.0	82	25.3	21.9	82	0.52	0.35	0.0	0.0	1.22	7.24	1.17	7.38
1999	1	15	4	0	0.17	-171	94.96	0.7	84	25.3	1008.3	103	7.6	17	7.9	25.1	21.9	82	25.2	21.9	82	0.34	0.33	0.0	0.0	1.22	7.24	1.17	7.38
1999	1	15	5	0	0.12	-171	95.06	0.8	89	25.2	1009.1	94	8.5	4	9.1	25.1	21.5	81	24.6	21.4	82	0.06	0.33	0.0	0.0	1.22	7.24	1.17	7.38
1999	1	15	6	0	0.29	-171	94.64	1.0	100	25.2	1009.5	91	7.8	352	8.3	24.5	21.8	85	24.3	21.8	86	0.00	0.34	0.0	0.1	1.53	9.08	1.44	9.99
1999	1	15	7	0	0.14	-171	94.73	1.6	90	25.2	1010.4	90	8.5	0	9.3	24.5	21.5	84	24.2	21.5	85	0.00	0.34	0.0	0.0	1.53	9.08	1.44	9.99
1999	1	15	8	0	0.05	-171	95.13	1.6	90	25.2	1011.0	91	7.8	1	8.7	24.4	21.5	84	24.2	21.5	85	0.00	0.34	0.0	0.0	1.53	9.08	1.44	9.99
1999	1	15	9	-1	99.91	-171	95.57	1.8	90	25.2	1011.4	97	7.5	6	8.4	24.3	21.5	84	24.1	21.5	86	0.00	0.33	0.0	0.1	1.49	8.95	1.42	9.43
1999	1	15	10	0	0.01	-171	94.40	1.5	290	25.1	1011.3	94	8.2	169	7.4	24.4	21.9	86	24.2	21.6	86	0.00	0.35	0.0	0.2	1.49	8.95	1.42	9.43
1999	1	15	11	-1	99.46	-171	92.14	1.4	88	25.1	1011.1	95	6.5	317	7.0	24.4	21.8	86	24.2	21.8	86	0.00	0.36	0.0	0.1	1.49	8.95	1.42	9.43
1999	1	15	12	-1	99.78	-171	91.28	0.4	90	25.1	1010.8	116	8.0	25	8.3	24.4	21.9	86	24.3	22.0	87	0.00	0.36	0.0	0.1	1.59	8.69	1.33	8.37
1999	1	15	13	-1	99.80	-171	90.64	1.4	90	25.1	1009.6	119	8.7	28	9.1	24.2	21.8	87	24.1	21.8	87	0.00	0.32	0.0	0.2	1.59	8.69	1.33	8.37
1999	1	15	14	-1	99.87	-171	90.05	0.7	90	25.1	1009.4	130	8.1	39	8.4	24.1	21.7	86	24.0	21.8	88	0.00	0.33	0.0	0.0	1.59	8.69	1.33	8.37
1999	1	15	15	-1	99.21	-171	89.94	1.3	115	25.1	1009.3	116	9.2	1	9.9	24.0	21.6	86	23.9	21.6	87	0.00	0.32	0.0	0.1	1.62	9.09	1.47	9.04
1999	1	15	16	-1	97.97	-171	89.79	1.1	114	25.1	1009.5	111	9.8	356	10.4	24.1	21.3	84	24.0	21.3	85	0.00	0.32	0.0	0.0	1.62	9.09	1.47	9.04
1999	1	15	17	-1	96.82	-171	89.64	1.0	110	25.1	1009.6	109	10.4	0	11.0	24.0	21.3	85	23.8	21.3	86	0.00	0.32	0.0	0.0	1.62	9.09	1.47	9.04
1999	1	15	18	-1	97.42	-171	89.22	0.9	79	25.1	1010.1	109	10.9	30	11.3	24.2	21.4	84	24.0	21.3	85	0.09	0.32	0.0	0.2	1.65	7.78	1.43	9.73
1999	1	15	19	-1	97.79	-171	89.77	0.6	89	25.1	1011.0	110	9.7	19	10.2	24.7	21.7	83	24.6	21.3	82	0.29	0.32	0.0	0.0	1.65	7.78	1.43	9.73
1999	1	15	20	-1	97.72	-171	90.34	1.1	105	25.1	1011.6	109	10.0	11	10.8	25.1	21.4	80	24.8	21.2	80	0.53	0.32	0.0	0.0	1.65	7.78	1.43	9.73
1999	1	15	21	-1	97.50	-171	89.92	1.2	165	25.1	1011.3	98	9.8	320	10.2	25.3	21.4	79	25.1	21.0	78	0.75	0.32	0.0	0.1	1.81	8.40	1.79	9.15
1999	1	15	22	-1	96.88	-171	88.95	0.9	121	25.1	1011.0	100	10.7	341	11.0	25.7	21.1	76	25.1	21.0	78	0.92	0.33	0.0	0.1	1.81	8.40	1.79	9.15
1999	1	15	23	-1	96.68	-171	88.94	1.8	91	25.2	1010.4	106	8.2	15	9.1	25.5	21.4	78	25.6	21.1	76	0.97	0.32	0.0	0.0	1.81	8.40	1.79	9.15
1999	1	16	0	-1	96.68	-171	89.36	2.0	89	25.2	1010.1	100	8.1	9	9.2	26.0	21.4	76	25.8	21.1	75	0.90	0.32	0.0	0.0	1.72	8.13	1.51	8.66
1999	1	16	1	-1	96.57	-171	90.14	1.7	91	25.2	1009.0	108	8.5	17	9.4	25.5	21.5	78	25.7	21.2	76	0.84	0.33	0.0	0.0	1.72	8.13	1.51	8.66
1999	1	16	2	-1	96.40	-171	90.87	1.6	90	25.3	1008.3	101	9.1	11	9.9	25.7	21.2	76	25.6	21.0	76	0.72	0.32	0.0	0.2	1.72	8.13	1.51	8.66
1999	1	16	3	-1	96.20	-171	91.62	1.9	90	25.2	1008.0	109	8.6	18	9.5	25.2	21.2	79	25.3	21.1	77	0.43	0.32	0.0	0.1	1.85	8.68	1.65	8.65
1999	1	16	4	-1	95.21	-171	92.96	11.2	119	25.2	1008.0	101	9.7	348	14.2	25.3	20.9	76	24.8	20.7	78	0.34	0.33	0.0	0.0	1.85	8.68	1.65	8.65
1999	1	16	5	-1	90.24	-170	40.11	2.5	92	25.2	1008.2	100	9.1	11	10.3	24.8	20.7	78	24.3	20.5	79	0.08	0.31	0.0	0.1	1.85	8.68	1.65	8.65
1999	1	16	6	-1	90.15	-170	40.20	3.9	304	25.2	1009.1	96	9.7	26	9.8	24.3	20.5	80	24.1	20.6	81	0.00	0.31	0.0	0.0	1.89	9.34	1.73	9.80
1999	1	16	7	-1	97.31	-171	88.46	4.5	31	25.1	1009.7	96	8.7	79	8.5	24.2	20.8	82	24.0	20.8	83	0.00	0.31	0.0	0.2	1.89	9.34	1.73	9.80
1999	1	16	8	-1	97.43	-171	87.10	1.6	101	25.1	1010.6	98	7.6	359	8.4	24.1	20.8	82	23.9	20.7	82	0.00	0.34	0.0	0.1	1.89	9.34	1.73	9.80
1999	1	16	9	-1	97.58	-171	89.16	0.8	90	25.1	1010.9	95	9.1	356	10.5	24.1	20.7	81	23.9	20.6	82	0.00	0.31	0.0	0.0	2.32	9.74	2.06	10.93
1999	1	16	10	-1	97.63	-171	90.08	0.9	91	25.0	1011.1	91	5.6	0	6.4	24.0	20.9	83	23.9	20.7	83	0.00	0.31	0.0	0.0	2.32	9.74	2.06	10.93
1999	1	16	11	-1	97.89	-171	88.23	1.4	90	25.0	1010.5	86	6.8	355	7.2	23.9	20.7	83	23.6	20.5	83	0.00	0.31	0.0	0.0	2.32	9.74	2.06	10.93
1999	1	16	12	0	4.55	-171	90.79	15.2	34	25.0	1009.8	93	8.5	32	14.2	24.0	20.6	81	23.8	20.6	82	0.00	0.32	0.0	0.0	2.06	9.57	2.01	10.43
1999	1	16	13	0	17.23	-171	97.86	15.4	35	25.1	1009.0	98	7.8	32	13.3	24.1	20.7	81	24.0	20.8	82	0.00	0.31	0.0	0.0	2.06	9.57	2.01	10.43
1999	1	16	14	0	29.97	-170	44.59	15.0	34	25.3	1008.2	93	7.8	29	13.7	24.1	20.6	80	23.9	20.5	81	0.00	0.30	0.0	0.0	2.06	9.57	2.01	10.43
1999	1	16	15	0	42.61	-170	51.36	15.5	37	25.4	1008.2	101	8.9	35	14.1	24.2	20.5	80	24.0	20.6	81	0.00	0.31	0.0	0.0	2.18	10.26	2.01	10.42
1999	1	16	16	0	54.74	-170	58.46	15.4	37	25.5	1008.6	111	9.7	41	14.1	24.5	20.5	79	24.3	20.4	79	0.00	0.33	0.0	0.0	2.18	10.26	2.01	10.42
1999	1	16	17	1	6.92	-170	65.55	15.4	37	25.6	1008.9	111	9.9	42	14.2	24.5	20.3	77	24.3	20.2	78	0.00	0.32	0.0	0.1	2.18	10.26	2.01	10.42
1999	1	16	18	1	19.29	-170	72.61	15.1	37	25.7	1009.1	116	11.0	48	14.7	25.1	20.1	74	24.6	20.0	76	0.09	0.31	0.0	0.0	2.14	9.90	1.86	9.68
1999	1	16	19	1	31.77	-170	79.85	15.4	37	25.8	1009.5	125	11.6	55	14.2	25.4	21.1	77	24.9	21.1	79	0.32	0.31	0.0	0.0	2.14	9.90	1.86	9.68
1999	1	16	20	1	44.14	-170	87.12	15.5	37	25.8	1010.1	126	12.2	56	14.7	25.8	21.0	75	25.2	20.9	77	0.57	0.32	0.0	0.0	2.14	9.90	1.86	9.68

1999	1	16	21	1	56.53	−170	4.55	15.5	37	25.9	1010.2	127	10.7	54	13.2	26.2	21.4	75	25.7	21.2	76	0.84	0.33	0.0	0.0	2.15	9.67	1.71	8.97
1999	1	16	22	2	8.97	−169	2.31	15.4	37	26.0	1009.1	122	11.2	51	14.2	26.4	21.1	73	25.8	20.9	74	0.65	0.32	0.0	0.1	2.15	9.67	1.71	8.97
1999	1	16	23	2	21.39	−169	9.97	15.5	35	26.3	1008.7	117	10.0	47	13.6	26.5	20.9	71	26.0	20.9	73	0.89	0.32	0.0	0.1	2.15	9.67	1.71	8.97
1999	1	17	0	2	33.76	−169	7.43	15.4	36	26.5	1008.0	119	10.3	49	13.6	26.5	21.1	72	26.3	21.1	73	0.91	0.33	0.0	8.2	2.11	9.63	1.77	9.73
1999	1	17	1	2	46.28	−169	5.00	15.4	35	26.6	1007.2	119	10.4	50	13.6	26.5	21.3	73	26.4	21.3	74	0.87	0.33	0.0	0.1	2.11	9.63	1.77	9.73
1999	1	17	2	2	59.32	−169	2.26	15.4	31	26.6	1006.5	107	9.8	43	13.9	26.3	21.1	73	26.2	21.3	74	0.74	0.33	0.0	0.2	2.11	9.63	1.77	9.73
1999	1	17	3	3	12.33	−169	9.60	15.4	32	26.6	1006.5	108	10.0	44	14.1	26.2	21.3	75	26.2	21.5	75	0.55	0.34	0.0	0.0	2.08	9.32	1.56	8.95
1999	1	17	4	3	25.10	−169	7.31	15.3	32	26.8	1006.6	104	10.6	42	15.0	26.1	21.1	74	26.2	21.3	74	0.11	0.31	0.0	0.2	2.08	9.32	1.56	8.95
1999	1	17	5	3	38.03	−169	5.09	15.3	30	27.1	1007.2	105	10.6	44	14.7	26.0	21.1	74	26.0	21.2	75	0.06	0.32	0.0	0.1	2.08	9.32	1.56	8.95
1999	1	17	6	3	51.13	−168	2.67	15.3	31	27.4	1007.7	100	11.4	42	15.9	26.1	21.2	74	25.9	21.2	75	0.00	0.32	0.0	0.3	2.20	8.78	2.00	9.82
1999	1	17	7	4	4.34	−168	0.09	15.3	29	27.7	1008.3	101	11.3	42	15.7	26.2	21.2	74	26.0	21.3	75	0.00	0.32	0.0	0.0	2.20	8.78	2.00	9.82
1999	1	17	8	4	17.40	−168	7.58	15.1	31	27.9	1008.4	100	12.3	44	16.6	26.4	20.6	71	26.1	20.8	73	0.00	0.31	0.0	0.0	2.20	8.78	2.00	9.82
1999	1	17	9	4	30.66	−168	5.28	15.0	31	28.0	1009.1	100	12.1	43	16.5	26.6	20.9	71	26.4	21.0	72	0.00	0.31	0.0	0.1	2.19	8.79	1.84	9.17
1999	1	17	10	4	43.90	−168	3.01	14.9	31	28.0	1008.7	103	12.3	45	16.4	26.4	21.1	72	26.2	21.2	74	0.00	0.31	0.0	0.0	2.19	8.79	1.84	9.17
1999	1	17	11	4	56.97	−168	0.77	15.2	29	27.9	1008.8	102	11.8	45	15.9	26.5	21.2	73	26.3	21.2	74	0.00	0.33	0.0	0.1	2.19	8.79	1.84	9.17
1999	1	17	12	5	10.53	−168	7.63	14.9	27	27.9	1008.2	101	11.6	45	15.6	26.4	20.9	72	26.2	21.0	73	0.00	0.31	0.0	0.1	2.42	8.79	2.15	9.99
1999	1	17	13	5	24.24	−168	4.75	15.0	31	27.9	1007.4	101	10.7	41	15.2	26.4	21.2	73	26.2	21.3	75	0.00	0.32	0.0	0.2	2.42	8.79	2.15	9.99
1999	1	17	14	5	37.71	−167	2.54	15.1	31	27.9	1006.7	102	10.4	41	14.8	26.3	21.3	74	26.1	21.3	75	0.00	0.32	0.0	0.1	2.42	8.79	2.15	9.99
1999	1	17	15	5	51.36	−167	0.32	15.0	32	27.8	1007.2	100	10.3	40	15.0	26.3	21.6	75	26.1	21.6	77	0.00	0.32	0.0	0.1	2.16	7.89	1.99	9.16
1999	1	17	16	6	4.95	−167	8.25	15.1	32	27.8	1007.6	98	10.2	39	15.0	26.3	21.5	75	26.1	21.6	76	0.00	0.32	0.0	0.0	2.16	7.89	1.99	9.16
1999	1	17	17	6	18.80	−167	6.16	15.0	33	27.7	1008.2	103	9.4	39	14.0	26.3	21.5	75	26.1	21.6	76	0.00	0.32	0.0	0.0	2.16	7.89	1.99	9.16
1999	1	17	18	6	32.16	−167	4.35	15.1	34	27.7	1009.1	103	9.6	40	14.1	26.4	21.6	75	26.1	21.7	77	0.05	0.34	0.0	0.0	2.14	7.89	2.01	8.13
1999	1	17	19	6	45.46	−167	2.79	15.1	33	27.5	1009.7	97	10.4	37	15.4	26.8	21.8	74	26.4	22.0	77	0.12	0.34	0.0	0.0	2.14	7.89	2.01	8.13
1999	1	17	20	6	58.99	−167	0.88	15.2	34	27.2	1010.8	101	10.8	40	15.4	27.1	22.1	74	26.6	22.3	77	0.23	0.32	0.0	0.1	2.14	7.89	2.01	8.13
1999	1	17	21	7	12.73	−167	8.47	14.7	33	27.3	1010.4	100	11.2	41	15.8	27.5	22.1	73	26.8	22.3	76	0.75	0.33	0.0	0.1	2.13	7.91	1.90	7.47
1999	1	17	22	7	26.21	−166	6.09	15.1	36	27.6	1009.7	104	10.9	41	15.5	27.5	21.9	71	27.1	22.0	74	0.20	0.32	0.0	0.1	2.13	7.91	1.90	7.47
1999	1	17	23	7	39.17	−166	4.39	15.0	35	27.6	1009.7	98	10.1	37	15.2	27.2	22.6	76	26.9	22.6	78	0.31	0.35	0.0	0.1	2.13	7.91	1.90	7.47
1999	1	18	0	7	52.50	−166	1.94	14.6	31	27.7	1008.5	85	11.9	32	17.6	27.1	22.2	75	26.9	22.3	76	0.90	0.34	5.8	1.0	2.13	7.50	1.96	8.03
1999	1	18	1	8	5.76	−166	9.42	14.6	33	27.7	1007.7	83	11.3	31	17.1	27.2	21.9	73	27.1	22.0	74	0.90	0.35	0.0	0.2	2.13	7.50	1.96	8.03
1999	1	18	2	8	19.05	−166	6.86	14.9	34	27.6	1007.6	84	10.5	29	16.5	27.0	22.0	74	26.9	22.1	75	0.62	0.33	0.0	0.0	2.13	7.50	1.96	8.03
1999	1	18	3	8	31.98	−166	4.37	14.7	33	27.6	1008.1	80	10.7	27	16.8	26.8	21.9	75	26.8	22.0	75	0.23	0.33	0.0	0.0	2.21	7.41	2.09	7.93
1999	1	18	4	8	45.00	−166	2.11	14.9	33	27.5	1008.2	75	11.1	25	17.5	26.5	21.8	75	26.5	21.8	76	0.18	0.33	0.0	0.1	2.21	7.41	2.09	7.93
1999	1	18	5	8	58.00	−166	9.80	14.9	33	27.3	1008.8	74	10.1	23	16.7	26.0	21.6	77	25.8	21.7	78	0.01	0.32	0.0	0.1	2.21	7.41	2.09	7.93
1999	1	18	6	9	10.95	−165	7.65	14.9	34	27.2	1009.3	73	10.8	23	17.3	25.8	21.8	79	25.6	21.9	80	0.00	0.33	0.0	0.1	2.14	7.14	2.06	8.05
1999	1	18	7	9	23.73	−165	5.48	14.8	33	27.2	1010.2	69	11.1	21	17.8	25.9	22.0	79	25.7	22.0	80	0.00	0.34	0.0	0.1	2.14	7.14	2.06	8.05
1999	1	18	8	9	36.59	−165	3.25	14.4	33	27.1	1011.0	73	11.5	24	17.9	25.8	21.7	78	25.6	21.7	79	0.00	0.35	0.0	0.1	2.14	7.14	2.06	8.05
1999	1	18	9	9	49.40	−165	0.66	14.6	34	26.7	1011.3	74	11.4	24	17.9	25.7	21.7	79	25.5	21.6	79	0.00	0.31	0.0	0.1	2.12	7.21	2.15	8.05
1999	1	18	10	10	2.14	−165	8.02	14.7	33	26.6	1010.7	73	11.4	24	17.8	25.4	21.3	78	25.2	21.2	79	0.00	0.31	0.0	0.0	2.12	7.21	2.15	8.05
1999	1	18	11	10	15.18	−165	5.45	14.8	32	26.5	1011.1	71	10.6	23	17.1	25.4	21.4	79	25.2	21.4	80	0.00	0.32	0.0	0.2	2.12	7.21	2.15	8.05
1999	1	18	12	10	27.99	−165	2.95	15.0	31	26.5	1010.8	74	11.0	25	17.4	25.3	20.9	76	25.2	20.9	77	0.00	0.31	0.0	0.1	1.98	7.01	2.13	7.84
1999	1	18	13	10	40.94	−164	0.48	14.9	31	26.3	1010.3	74	10.6	25	17.0	25.1	21.0	78	24.9	21.0	79	0.00	0.31	0.0	0.3	1.98	7.01	2.13	7.84
1999	1	18	14	10	53.79	−164	7.99	14.9	31	26.3	1009.6	85	10.2	30	16.1	25.1	20.7	77	24.9	20.7	78	0.00	0.31	0.0	0.1	1.98	7.01	2.13	7.84
1999	1	18	15	11	6.80	−164	5.46	14.9	32	26.2	1009.6	87	10.3	31	16.0	25.0	20.8	78	24.8	20.9	79	0.00	0.31	0.0	0.1	1.85	6.38	1.89	7.72
1999	1	18	16	11	19.86	−164	2.95	15.1	32	26.2	1010.2	91	10.5	35	15.8	24.9	21.0	79	24.7	21.1	80	0.00	0.31	0.4	0.1	1.85	6.38	1.89	7.72
1999	1	18	17	11	33.33	−164	0.48	15.1	32	26.2	1010.7	100	10.9	41	15.6	25.1	21.2	79	24.8	21.3	81	0.00	0.31	0.4	0.2	1.85	6.38	1.89	7.72
1999	1	18	18	11	46.76	−164	8.03	15.2	31	26.2	1011.1	99	10.6	40	15.4	25.3	21.3	79	24.8	21.5	82	0.11	0.31	0.4	0.1	1.91	7.32	1.78	7.58
1999	1	18	19	12	0.48	−164	5.70	15.1	32	26.1	1012.7	95	10.2	36	15.4	25.7	21.4	77	25.1	21.8	82	0.35	0.32	0.4	0.1	1.91	7.32	1.78	7.58
1999	1	18	20	12	14.61	−164	3.08	15.2	32	26.2	1013.2	95	10.7	37	15.7	26.1	21.2	74	25.6	21.3	77	0.57	0.32	0.4	0.0	1.91	7.32	1.78	7.58
1999	1	18	21	12	28.65	−163	0.56	15.1	31	26.3	1012.5	103	10.1	41	14.6	26.3	21.5	75	25.6	21.7	79	0.75	0.32	0.4	0.1	1.78	7.51	1.54	7.50
1999	1	18	22	12	42.64	−163	8.28	15.1	32	26.3	1012.6	98	9.6	38	14.5	26.3	21.6	76	25.8	21.8	79	0.26	0.33	0.3	0.0	1.78	7.51	1.54	7.50
1999	1	18	23	12	56.36	−163	6.07	15.2	32	26.3	1012.0	97	9.9	38	14.9	26.4	21.3	74	26.0	21.6	77	0.84	0.32	0.4	0.0	1.78	7.51	1.54	7.50
1999	1	19	0	13	9.06	−163	4.57	15.1	33	26.4	1011.5	93	10.0	34	15.4	26.3	21.6	75	26.1	21.7	77	0.55	0.33	0.3	7.6	1.90	7.22	1.84	7.53
1999	1	19	1	13	22.34	−163	2.48	15.0	33	26.5	1011.1	87	9.5	30	15.4	26.1	20.9	73	25.8	21.1	75			0.7	0.1	1.90	7.22	1.84	7.53
1999	1	19	2	13	35.40	−163	0.28	15.1	33	26.4	1010.8	88	9.7	30	15.5	26.0	21.2	75	26.0	21.3	75			0.0	0.0	1.90	7.22	1.84	7.53
1999	1	19	3	13	45.92	−163	0.46	14.5	60	26.4	1011.4	73	8.9	7	16.4	25.9	21.2	75	26.0	21.0	74			0.0	0.0	1.89	6.38	1.76	7.21
1999	1	19	4	13	54.29	−162	2.74	14.9	40	26.4	1012.0	68	9.5	14	16.8	25.0	21.3	80	24.9	21.2	80			0.0	0.1	1.89	6.38	1.76	7.21
1999	1	19	5	14	7.12	−162	0.84	14.8	33	26.4	1012.3	76	12.0	31	17.9	24.2	21.1	83	24.2	21.4	85			0.1	0.1	1.89	6.38	1.76	7.21
1999	1	19	6	14	20.77	−162	8.06	14.9	30	26.4	1013.1	78	11.7	29	17.8	24.4	20.9	81	24.3	21.0	82			0.2	0.3	2.16	7.47	2.12	7.88
1999	1	19	7	14	34.50	−162	4.40	14.9	26	26.4	1013.3	83	10.4	33	16.0	24.2	21.5	85	24.1	21.5	86			1.3	0.1	2.16	7.47	2.12	7.88
1999	1	19	8	14	48.34	−162	0.46	15.0	27	26.3	1014.1	87	11.0	36	16.2	24.4	21.2	82	24.3	21.3	84			0.2	0.1	2.16	7.47	2.12	7.88
1999	1	19	9	15	1.89	−162	6.43	15.1	27	25.5	1013.9	93	11.2	40	15.9	24.4	20.8	80	24.3	20.8	81			0.0	0.0	1.89	7.79	1.66	8.29
1999	1	19	10	15	15.33	−162	2.80	15.2	29	25.5	1013.8	95	11.6	41	16.3	24.4	20.1	77	24.2	20.2	79			0.0	0.2	1.89	7.79	1.66	8.29
1999	1	19	11	15	28.91	−162	9.23	15.2	29	25.5	1013.7	92	11.1	38	16.1	24.4	20.1	77	24.2	20.2	78			0.0	0.1	1.89	7.79	1.66	8.29
1999	1	19	12	15	42.54	−162	5.71	14.9	29	25.4	1013.6	91	10.4	36	15.5	24.5	19.7	75	24.3	19.9	77			0.0	0.1	1.77	6.88	1.56	7.79
1999	1	19	13	15	56.49	−161	2.20	15.1	33	25.5	1012.8	84	10.2	31	16.1	23.7	20.5	82	23.5	20.6	84			0.0	0.1	1.77	6.88	1.56	7.79
1999	1	19	14	16	9.68	−161	9.39	14.9	33	25.6	1012.6	85	11.2	31	17.1	23.2	21.0	87	23.1	20.9	88			0.1	0.0	1.77	6.88	1.56	7.79
1999	1	19	15	16	22.45	−161	6.35	14.9	33	25.5	1012.6	90	11.4	34	17.0	23.2	20.9	87	22.9	20.8	88			1.1	0.1	1.91	7.14	1.60	8.25

1999	1	19	16	16	35.01	−161	63.60	15.0	37	25.4	1013.5	93	10.2	33	15.7	23.5	20.7	85	23.3	20.8	86			0.0	0.0	1.91	7.14	1.60	8.25
1999	1	19	17	16	47.68	−161	71.24	15.1	34	25.4	1014.2	91	9.9	33	15.5	23.8	20.4	82	23.5	20.5	83			0.0	0.0	1.91	7.14	1.60	8.25
1999	1	19	18	17	0.37	−161	79.03	15.2	34	25.4	1014.8	103	9.6	39	14.3	24.2	20.5	80	23.7	20.6	83			0.0	0.1	1.95	7.48	1.80	8.32
1999	1	19	19	17	13.13	−161	86.82	14.9	29	25.6	1015.6	103	11.7	45	15.9	24.1	20.4	80	23.8	20.2	81			0.1	0.1	1.95	7.48	1.80	8.32
1999	1	19	20	17	26.71	−161	94.30	15.1	28	25.6	1016.4	112	10.3	49	13.6	25.1	19.9	73	24.6	19.7	75			0.0	0.0	1.95	7.48	1.80	8.32
1999	1	19	21	17	41.06	−160	42.12	15.3	30	25.6	1015.9	111	10.4	47	14.0	25.4	19.6	71	24.5	19.5	74			0.0	0.1	1.96	7.75	1.80	9.13
1999	1	19	22	17	54.71	−160	50.24	15.3	31	25.7	1015.6	101	9.0	38	13.8	25.2	19.4	70	24.6	19.4	73			0.0	0.1	1.96	7.75	1.80	9.13
1999	1	19	23	18	8.50	−160	59.04	15.6	28	25.5	1015.7	98	8.7	36	13.7	25.0	19.2	70	24.7	19.4	73			0.0	0.2	1.96	7.75	1.80	9.13
1999	1	20	0	18	19.40	−160	64.99	11.5	29	24.8	1015.1	73	6.7	23	11.7	24.1	19.7	77	24.0	19.7	77			0.0	0.3	2.49	11.07	2.22	10.29
1999	1	20	1	18	29.89	−160	70.58	11.9	29	25.0	1015.1	62	3.0	11	8.7	24.1	20.7	81	24.4	20.6	79			0.0	0.0	2.49	11.07	2.22	10.29
1999	1	20	2	18	40.27	−160	76.39	11.7	30	25.1	1015.0	83	6.5	27	11.2	24.4	19.7	75	24.3	19.8	76			0.0	0.0	2.49	11.07	2.22	10.29
1999	1	20	3	18	50.67	−160	82.46	11.5	31	24.8	1015.1	90	9.6	38	13.5	23.7	18.8	74	23.5	18.9	75			0.0	0.0	2.26	10.03	1.96	9.83
1999	1	20	4	19	2.82	−160	89.09	14.1	31	25.3	1016.0	105	8.0	39	12.2	22.2	20.2	88	22.1	20.2	89			0.3	0.1	2.26	10.03	1.96	9.83
1999	1	20	5	19	15.21	−160	96.18	14.1	34	25.4	1016.4	127	5.4	38	8.8	22.6	20.5	88	22.5	20.3	88			0.1	0.0	2.26	10.03	1.96	9.83
1999	1	20	6	19	27.61	−159	43.76	14.2	32	25.5	1016.9	81	3.7	16	10.2	23.5	20.1	81	23.0	19.9	83			0.0	0.0	1.93	11.29	1.68	11.08
1999	1	20	7	19	40.18	−159	50.95	13.9	31	25.5	1017.2	79	6.3	22	12.4	23.9	20.2	80	23.7	20.1	80			0.0	0.1	1.93	11.29	1.68	11.08
1999	1	20	8	19	52.53	−159	58.20	13.9	33	25.4	1017.4	87	5.4	22	11.3	23.7	20.0	80	23.5	19.9	80			0.0	0.0	1.93	11.29	1.68	11.08
1999	1	20	9	20	4.98	−159	65.28	14.2	34	25.2	1017.6	71	5.1	15	11.6	23.7	19.2	76	23.4	19.0	76			0.0	0.1	1.94	11.21	1.99	11.45
1999	1	20	10	20	16.61	−159	72.19	11.9	33	25.2	1017.2	74	4.6	17	10.1	23.5	19.2	77	23.2	19.1	78			0.0	0.0	1.94	11.21	1.99	11.45
1999	1	20	11	20	26.04	−159	77.98	10.0	30	25.2	1017.1	71	3.9	17	8.6	23.6	19.2	76	23.3	19.0	77			0.0	0.0	1.94	11.21	1.99	11.45
1999	1	20	12	20	34.12	−159	82.90	10.1	30	25.2	1017.2	54	4.4	11	9.3	23.4	19.7	79	23.3	19.6	79			0.0	0.1	2.04	11.14	1.65	11.49
1999	1	20	13	20	42.73	−159	87.54	10.4	25	25.2	1016.6	83	3.4	22	7.6	23.1	19.4	80	22.9	19.4	81			0.0	0.1	2.04	11.14	1.65	11.49
1999	1	20	14	20	51.41	−159	92.30	11.2	26	25.2	1016.4	87	3.0	21	7.6	23.2	18.9	77	23.0	18.9	78			0.0	0.1	2.04	11.14	1.65	11.49
1999	1	20	15	21	0.94	−159	97.85	11.1	26	25.3	1016.4	71	5.0	21	9.9	23.2	18.9	77	23.0	18.9	78			0.0	0.1	1.91	11.11	1.74	11.13
1999	1	20	16	21	10.18	−158	42.66	10.5	28	25.0	1016.6	65	4.9	17	9.8	23.1	18.4	75	22.9	18.4	76			0.0	0.1	1.91	11.11	1.74	11.13
1999	1	20	17	21	16.43	−158	46.34	3.9	56	24.9	1017.4	23	3.3	351	5.9	22.8	17.2	71	22.6	17.2	71			0.0	0.0	1.91	11.11	1.74	11.13
1999	1	20	18	21	18.49	−158	48.07	0.3	49	25.2	1018.0	37	1.6	353	1.7	22.9	18.0	74	22.8	17.9	74			0.0	0.1	0.12	7.38	0.17	6.85
1999	1	20	19	21	18.48	−158	48.06	0.3	49	25.4	1018.3	27	2.5	341	2.7	23.5	17.9	71	23.2	17.9	72			0.0	0.2	0.12	7.38	0.17	6.85
1999	1	20	20	21	18.50	−158	48.07	0.3	49	25.5	1018.4	270	0.5	339	0.5	24.3	17.5	66	24.2	17.9	68			0.0	0.0	0.12	7.38	0.17	6.85
1999	1	20	21	21	18.47	−158	48.05	0.3	49	25.6	1018.0	293	0.9	306	0.9	25.1	17.0	61	25.3	16.9	60			0.0	0.0	0.11	4.38	0.18	4.35
1999	1	20	22	21	18.48	−158	48.05	0.3	49	25.7	1016.4	30	2.5	343	2.7	26.0	16.0	54	25.3	15.8	56			0.0	0.0	0.11	4.38	0.18	4.35
1999	1	20	23	21	18.52	−158	48.05	0.3	49	25.7	1016.0	24	4.0	337	4.2	25.6	17.2	60	25.0	17.1	61			0.0	0.0	0.11	4.38	0.18	4.35
1999	1	21	0	21	18.49	−158	48.08	0.3	49	25.8	1015.3	29	2.7	343	2.8	26.9	17.3	56	26.5	17.3	57			0.0	0.2	0.12	6.29	0.15	5.21
1999	1	22	7	23	41.44	−160	85.58	14.2	307	23.9	1018.9	52	18.6	82	18.3	20.7	17.4	81	20.6	17.7	83	0.00	0.34	5.1	0.2	5.44	11.70	3.89	8.55
1999	1	22	8	23	48.66	−160	72.62	14.4	309	23.9	1019.3	53	18.4	82	17.9	21.0	16.9	77	21.0	17.1	79	0.00	0.34	0.2	0.0	5.44	11.70	3.89	8.55
1999	1	22	9	23	55.96	−160	59.72	14.0	305	23.8	1019.8	54	18.3	83	17.7	19.8	17.4	86	19.7	17.5	87	0.00	0.34	0.9	0.0	4.84	11.99	3.89	9.17
1999	1	22	10	24	3.57	−160	46.75	13.9	305	23.7	1020.5	54	18.2	84	17.5	20.5	16.5	78	20.3	16.7	80	0.00	0.35	0.0	0.0	4.84	11.99	3.89	9.17

1999	1	22	11	24	11.21	−161	93.64	13.6	305	23.8	1020.7	56	18.5	87	17.4	20.0	16.3	79	19.9	16.4	80			0.7	0.0	4.84	11.99	3.89	9.17
1999	1	22	12	24	18.58	−161	80.10	14.2	302	23.8	1020.6	58	19.2	93	17.3	19.8	16.2	80	20.0	16.4	80			0.1	0.0	6.02	12.59	4.36	10.05
1999	1	22	13	24	25.90	−161	66.55	14.2	302	24.0	1020.6	59	19.3	95	17.2	19.6	15.9	79	19.8	16.0	79			0.2	0.0	6.02	12.59	4.36	10.05
1999	1	22	14	24	33.26	−161	53.18	14.2	299	24.1	1020.4	60	17.9	94	15.9	20.6	15.6	73	20.5	15.8	75			0.1	0.0	6.02	12.59	4.36	10.05
1999	1	22	15	24	40.73	−162	99.97	14.2	300	23.8	1020.3	56	17.4	90	15.8	20.6	16.0	75	20.5	15.7	74			0.0	0.0	6.02	12.59	4.36	10.05
1999	1	22	16	24	47.95	−162	86.59	14.2	300	23.1	1021.7	59	17.4	92	15.4	20.4	15.3	73	20.3	15.2	73			0.0	0.0	6.02	12.59	4.36	10.05
1999	1	22	17	24	55.08	−162	72.33	14.7	301	22.9	1021.9	62	16.4	92	14.2	20.4	15.3	73	20.2	15.3	74			0.0	0.0	6.02	12.59	4.36	10.05
1999	1	22	18	24	59.41	−162	56.47	14.8	282	23.2	1022.9	66	16.2	120	11.0	20.2	14.7	71	20.3	14.9	71			0.0	0.0	6.02	12.59	4.36	10.05
1999	1	22	19	25	2.05	−163	99.51	15.1	284	23.3	1023.8	69	15.9	120	10.6	20.6	14.4	67	20.7	14.7	69			0.0	0.1	6.02	12.59	4.36	10.05
1999	1	22	20	25	5.36	−163	82.31	15.1	281	22.9	1024.3	76	16.5	133	10.3	20.9	13.8	64	21.6	14.3	63			0.0	0.1	6.02	12.59	4.36	10.05
1999	1	22	21	25	8.26	−163	65.66	15.1	281	23.1	1024.2	74	16.1	128	10.1	20.8	14.4	67	21.4	14.7	66			0.0	0.0	6.02	12.59	4.36	10.05
1999	1	22	22	25	10.94	−163	49.12	14.9	283	23.1	1023.5	73	15.9	127	9.9	20.8	14.5	67	21.8	14.9	65			0.0	0.0	6.02	12.59	4.36	10.05
1999	1	22	23	25	13.54	−164	92.37	14.7	283	23.1	1022.4	74	15.4	129	9.2	20.8	14.2	66	21.7	14.5	64			0.0	0.0	6.02	12.59	4.36	10.05
1999	1	23	0	25	16.46	−164	75.67	15.3	281	24.0	1021.5	76	14.8	130	8.6	21.2	14.7	67	22.3	14.9	63			0.0	0.1	6.02	12.59	4.36	10.05
1999	1	23	1	25	19.56	−164	58.99	15.3	284	23.9	1020.9	79	14.3	132	7.9	21.3	15.2	68	22.1	15.4	66			0.0	7.2	6.02	12.59	4.36	10.05
1999	1	23	2	25	22.79	−164	42.75	15.1	283	24.3	1020.8	76	14.8	130	8.5	21.1	15.6	71	21.7	16.0	70			0.0	0.0	6.02	12.59	4.36	10.05
1999	1	23	3	25	25.76	−165	86.49	15.4	277	24.3	1021.2	73	14.5	129	8.2	20.9	15.6	72	21.3	15.8	71			0.0	0.1	6.02	12.59	4.36	10.05
1999	1	23	4	25	27.56	−165	70.19	15.6	280	24.4	1021.0	85	14.3	144	7.1	21.6	14.6	64	21.6	14.4	64			0.0	0.0	5.46	19.25	3.52	19.52
1999	1	23	5	25	30.45	−165	53.74	15.3	280	24.2	1021.6	81	13.6	135	6.8	21.6	15.5	68	21.6	15.5	68			0.0	0.0	5.46	19.25	3.52	19.52
1999	1	23	6	25	33.59	−166	96.81	15.7	279	24.0	1022.0	75	12.5	123	6.3	21.8	15.8	69	21.7	15.9	69			0.0	0.1	4.71	19.00	3.36	19.93
1999	1	23	7	25	36.15	−166	79.24	15.3	280	24.2	1022.6	79	14.4	136	7.6	21.7	15.8	70	21.7	16.0	70			0.0	0.1	4.71	19.00	3.36	19.93
1999	1	23	8	25	39.88	−166	62.59	15.4	299	23.7	1022.7	79	14.5	106	10.2	21.2	16.0	72	21.2	16.3	74			0.0	0.2	4.71	19.00	3.36	19.93
1999	1	23	9	25	47.01	−166	47.24	15.5	301	23.5	1022.8	79	13.7	105	9.4	21.6	16.3	72	21.5	16.6	74			0.0	0.2	3.34	16.82	3.40	17.89
1999	1	23	10	25	54.71	−167	92.49	15.3	299	23.5	1022.3	79	15.6	109	11.1	20.4	16.6	79	20.4	16.9	81			0.0	0.0	3.34	16.82	3.40	17.89
1999	1	23	11	26	2.53	−167	77.68	15.4	300	23.4	1022.1	81	13.3	104	8.8	21.1	16.6	76	20.8	16.8	78			0.0	0.1	3.34	16.82	3.40	17.89
1999	1	23	12	26	10.21	−167	62.25	15.5	300	23.0	1022.0	89	13.9	117	8.3	20.2	16.7	80	20.3	16.8	80			1.7	0.4	3.82	17.70	3.31	18.47
1999	1	23	13	26	17.86	−167	46.78	15.6	298	23.0	1022.1	93	14.3	126	8.1	20.4	16.7	79	20.2	16.8	81			0.0	0.1	3.82	17.70	3.31	18.47
1999	1	23	14	26	25.93	−168	91.23	15.5	302	22.7	1021.9	95	11.6	116	5.7	21.2	16.5	75	20.8	16.7	77			0.0	0.0	3.82	17.70	3.31	18.47
1999	1	23	15	26	34.12	−168	75.38	15.6	301	22.7	1021.8	90	10.7	101	5.7	21.1	17.0	77	20.9	17.0	79	0.00	0.33	0.0	0.0	3.79	19.34	2.88	19.12
1999	1	23	16	26	42.77	−168	59.62	15.6	301	22.4	1021.7	94	11.6	113	5.9	21.0	16.8	77	20.8	17.0	79	0.00	0.34	0.0	0.0	3.79	19.34	2.88	19.12
1999	1	23	17	26	51.12	−168	44.12	15.3	301	22.1	1021.9	95	11.5	114	5.6	21.0	16.9	77	20.7	16.9	79	0.00	0.30	0.0	0.0	3.79	19.34	2.88	19.12
1999	1	23	18	26	59.42	−169	89.07	15.6	301	22.0	1022.1	98	9.0	96	3.3	20.5	17.5	83	20.2	17.4	84	0.01	0.34	0.2	0.1	3.46	19.07	2.73	19.82
1999	1	23	19	27	7.18	−169	73.44	15.7	301	21.8	1022.9	103	9.1	104	2.8	20.5	17.4	83	20.4	17.6	84	0.22	0.33	0.0	0.0	3.46	19.07	2.73	19.82
1999	1	23	20	27	14.95	−169	58.08	15.5	301	22.0	1023.7	93	8.3	81	3.8	21.0	17.8	82	20.9	17.7	82	0.20	0.31	0.0	0.1	3.46	19.07	2.73	19.82
1999	1	23	21	27	22.60	−169	42.71	15.4	301	22.4	1023.9	98	9.3	100	3.5	21.3	17.9	81	22.0	18.4	80	0.56	0.31	0.0	0.0	3.48	18.85	2.65	17.40
1999	1	23	22	27	30.65	−170	87.34	15.6	301	22.4	1023.7	102	9.9	112	3.5	21.3	17.8	81	22.3	17.9	77	0.25	0.34	0.0	0.2	3.48	18.85	2.65	17.40
1999	1	23	23	27	38.52	−170	72.08	15.8	299	22.7	1023.5	105	10.9	128	3.8	21.2	17.5	80	22.5	17.8	75	0.35	0.31	0.0	0.1	3.48	18.85	2.65	17.40
1999	1	24	0	27	47.34	−170	56.89	15.8	302	21.6	1022.5	104	8.6	91	2.7	21.2	17.4	79	21.9	17.3	75	0.31	0.33	0.0	6.7	3.12	18.98	2.34	17.33
1999	1	24	1	27	55.87	−170	41.62	15.9	299	21.3	1022.0	100	7.2	62	3.0	21.4	17.4	78	21.6	17.3	77	0.30	0.34	0.0	0.1	3.12	18.98	2.34	17.33
1999	1	24	2	28	4.46	−171	86.40	15.8	304	20.9	1022.1	101	5.7	34	3.4	21.3	17.6	80	21.5	17.6	79	0.23	0.32	0.0	0.1	3.12	18.98	2.34	17.33
1999	1	24	3	28	12.35	−171	71.08	15.2	301	21.3	1022.1	47	5.0	36	8.2	19.8	16.8	82	19.8	16.9	83	0.09	0.32	0.0	0.0	4.01	19.63	2.35	16.53
1999	1	24	4	28	20.49	−171	55.69	15.8	302	20.6	1021.8	51	6.5	46	8.5	18.7	16.4	86	18.6	16.4	87	0.06	0.31	0.0	0.1	4.01	19.63	2.35	16.53
1999	1	24	5	28	28.27	−171	40.63	15.8	301	21.9	1022.6	63	7.0	52	7.5	19.0	16.7	87	18.9	16.5	86	0.00	0.31	0.0	0.1	4.01	19.63	2.35	16.53
1999	1	24	6	28	36.17	−172	85.93	15.8	302	22.2	1023.8	66	6.8	53	7.0	19.6	16.9	85	19.4	16.8	85	0.00	0.32	0.0	0.0	3.55	18.71	2.33	14.87
1999	1	24	7	28	44.59	−172	71.02	15.6	301	22.2	1024.7	65	7.0	53	7.3	19.8	17.0	84	19.6	17.0	85	0.00	0.32	0.0	0.0	3.55	18.71	2.33	14.87
1999	1	24	8	28	53.28	−172	55.96	15.4	302	21.7	1024.5	20	8.4	40	12.7	18.6	16.6	88	18.6	16.7	89	0.00	0.35	0.0	0.1	3.55	18.71	2.33	14.87
1999	1	24	9	29	1.10	−172	41.16	15.5	301	21.1	1025.1	39	12.0	62	13.5	16.5	15.2	92	16.3	15.1	93	0.00	0.35	1.3	0.2	3.52	15.71	2.75	10.44
1999	1	24	10	29	8.59	−173	86.02	15.9	300	21.3	1024.0	80	15.2	110	10.4	17.9	15.2	84	17.6	15.7	88	0.00	0.34	0.2	0.1	3.52	15.71	2.75	10.44
1999	1	24	11	29	15.69	−173	70.59	15.7	300	21.0	1024.8	74	9.5	78	7.0	18.2	15.8	86	18.0	15.7	86	0.00	0.34	0.1	0.0	3.52	15.71	2.75	10.44
1999	1	24	12	29	23.00	−173	55.05	15.6	299	21.0	1023.6	90	11.7	110	6.2	18.8	15.3	80	18.4	15.7	84	0.00	0.33	0.0	0.2	3.66	16.84	2.53	11.70
1999	1	24	13	29	30.35	−174	99.42	15.4	300	21.0	1023.6	68	9.7	76	7.9	19.2	16.0	81	19.0	16.0	83	0.00	0.30	0.0	0.0	3.66	16.84	2.53	11.70
1999	1	24	14	29	37.18	−174	83.42	15.2	301	19.6	1023.6	55	11.4	73	10.9	17.9	16.2	90	17.8	16.3	91	0.00	0.31	0.0	0.1	3.66	16.84	2.53	11.70
1999	1	24	15	29	44.73	−174	67.62	15.5	301	20.4	1023.2	68	13.1	87	10.7	18.0	16.0	88	17.8	16.0	89	0.00	0.32	0.0	0.2	3.67	15.15	2.71	12.02
1999	1	24	16	29	52.38	−174	51.53	15.5	304	20.8	1022.7	74	11.8	87	9.0	18.0	16.0	88	17.9	16.0	89	0.00	0.30	0.0	0.1	3.67	15.15	2.71	12.02
1999	1	24	17	30	0.99	−175	95.74	15.6	303	20.8	1023.3	75	11.8	89	8.9	18.5	15.6	83	18.2	15.6	85	0.00	0.30	0.0	0.1	3.67	15.15	2.71	12.02
1999	1	24	18	30	10.03	−175	80.29	15.6	302	21.0	1023.8	80	11.5	93	7.7	18.7	15.7	83	18.5	15.7	84	0.00	0.30	0.0	0.0	3.61	15.81	2.53	12.05
1999	1	24	19	30	18.32	−175	64.53	15.6	299	20.9	1023.7	84	11.8	101	7.2	19.0	15.4	80	18.7	15.6	82	0.03	0.29	0.0	0.0	3.61	15.81	2.53	12.05
1999	1	24	20	30	26.59	−175	48.73	15.8	301	20.4	1024.4	75	11.7	91	8.3	19.0	15.0	78	18.8	15.1	79	0.17	0.30	0.0	0.0	3.61	15.81	2.53	12.05
1999	1	24	21	30	34.69	−176	92.89	15.3	300	20.6	1024.8	68	12.0	85	9.6	18.7	15.4	81	18.7	15.5	82	0.41	0.30	0.0	0.0	3.81	16.14	2.65	11.26
1999	1	24	22	30	42.75	−176	77.26	15.4	301	20.5	1024.9	74	11.9	91	8.8	18.5	15.3	81	19.0	15.5	80	0.48	0.30	0.0	0.0	3.81	16.14	2.65	11.26
1999	1	24	23	30	50.60	−176	62.20	15.3	301	19.7	1024.5	87	12.0	106	7.1	18.4	15.3	82	19.5	15.8	80	0.67	0.31	0.0	0.0	3.81	16.14	2.65	11.26
1999	1	25	0	30	58.28	−176	47.09	15.5	302	18.5	1023.8	85	9.6	89	5.6	18.1	15.3	84	18.7	15.2	80	0.70	0.30	0.0	0.0	3.65	16.26	2.68	11.99
1999	1	26	1	34	17.98	177	17.74	15.7	298	17.0	1017.3	156	8.2	287	5.2	16.3	15.5	95	16.2	15.5	96	0.17	0.33	0.3	5.6	2.22	12.04	2.05	9.98
1999	1	26	2	34	26.26	177	1.52	15.1	297	15.5	1015.9	148	7.4	295	4.2	15.7	14.7	94	15.5	14.7	96	0.18	0.33	0.0	5.3	2.22	12.04	2.05	9.98
1999	1	26	3	34	33.59	176	44.93	15.8	296	14.9	1015.7	114	4.8	2	3.3	15.1	14.4	96	15.0	14.3	96	0.11	0.33	0.0	0.0	2.22	12.56	2.31	11.18
1999	1	26	4	34	40.78	176	28.04	16.0	295	14.9	1015.2	111	5.8	8	2.4	14.8	14.7	100	14.8	14.3	97	0.13	0.26	0.0	5.5	2.22	12.56	2.31	11.18
1999	1	26	5	34	48.46	176	11.63	15.8	298	14.4	1015.5	90	5.8	43	4.0	14.4	13.5	94	14.3	13.6	95	0.01	0.33	0.0	0.1	2.22	12.56	2.31	11.18

1999	1	26	6	34	56.18	175	55.26	16.0	300	14.1	1015.2	101	7.6	63	2.6	14.1	13.5	96	14.0	13.4	96	0.00	0.33	0.4	0.4	2.42	13.72	1.98	12.26
1999	1	26	7	35	4.11	175	39.06	16.1	300	14.2	1014.7	81	9.1	78	6.0	14.0	13.5	96	13.9	13.3	96	0.00	0.33	0.5	0.3	2.42	13.72	1.98	12.26
1999	1	26	8	35	11.89	175	22.54	16.0	300	14.6	1013.6	87	12.7	109	7.4	14.1	13.6	97	14.0	13.5	97	0.00	0.33	1.8	0.9	2.42	13.72	1.98	12.26
1999	1	26	9	35	19.55	175	5.60	15.9	299	14.2	1012.2	88	13.6	114	8.1	13.7	13.1	97	13.6	13.2	97	0.00	0.34	3.7	3.4	1.92	10.20	1.76	10.66
1999	1	26	10	35	27.35	174	48.74	16.0	301	14.0	1010.4	97	16.8	136	9.9	14.1	13.2	94	13.9	13.2	95	0.00	0.34	2.6	53.1	1.92	10.20	1.76	10.66
1999	1	26	11	35	35.23	174	31.89	16.0	304	15.1	1007.1	96	17.9	134	11.3	14.0	13.4	97	14.0	13.4	96	0.00	0.34	8.5	6.4	1.92	10.20	1.76	10.66
1999	1	26	12	35	43.48	174	15.60	15.8	305	14.0	1005.7	104	18.6	149	11.3	13.7	13.5	98	13.8	13.2	97	0.00	0.34	14.1	8.5	3.11	10.89	2.53	11.08
1999	1	26	13	35	51.10	173	59.55	15.9	302	16.8	1004.0	114	16.2	165	8.3	14.7	14.5	98	14.6	14.3	98	0.00	0.34	10.4	6.6	3.11	10.89	2.53	11.08
1999	1	26	14	35	59.05	173	44.02	15.7	299	17.1	1002.6	106	11.2	138	3.9	14.9	14.6	98	14.8	14.3	97	0.00	0.34	8.4	7.0	3.11	10.89	2.53	11.08
1999	1	26	15	36	6.59	173	29.47	15.3	301	16.5	1002.2	74	11.1	88	8.0	14.0	13.8	98	13.9	13.6	98	0.00	0.34	4.8	3.9	4.49	12.88	4.21	14.54
1999	1	26	16	36	13.29	173	13.71	15.3	299	15.2	1001.8	59	13.0	83	11.2	13.0	12.5	97	12.9	12.4	96	0.00	0.34	0.2	0.1	4.49	12.88	4.21	14.54
1999	1	26	17	36	19.99	172	57.73	15.3	301	16.8	1001.1	58	14.6	85	12.9	13.5	12.8	95	13.2	12.7	97	0.00	0.33	0.5	0.3	4.49	12.88	4.21	14.54
1999	1	26	18	36	27.45	172	42.30	14.7	302	16.2	1001.5	53	16.9	86	15.7	13.2	12.2	94	12.9	12.4	97	0.00	0.33	0.9	0.1	6.45	14.72	4.95	13.68
1999	1	26	19	36	33.09	172	26.32	15.3	280	16.7	1002.7	48	18.1	102	14.8	12.6	11.5	93	12.6	11.9	96	0.00	0.33	7.1	0.1	6.45	14.72	4.95	13.68
1999	1	26	20	36	35.32	172	9.63	15.1	285	16.9	1002.1	40	18.8	93	16.7	12.4	11.4	94	12.3	11.5	95	0.02	0.34	3.3	0.1	6.45	14.72	4.95	13.68
1999	1	26	21	36	38.10	171	52.37	15.0	283	16.6	1003.7	35	20.7	91	19.1	11.9	10.9	94	11.7	11.2	97	0.04	0.33	4.5	0.1	7.42	16.65	4.76	14.14
1999	1	26	22	36	40.60	171	34.02	15.0	272	13.5	1004.9	37	20.5	104	17.1	11.8	10.1	90	11.6	10.8	95	0.12	0.27	0.5	0.2	7.42	16.65	4.76	14.14
1999	1	26	23	36	40.48	171	15.40	15.2	272	13.2	1005.7	22	18.6	85	17.6	11.6	9.6	88	11.6	9.6	87	0.17	0.32	0.0	0.1	7.42	16.65	4.76	14.14
1999	1	27	0	36	40.55	170	56.90	14.3	268	13.1	1006.9	25	17.1	86	15.9	11.2	9.5	89	11.2	9.3	88	0.16	0.32	0.0	0.2	6.99	18.21	5.17	17.61
1999	1	27	1	36	40.85	170	38.71	15.2	273	13.9	1007.5	16	17.3	81	16.8	11.2	8.8	85	11.0	8.8	86	0.31	0.33	0.0	0.2	6.99	18.21	5.17	17.61
1999	1	27	2	36	40.62	170	20.47	14.8	271	12.4	1008.7	17	16.1	80	15.5	10.6	8.6	87	10.5	8.3	86	0.34	0.33	0.0	0.0	6.99	18.21	5.17	17.61
1999	1	27	3	36	40.08	170	2.10	15.2	271	12.5	1008.8	24	16.1	86	14.7	10.8	8.1	84	10.9	8.1	83	0.26	0.29	0.0	0.2	6.89	18.68	4.41	17.15
1999	1	27	4	36	39.46	169	43.61	14.9	269	14.0	1009.0	26	14.8	85	13.3	11.1	8.3	83	11.1	8.2	83	0.29	0.32	0.0	0.0	6.89	18.68	4.41	17.15
1999	1	27	5	36	40.10	169	25.07	15.2	301	14.5	1009.9	33	13.4	68	14.2	11.3	8.2	81	11.1	8.2	82	0.03	0.32	0.0	0.2	6.89	18.68	4.41	17.15
1999	1	27	6	36	46.50	169	8.38	14.7	301	14.6	1010.0	34	13.9	63	15.4	11.4	7.8	79	11.1	7.8	80	0.01	0.32	0.0	0.0	6.03	17.06	4.15	14.90
1999	1	27	7	36	53.83	168	51.83	14.9	306	14.6	1010.9	37	13.2	62	14.9	11.3	7.5	78	11.1	7.4	78	0.00	0.32	0.0	0.0	6.03	17.06	4.15	14.90
1999	1	27	8	37	1.71	168	35.68	15.1	304	14.9	1011.3	42	12.1	63	13.4	11.4	7.4	76	11.3	7.1	76	0.00	0.32	0.0	0.0	6.03	17.06	4.15	14.90
1999	1	27	9	37	9.83	168	19.56	15.1	302	14.9	1009.8	46	15.1	73	15.4	11.1	7.7	80	10.9	7.5	79	0.00	0.30	0.0	0.0	5.26	17.16	4.17	17.23
1999	1	27	10	37	17.72	168	3.61	15.0	304	15.3	1010.1	51	13.7	75	13.4	11.3	7.7	79	11.1	7.5	79	0.00	0.30	0.0	0.0	5.26	17.16	4.17	17.23
1999	1	27	11	37	25.75	167	47.92	15.2	302	15.5	1010.0	49	13.9	74	13.8	11.1	7.6	79	10.9	7.4	79	0.00	0.31	0.0	0.3	5.26	17.16	4.17	17.23
1999	1	27	12	37	33.18	167	32.56	14.9	305	14.9	1009.7	63	12.2	82	10.6	11.3	6.9	74	11.1	6.7	75	0.00	0.32	0.0	0.1	7.49	17.34	5.43	17.37
1999	1	27	13	37	41.07	167	16.75	15.2	302	14.9	1010.0	68	12.0	85	9.7	11.1	7.0	76	10.8	7.0	77	0.00	0.31	0.0	0.1	7.49	17.34	5.43	17.37
1999	1	27	14	37	49.01	167	0.30	15.3	300	13.5	1010.1	62	10.8	74	9.8	9.7	7.5	86	9.5	7.2	86	0.00	0.32	0.0	0.0	7.49	17.34	5.43	17.37
1999	1	27	15	37	56.77	166	43.61	15.3	305	13.7	1009.2	54	12.7	76	12.2	10.2	7.7	85	9.9	7.7	86	0.00	0.31	0.0	0.1	5.46	17.13	3.80	17.26
1999	1	27	16	38	4.56	166	26.87	15.1	300	13.3	1009.2	65	12.8	85	10.8	10.1	7.1	81	9.9	7.2	83	0.00	0.29	0.1	0.0	5.46	17.13	3.80	17.26
1999	1	27	17	38	12.09	166	9.43	15.4	298	13.1	1009.2	65	12.7	88	10.2	9.3	7.1	86	9.4	7.3	87	0.00	0.32	0.0	0.0	5.46	17.13	3.80	17.26
1999	1	27	18	38	19.27	165	52.06	15.4	300	12.7	1009.1	71	11.8	90	8.7	9.3	7.2	86	9.4	7.4	88	0.00	0.32	0.0	0.0	5.30	18.67	3.89	18.16
1999	1	27	19	38	26.80	165	34.92	15.2	300	12.6	1008.4	54	12.8	76	12.1	9.8	7.0	83	9.6	7.1	84	0.00	0.30	0.0	0.0	5.30	18.67	3.89	18.16
1999	1	27	20	38	34.45	165	18.14	15.3	303	13.1	1008.1	58	14.3	85	12.8	9.9	6.6	80	9.7	6.7	82	0.00	0.28	0.0	0.0	5.30	18.67	3.89	18.16
1999	1	27	21	38	37.39	164	59.65	15.6	281	13.1	1009.0	57	12.3	95	8.7	9.7	7.2	85	9.7	7.5	87	0.05	0.31	0.0	0.0	5.09	20.04	4.25	20.30
1999	1	27	22	38	40.06	164	40.62	15.4	280	11.5	1008.5	48	13.0	90	10.3	9.2	7.5	89	9.4	7.7	90	0.12	0.31	0.0	0.0	5.09	20.04	4.25	20.30
1999	1	27	23	38	42.52	164	21.28	15.4	279	11.9	1008.5	51	12.4	90	9.4	9.5	7.3	87	9.8	7.8	87	0.12	0.25	0.1	0.0	5.09	20.04	4.25	20.30
1999	1	28	0	38	44.96	164	2.00	15.5	283	12.2	1008.3	57	12.7	95	9.1	9.6	7.2	85	10.1	7.6	84	0.54	0.30	0.0	0.0	5.75	19.65	4.18	19.33
1999	1	28	1	38	47.86	163	42.97	15.0	278	13.0	1007.3	58	12.1	98	8.1	9.7	6.9	83	10.6	7.4	81	0.67	0.30	0.0	0.1	5.75	19.65	4.18	19.33
1999	1	28	2	38	50.23	163	23.56	15.4	279	12.5	1006.8	55	10.7	87	7.6	9.7	6.6	81	9.9	6.6	80	0.43	0.31	0.0	0.2	5.75	19.65	4.18	19.33
1999	1	28	3	38	53.39	163	4.28	15.4	281	10.1	1006.5	55	9.7	79	7.2	9.5	6.9	84	9.6	6.7	82	0.44	0.28	0.0	0.1	5.12	19.86	4.35	20.11
1999	1	28	4	38	56.28	162	45.31	15.1	280	11.6	1006.0	41	9.2	68	8.5	9.2	6.9	85	9.2	6.7	84	0.23	0.30	0.0	0.2	5.12	19.86	4.35	20.11
1999	1	28	5	38	59.05	162	26.25	15.3	280	9.4	1005.9	32	8.8	61	9.3	8.6	6.5	86	8.6	6.3	85	0.08	0.26	0.0	0.2	5.12	19.86	4.35	20.11
1999	1	28	6	39	1.54	162	7.65	15.3	278	10.4	1006.6	27	9.2	60	10.1	7.5	6.1	91	7.5	6.0	91	0.02	0.30	0.1	0.1	4.49	19.18	3.06	18.14
1999	1	28	7	39	3.83	161	48.92	14.8	279	10.3	1007.3	26	9.2	60	10.2	7.8	5.8	88	7.5	5.7	89	0.00	0.32	0.0	0.0	4.49	19.18	3.06	18.14
1999	1	28	8	39	6.19	161	30.22	14.8	280	10.4	1008.2	20	7.7	50	10.0	7.9	5.4	84	7.7	5.3	85	0.00	0.31	0.0	0.0	4.49	19.18	3.06	18.14
1999	1	28	9	39	8.69	161	11.92	14.7	283	11.0	1008.2	10	7.6	44	10.9	7.4	5.0	84	7.3	5.0	85	0.00	0.31	0.0	0.1	5.83	19.12	3.46	16.92
1999	1	28	10	39	11.35	160	53.48	15.1	284	11.2	1008.3	23	6.3	43	9.0	7.3	4.9	85	7.1	4.9	86	0.00	0.31	0.0	0.1	5.83	19.12	3.46	16.92
1999	1	28	11	39	13.96	160	34.66	15.3	281	11.3	1008.6	0	4.4	25	9.8	7.0	4.8	86	7.1	4.8	85	0.00	0.30	0.0	0.0	5.83	19.12	3.46	16.92
1999	1	28	12	39	16.59	160	15.33	15.1	282	11.7	1008.5	312	1.8	5	9.3	7.7	5.3	85	7.4	5.1	85	0.00	0.28	0.2	0.2	4.46	18.82	3.40	17.14
1999	1	28	13	39	19.29	159	55.67	15.0	282	11.7	1007.8	345	1.2	6	8.3	8.1	5.2	82	7.9	5.1	82	0.00	0.26	0.0	0.0	4.46	18.82	3.40	17.14
1999	1	28	14	39	22.24	159	35.89	15.0	282	11.7	1007.6	239	3.3	348	10.5	8.7	5.0	78	8.5	5.0	79	0.00	0.30	0.0	0.0	4.46	18.82	3.40	17.14
1999	1	28	15	39	25.16	159	15.78	15.4	282	12.0	1006.5	212	3.4	341	9.6	9.2	5.0	75	9.0	5.0	76	0.00	0.24	0.0	0.1	4.98	19.10	3.40	19.17
1999	1	28	16	39	28.50	158	57.48	12.4	274	12.2	1005.5	201	5.0	315	7.1	9.1	5.9	81	9.1	5.8	80	0.00	0.31	0.0	0.1	4.98	19.10	3.40	19.17
1999	1	28	17	39	31.67	158	37.79	15.5	279	11.6	1004.9	191	5.8	325	10.1	8.8	7.3	91	8.8	7.1	89	0.00	0.31	0.0	0.0	4.98	19.10	3.40	19.17
1999	1	28	18	39	34.35	158	18.10	15.9	277	10.2	1004.4	178	7.2	313	9.8	8.8	8.0	95	8.9	7.8	93	0.00	0.31	0.0	0.0	4.34	19.93	2.59	19.70
1999	1	28	19	39	36.34	157	58.66	15.3	278	9.9	1003.9	171	7.9	307	9.4	9.0	8.3	95	9.0	8.1	94	0.00	0.30	0.0	0.0	4.34	19.93	2.59	19.70
1999	1	28	20	39	38.71	157	39.27	15.4	277	11.3	1003.5	180	6.1	320	9.3	10.2	8.8	91	9.9	8.6	92	0.00	0.29	0.0	0.0	4.34	19.93	2.59	19.70
1999	1	28	21	39	41.12	157	20.10	15.4	277	9.9	1003.3	177	4.6	328	8.4	10.7	9.2	91	10.5	9.2	91	0.01	0.31	0.0	0.1	4.44	19.93	2.98	20.44
1999	1	28	22	39	43.27	157	0.36	15.6	279	9.6	1002.1	180	5.4	323	8.9	10.4	9.4	93	10.4	9.2	93	0.03	0.31	0.0	0.0	4.44	19.93	2.98	20.44
1999	1	28	23	39	45.97	156	40.38	15.6	283	9.7	1002.0	180	6.3	317	8.9	10.5	9.5	94	10.4	9.2	92	0.10	0.30	0.0	0.0	4.44	19.93	2.98	20.44
1999	1	29	0	39	49.14	156	20.57	15.3	280	9.8	1000.6	97	3.1	3	4.9	10.1	9.4	95	10.1	9.1	94	0.15	0.30	0.0	0.0	4.09	19.44	2.69	16.45

1999	1	29	1	39	51.92	156	0.45	15.7	282	10.3	999.0	62	6.3	52	5.1	9.4	8.5	94	9.4	8.5	94	0.16	0.31	0.0	0.0	4.09	19.44	2.69	16.45
1999	1	29	2	39	54.80	155	40.61	15.5	277	10.4	997.4	79	6.1	42	3.3	9.3	8.5	95	9.3	8.4	94	0.07	0.31	0.0	0.0	4.09	19.44	2.69	16.45
1999	1	29	3	39	56.16	155	20.21	15.5	273	9.4	995.9	48	4.0	29	6.0	8.8	8.0	94	8.9	7.9	94	0.05	0.32	0.0	0.0	3.48	17.90	2.41	17.64
1999	1	29	4	39	57.69	154	59.62	15.5	275	10.0	994.6	54	5.6	44	5.3	8.7	7.9	95	8.7	7.9	94	0.04	0.32	0.4	0.5	3.48	17.90	2.41	17.64
1999	1	29	5	39	58.92	154	39.20	15.2	275	9.8	994.0	8	2.9	16	8.2	8.5	8.0	96	8.5	7.7	95	0.03	0.32	0.4	0.5	3.48	17.90	2.41	17.64
1999	1	29	6	40	0.40	154	19.09	15.5	275	7.4	993.8	339	5.7	26	11.6	7.2	6.4	94	7.3	6.4	94	0.03	0.31	0.8	0.2	4.78	20.37	2.59	20.26
1999	1	29	7	40	1.47	153	58.77	15.5	275	8.5	993.9	0	11.8	52	14.8	6.4	5.7	95	6.3	5.7	96	0.00	0.31	2.9	0.1	4.78	20.37	2.59	20.26
1999	1	29	8	40	2.19	153	38.74	15.3	279	10.3	994.4	8	11.3	55	13.7	6.8	5.6	92	6.4	5.4	93	0.00	0.27	0.2	0.0	4.78	20.37	2.59	20.26
1999	1	29	9	40	3.08	153	19.62	13.8	279	10.7	995.8	335	20.3	43	25.0	4.7	2.2	84	4.2	2.3	88	0.00	0.31	5.8	0.7	4.72	17.42	3.19	19.60
1999	1	29	10	40	3.69	153	2.60	12.6	284	13.2	996.0	339	19.4	43	23.5	3.6	1.2	84	3.5	1.5	87	0.00	0.30	2.9	0.1	4.72	17.42	3.19	19.60
1999	1	29	11	40	5.00	152	49.29	10.7	283	11.5	996.7	342	18.2	46	21.6	3.1	-0.2	79	2.8	0.0	82	0.00	0.29	0.8	0.0	4.72	17.42	3.19	19.60
1999	1	29	12	40	6.62	152	34.88	13.0	281	12.1	998.2	341	13.6	40	17.9	3.1	-1.1	74	2.9	-0.7	78	0.00	0.30	1.6	0.2	3.67	10.60	3.03	10.31
1999	1	29	13	40	8.73	152	17.56	12.6	278	12.7	998.0	335	15.1	38	19.7	3.2	-2.9	64	3.0	-2.7	66	0.00	0.27	2.8	0.1	3.67	10.60	3.03	10.31
1999	1	29	14	40	10.36	151	59.68	13.2	276	10.2	998.7	325	15.6	34	20.7	1.6	-5.3	60	1.4	-4.7	64	0.00	0.27	0.1	0.0	3.67	10.60	3.03	10.31
1999	1	29	15	40	11.21	151	41.50	13.9	276	10.1	1000.3	323	13.3	31	18.8	1.1	-9.3	46	1.0	-8.7	49	0.00	0.23	0.0	0.1	3.05	10.70	2.03	11.18
1999	1	29	16	40	11.81	151	23.52	14.0	276	10.9	999.9	323	14.3	32	19.8	0.2	-7.9	55	0.1	-7.2	58	0.00	0.23	0.0	0.1	3.05	10.70	2.03	11.18
1999	1	29	17	40	12.69	151	5.25	14.0	275	5.1	1000.8	315	12.6	25	18.7	-0.1	-9.5	49	-0.2	-8.9	52	0.00	0.23	0.0	0.2	3.05	10.70	2.03	11.18
1999	1	29	18	40	13.81	150	47.03	14.7	280	9.9	1001.5	309	12.9	18	19.9	-0.3	-7.3	59	-0.5	-7.0	61	0.00	0.27	1.3	0.0	2.63	11.70	1.86	11.33
1999	1	29	19	40	15.65	150	28.13	14.8	279	10.6	1002.0	297	11.8	11	19.2	0.1	-7.6	56	-0.1	-7.4	58	0.00	0.27	0.1	0.1	2.63	11.70	1.86	11.33
1999	1	29	20	40	17.70	150	9.22	14.9	278	11.0	1001.5	300	10.7	14	18.0	-0.4	-7.0	61	-0.5	-6.9	62	0.00	0.24	0.0	0.0	2.63	11.70	1.86	11.33
1999	1	29	21	40	18.96	149	50.17	15.1	275	9.7	1002.1	312	12.8	24	19.3	-0.7	-7.5	60	-0.9	-7.2	62	0.00	0.22	0.0	0.0	2.81	15.34	1.57	12.62
1999	1	29	22	40	19.61	149	30.98	15.1	276	9.3	1002.3	305	9.7	16	16.9	0.0	-9.8	48	-0.1	-9.8	48	0.01	0.28	0.2	0.0	2.81	15.34	1.57	12.62
1999	1	29	23	40	20.35	149	12.29	14.9	278	9.1	1002.6	330	13.2	33	18.8	-1.7	-5.7	75	-1.9	-5.4	77	0.03	0.29	4.3	0.4	2.81	15.34	1.57	12.62
1999	1	30	0	40	21.74	148	54.42	14.4	280	9.0	1004.6	299	15.3	14	22.4	-0.5	-6.7	63	-1.0	-6.8	65	0.16	0.25	1.7	0.2	2.74	10.24	2.18	12.55
1999	1	30	1	40	23.14	148	36.52	13.6	280	10.5	1006.0	305	15.7	19	22.2	-1.3	-6.8	66	-1.2	-6.6	67	0.14	0.27	1.7	0.0	2.74	10.24	2.18	12.55
1999	1	30	2	40	24.15	148	19.69	12.1	279	10.5	1006.0	318	18.9	30	24.1	-2.2	-6.7	71	-2.5	-6.0	77	0.53	0.24	4.4	0.3	2.74	10.24	2.18	12.55
1999	1	30	3	40	25.05	148	4.05	10.2	280	9.5	1006.8	309	17.1	23	21.9	-2.1	-7.8	65	-2.5	-7.4	69	0.15	0.22	1.0	0.1	4.67	9.73	3.97	8.35
1999	1	30	4	40	26.30	147	49.63	11.4	281	9.2	1007.1	317	17.9	28	22.6	-2.4	-8.1	65	-2.7	-7.7	68	0.12	0.26	2.1	0.3	4.67	9.73	3.97	8.35
1999	1	30	5	40	27.87	147	34.18	12.1	275	9.2	1008.3	302	15.4	17	21.2	-2.1	-10.9	51	-2.2	-10.7	52	0.38	0.23	0.1	0.0	4.67	9.73	3.97	8.35
1999	1	30	6	40	29.07	147	18.62	12.4	278	6.0	1009.5	313	14.1	25	19.4	-2.4	-11.6	49	-2.6	-11.4	51	0.07	0.26	0.0	0.0	3.89	10.73	3.33	8.25
1999	1	30	7	40	29.91	147	2.70	12.1	274	4.5	1010.5	315	14.3	30	19.3	-2.7	-12.1	48	-2.8	-11.5	51	0.02	0.24	0.0	0.0	3.89	10.73	3.33	8.25
1999	1	30	8	40	30.45	146	46.66	11.6	275	5.7	1011.4	308	12.5	22	17.9	-2.2	-11.9	47	-2.3	-11.8	48	0.00	0.23	0.0	0.2	3.89	10.73	3.33	8.25
1999	1	30	9	40	31.77	146	30.05	12.7	275	4.8	1011.8	309	13.0	22	18.7	-2.1	-10.8	51	-2.2	-10.5	53	0.00	0.25	0.0	0.1	3.25	9.79	2.70	9.30
1999	1	30	10	40	32.92	146	12.52	14.0	276	5.6	1012.0	292	12.0	11	18.6	-1.7	-10.5	51	-1.8	-10.6	51	0.00	0.22	0.0	0.1	3.25	9.79	2.70	9.30
1999	1	30	11	40	34.25	145	53.74	14.8	275	2.5	1012.5	315	9.3	22	15.8	-2.0	-8.6	60	-2.2	-8.7	61	0.00	0.21	0.0	0.0	3.25	9.79	2.70	9.30
1999	1	30	12	40	35.37	145	37.56	14.6	276	2.5	1012.1	306	9.3	17	16.1	-1.8	-8.0	63	-2.0	-8.0	63	0.00	0.25	0.0	0.1	2.13	7.53	1.57	7.10
1999	1	30	13	40	36.39	145	18.45	14.8	274	2.7	1012.9	288	8.0	7	15.4	-1.9	-7.5	65	-2.1	-7.6	66	0.00	0.26	0.0	0.0	2.13	7.53	1.57	7.10
1999	1	30	14	40	37.61	144	59.41	14.5	279	2.6	1012.9	298	9.3	11	16.5	-1.4	-9.1	56	-1.5	-9.3	55	0.00	0.27	0.0	0.1	2.13	7.53	1.57	7.10
1999	1	30	15	40	39.47	144	40.36	14.5	280	6.7	1012.1	299	7.7	10	15.0	-1.5	-8.2	60	-1.6	-8.2	60	0.00	0.21	0.0	0.0	1.91	8.10	1.45	9.73
1999	1	30	16	40	42.02	144	21.34	14.8	280	6.2	1012.3	288	7.0	4	14.5	-1.4	-7.7	62	-1.5	-7.7	62	0.00	0.27	0.0	0.0	1.91	8.10	1.45	9.73
1999	1	30	17	40	44.40	144	1.75	14.9	277	5.0	1012.4	280	6.0	1	13.6	-2.7	-6.1	77	-2.7	-6.4	76	0.00	0.29	1.5	0.0	1.91	8.10	1.45	9.73
1999	1	30	18	40	46.36	143	41.91	14.8	278	4.3	1011.9	317	6.6	18	13.4	-2.9	-5.9	80	-3.1	-6.1	80	0.00	0.28	2.0	0.0	1.78	7.69	1.35	8.89
1999	1	30	19	40	48.17	143	21.81	15.1	279	3.6	1012.2	324	6.4	21	13.0	-3.1	-6.1	80	-3.3	-6.2	80	0.00	0.27	0.8	0.1	1.78	7.69	1.35	8.89
1999	1	30	20	40	50.03	143	1.73	15.1	278	4.8	1012.2	333	5.6	22	11.9	-2.8	-5.7	81	-2.8	-5.6	81	0.00	0.29	1.6	0.2	1.78	7.69	1.35	8.89
1999	1	30	21	40	49.83	142	41.62	15.1	271	4.5	1012.5	341	7.5	34	12.7	-2.6	-5.2	82	-2.8	-5.0	85	0.00	0.29	5.6	0.3	1.86	13.89	1.01	10.65
1999	1	30	22	40	50.16	142	21.58	15.0	272	4.0	1012.9	336	9.5	35	14.6	-2.4	-4.7	84	-2.6	-4.4	88	0.01	0.28	4.2	0.2	1.86	13.89	1.01	10.65
1999	1	30	23	40	49.98	142	1.94	14.8	272	3.3	1014.4	306	10.3	19	17.2	-2.1	-5.0	80	-2.5	-5.1	82	0.02	0.29	5.7	0.1	1.86	13.89	1.01	10.65
1999	1	31	0	40	41.92	141	46.08	14.8	245	8.7	1014.9	299	14.3	37	19.6	-1.0	-6.4	67	-1.3	-6.3	69	0.35	0.23	0.4	0.3	1.31	8.41	0.99	12.80
1999	1	31	1	40	35.14	141	32.62	12.1	234	8.1	1015.6	283	4.8	22	8.5	-1.7	-8.8	58	-1.6	-8.6	59	0.21	0.25	0.0	0.1	1.31	8.41	0.99	12.80
1999	1	31	2	40	33.86	141	29.45	3.3	62	7.6	1014.6	225	8.2	158	6.6	-0.5	-9.2	52	-0.4	-9.1	52	0.58	0.24	0.0	0.1	1.31	8.41	0.99	12.80
1999	1	31	3	40	33.84	141	29.46	3.3	62	7.4	1013.4	243	7.5	181	5.9	1.3	-9.6	44	1.0	-9.8	44	0.25	0.24	0.0	0.1	0.38	11.24	0.32	8.96
1999	1	31	4	40	33.84	141	29.46	3.3	62	7.3	1012.9	256	8.9	197	7.3	1.5	-9.0	45	1.2	-9.2	46	0.52	0.24	0.0	0.0	0.38	11.24	0.32	8.96
1999	1	31	5	40	33.85	141	29.46	3.3	62	7.2	1012.0	251	9.1	190	7.4	1.7	-8.5	47	1.5	-8.4	48	0.42	0.24	0.0	0.0	0.38	11.24	0.32	8.96
1999	1	31	6	40	33.26	141	30.88	8.2	112	7.1	1011.7	233	10.0	95	9.1	1.1	-7.4	53	1.3	-7.1	53	0.20	0.25	0.0	0.3	0.40	9.34	0.36	8.87
1999	1	31	7	40	46.90	141	34.16	15.7	4	7.2	1010.5	235	12.2	272	9.5	1.4	-4.8	63	1.1	-4.9	64	0.08	0.25	0.0	0.0	0.40	9.34	0.36	8.87
1999	1	31	8	41	2.09	141	35.95	15.6	0	7.2	1010.4	248	11.6	289	11.3	-0.7	-4.1	77	-0.2	-3.8	77	0.00	0.29	0.8	0.0	0.40	9.34	0.36	8.87
1999	1	31	9	41	17.60	141	37.27	15.4	0	7.3	1010.4	264	8.8	308	11.0	-0.3	-2.4	86	-0.3	-2.1	88	0.00	0.29	5.4	0.0	1.24	14.93	1.58	16.58
1999	1	31	10	41	30.02	141	29.62	14.8	271	7.3	1010.2	312	12.7	14	19.8	-0.3	-4.2	75	0.0	-4.1	74	0.00	0.28	1.9	0.3	1.24	14.93	1.58	16.58
1999	1	31	11	41	27.29	141	18.00	0.7	301	7.3	1011.0	289	14.8	341	15.3	1.0	-6.4	58	0.9	-6.4	58	0.00	0.25	0.0	0.2	1.24	14.93	1.58	16.58
1999	1	31	12	41	27.08	141	18.03	1.0	273	7.6	1011.1	294	14.1	19	14.5	0.0	-5.3	68	0.0	-5.3	67	0.00	0.22	0.0	0.0	1.15	5.38	0.68	9.47
1999	1	31	13	41	26.44	141	17.66	0.7	274	8.1	1010.9	282	13.3	8	13.7	0.4	-4.2	71	0.3	-4.3	71	0.00	0.28	0.4	0.0	1.15	5.38	0.68	9.47
1999	1	31	14	41	27.17	141	18.25	0.3	291	8.6	1010.8	284	17.6	354	17.7	1.5	-6.4	56	1.4	-6.3	56	0.00	0.25	0.1	0.0	1.15	5.38	0.68	9.47
1999	1	31	15	41	26.94	141	18.49	0.1	291	9.1	1011.3	288	17.6	358	17.7	0.9	-8.9	48	0.7	-9.0	48	0.00	0.23	0.0	0.0	1.42	5.10	0.79	5.99
1999	1	31	16	41	26.91	141	18.60	0.9	293	9.5	1011.2	298	16.3	13	16.7	0.4	-8.7	51	0.3	-8.8	50	0.00	0.23	0.0	0.0	1.42	5.10	0.79	5.99
1999	1	31	17	41	27.06	141	17.98	0.8	303	10.0	1011.5	302	14.5	1	14.9	-0.3	-9.1	51	-0.4	-9.1	52	0.00	0.21	0.0	0.1	1.42	5.10	0.79	5.99
1999	1	31	18	41	27.00	141	17.96	0.7	310	10.3	1011.6	308	13.9	359	14.2	-0.7	-9.8	50	-0.7	-9.6	51	0.00	0.21	0.0	0.0	1.00	4.55	0.76	5.10
1999	1	31	19	41	27.35	141	17.83	1.5	293	10.7	1011.6	299	10.7	5	11.4	-0.9	-10.1	50	-1.0	-10.3	49	0.00	0.26	0.0	0.0	1.00	4.55	0.76	5.10

1999	1	31	20	41	27.39	141	17.75	0.6	265	11.0	1011.2	273	10.0	8	10.3	-0.7	-9.3	52	-1.0	-9.4	53	0.00	0.24	0.0	0.0	1.00	4.55	0.76	5.10
1999	1	31	21	41	27.13	141	17.59	0.8	270	11.2	1010.9	258	5.4	349	5.9	-0.9	-8.8	55	-1.0	-9.0	55	0.00	0.22	0.0	0.1	0.62	3.88	0.50	6.56
1999	1	31	22	41	25.24	141	17.72	2.6	183	11.4	1010.6	264	6.3	66	6.9	-0.6	-9.3	52	-0.9	-9.4	53	0.01	0.21	0.0	0.1	0.62	3.88	0.50	6.56
1999	1	31	23	41	21.96	141	14.36	2.2	31	11.2	1010.7	186	4.3	115	3.9	-4.6	-10.5	63	-4.7	-9.8	67	0.07	0.22	0.0	0.2	0.62	3.88	0.50	6.56
1999	2	1	0	41	21.96	141	14.38	2.2	31	11.1	1010.2	180	5.1	142	4.2	-4.0	-8.7	70	-3.5	-8.6	68	0.12	0.26	0.0	0.3	0.21	5.06	0.16	5.68
1999	2	1	1	41	21.97	141	14.40	2.2	31	10.9	1009.7	170	4.2	126	3.5	-2.8	-5.4	82	-2.0	-4.8	82	0.09	0.29	0.2	0.0	0.21	5.06	0.16	5.68
1999	2	1	2	41	21.96	141	14.36	2.2	31	10.6	1008.8	187	3.3	144	2.3	-1.9	-3.4	89	-1.4	-3.9	83	0.08	0.29	2.1	0.3	0.21	5.06	0.16	5.68
1999	2	1	3	41	21.96	141	14.36	2.2	30	10.3	1007.3	247	3.9	228	3.1	0.1	-1.4	89	0.1	-3.2	79	0.25	0.28	0.9	0.4	0.16	6.49	0.18	6.13

Sum File (MR98-K02)

Station No.		Date (Start)	Time (Strat)	Date (Stop)	Time (Stop)		Location (Start)	Location (Stop)	Depth (m)
1	UTC	30-Dec-98	23:20	31-Dec-98	10:20	Latitude	3-58.2N	4-05.4N	4762
	Ship Time	31-Dec-98	8:20	31-Dec-98	19:20	Longitude	134-57.8E	135-01.3E	
	Japan Time	31-Dec-98	8:20	31-Dec-98	19:20				

Wind Direction	Wind Speed	Weather	Temp (dry)	Temp (wet)	Water Temp	Pressure (hpa)	Time (Ship)
ESE	5.0m/sec	c	30.5° C	27.0° C	30.0° C	1011.5	12:00

Observation Menu	Status & Position	Date Ship Time	Time Ship Time	Latitude	Longitude	Sensor Depth m	Remark
Sediment Trap	Deploy	12/31	10:18	4-02.911N	135-00.019E	4708	
CTD	Start	12/31	11:50	4-02.8488N	135-01.1816E		9802011.DAT
Shallow Cast 4	Max Depth		11:57	4-02.9442N	135-01.2534E	200	
	Stop		12:24	4-03.1504N	135-01.3697E		
Sea Surface	Start	12/31	11:54				Bucket Temp
Sampling	Stop		12:40	4-03.353N	135-01.325E		29.4° C
Freefall	Start	12/31	13:10				
	Max Depth		13:12	4-04.2005N	135-01.1713E	200	
	Stop		13:16	4-04.3901N	135-01.1501E		
	Start	12/31	13:17	4-04.4047N	135-01.1531E		
	Max Depth		13:20	4-04.5372N	135-01.1130E	200	
	Stop		13:27	4-04.8140N	135-01.0441E		
in-situ	Deploy	12/31	14:29	4-04.9283N	135-00.8387E		
Filtration	Recover		19:20	4-04.8320N	135-00.2791E		

Sum File (MR98-K02)

Station No.		Date (Start)	Time (Strat)	Date (Stop)	Time (Stop)		Location (Start)	Location (Stop)	Depth (m)
2	UTC	1-Jan-99	7:00	2-Jan-99	8:20	Latitude	5-00.7114N	5-00.2588N	
	Ship Time	1-Jan-99	16:00	2-Jan-99	17:20	Longitude	140-01.1955E	140-08.7448E	
	Japan Time	1-Jan-99	16:00	2-Jan-99	17:20				

Wind Direction	Wind Speed	Weather	Temp (dry)	Temp (wet)	Water Temp	Pressure (hpa)	Time (Ship)
East	8.5m/sec	o	29.0° C	27.0° C	30.1° C	1009.8	12:00

Observation Menu	Status & Position	Date Ship Time	Time Ship Time	Latitude	Longitude	Sensor Depth m	Remark
Floating Sediment Trap	Deploy	1/1	16:15	5-00.4415N	140-00.4560E		
	Recover	1/2	17:20	5-00.2588N	140-08.7448E		
CTD Shallow Cast 1	Start	1/1	17:25	5-01.1122N	140-01.8530E		9802021.DAT
	Max Depth		17:29	5-01.1363N	140-01.9386E	200	
	Stop		17:42	5-01.2200N	140-02.1431E		
Sea Surface Sampling	Start	1/1	17:38				Bucket Temp
	Stop		17:47	5-01.2427N	140-02.1966E		29.6° C
CTD Shallow Cast 2	Start	1/1	18:34	5-01.1940N	140-02.2198E		9802022.DAT
	Max Depth		18:41	5-01.2020N	140-02.3321E	200	
	Stop		19:11	5-01.2700N	140-02.9055E		9802022U.DAT
Sea Surface Sampling	Start	1/1	19:42	5-01.3777N	140-03.5338E		
	Stop		19:47	5-01.4271N	140-03.7004E		
Incubation	Deploy	1/1	19:50	5-01.4620N	140-03.7674E		
	Recover	1/2	16:16	5-00.0430N	140-07.8131E		
CTD deep cast	Start	1/1	21:12	5-01.8591N	140-05.0488E		9802023.DAT
	Max Depth		22:27	5-02.0715N	140-06.1590E	4100	depth 4176m
	Stop		23:59	5-02.3417N	140-07.4518E		
Plankton Net	Start	1/2	0:36	5-02.4973N	147-07.9169E		
	Max Depth		1:00	5-02.6912N	140-08.0756E	1000	
	Stop		1:30	5-02.7701N	140-08.0064E		
Sediment Trap	Deploy	1/2	6:10	5-04.9498N	140-07.4079E		
	Recover		7:45	5-03.6147N	140-06.3294E		
CTD Shallow Cast 3	Start	1/2	10:03	5-02.1741N	140-06.2437E		9802024.DAT
	Max Depth		10:09	5-02.1392N	140-06.1938E	200	
	Stop		10:40	5-02.0482N	140-05.9279E		
Sea Surface Sampling	Start	1/2	10:15	5-02.1073N	140-06.1421E		Bucket Temp
	Stop		10:33	5-02.0950N	140-06.0936E		29.7° C
Sea Surface Sampling	Start	1/2	10:47	5-02.0207N	140-05.8765E		
	Stop		10:50	5-02.0102N	140-05.8213E		
Freefall	Start	1/2	11:04	5-02.0247N	140-05.7765E		
	Max Depth		11:08	5-01.9928N	140-05.7163E	200	
	Stop		11:12	5-01.9769N	140-05.6723E		
	Start	1/2	11:12	5-01.9769N	140-05.6723E		
	Max Depth		11:15	5-01.9497N	140-05.6331E	200	
	Stop		11:23	5-01.9085N	140-05.4825E		

Sum File (MR98-K02)

Station No.		Date (Start)	Time (Strat)	Date (Stop)	Time (Stop)		Location (Start)	Location (Stop)	Depth (m)
3	UTC	3-Jan-99	10:09	4-Jan-99	11:14	Latitude	0-00.3171N	0-00.4753N	3638
	Ship Time	3-Jan-99	22:09	4-Jan-99	23:14	Longitude	144-59.8077E	145-02.6939E	
	Japan Time	3-Jan-99	21:09	4-Jan-99	22:14				

Wind Direction	Wind Speed	Weather	Temp (dry)	Temp (wet)	Water Temp	Pressure (hpa)	Time (Ship)
SE	4.6m/sec	bc	30.3° C	26.0° C	30.3° C	1011.3	12:00

Observation Menu	Status & Position	Date Ship Time	Time Ship Time	Latitude	Longitude	Sensor Depth m	Remark
CTD Shallow Cast 1	Start	1/3	22:10	0-00.3171N	144-59.8077E		9802031.DAT
	Max Depth		22:16	0-00.3311N	144-59.7964E	200	
	Stop		22:29	0-00.3606N	144-59.8442E		
Sea Surface Sampling	Start	1/3	22:14	0-00.3290N	144-59.8017E		Bucket Temp
	Stop		22:27	0-00.3474N	144-59.8590E		29.7° C
CTD Shallow Cast 2	Start	1/3	23:18	0-00.4333N	144-59.8940E		9802032.DAT
	Max Depth		23:25	0-00.4390N	144-59.8776E	200	
	Stop		23:49	0-00.4567N	144-59.8535E		
Incubation	Deploy	1/4	0:03	00-00.4119N	144-59.8321E		
	Recover		23:14	00-01.4753N	145-02.6939E		
Plankton Net	Start	1/4	0:32	00-00.4887N	144-59.8956E		
	Stop		3:22	0-00.6340N	144-59.7186E		
CTD deep cast	Start	1/4	3:47	0-01.6619N	144-59.8394E		9802033.DAT
	Max Depth		4:41	0-01.4830N	145-00.0378E	3563	
	Stop		6:05	0-01.1632N	145-00.3766E		
Sediment Trap	Deploy	1/4	8:00	0-00.7518S	144-59.9290E		depth 3762m
	Recover		9:20	0-00.8425S	145-01.5795E		depth 3680m
CTD Shallow Cast 3	Start	1/4	11:12	00-00.3844N	145-01.2176E		9802034.DAT
	Max Depth		11:19	00-00.4837N	145-01.2203E	200	
	Stop		11:44	00-00.5952N	145-01.3292E		
Sea Surface Sampling	Start	1/4	11:15	00-00.4175N	145-01.2203E		Bucket Temp
	Stop		11:30	00-00.5067N	145-01.2613E		29.7° C
Freefall	Start	1/4	12:08	0-00.6628N	145-01.3456E		
	Max Depth		12:11	0-00.6573N	145-01.3279E	200	
	Stop		12:14	0-00.6388N	145-01.3156E		
	Start	1/4	12:14	0-00.6376N	145-01.3129E	200	
	Max Depth		12:17	0-00.6241N	145-01.2946E		
	Stop		12:20	0-00.5986N	145-01.2662E		
in-situ Filtration	Start	1/4	13:27	0-00.2934N	145-01.0240E	3300	
	Stop		17:11	0-00.3223S	145-02.4770E		
Niskin-X Calibration	Start	1/4	18:10	0-00.2405S	145-02.8112E		
	Stop		18:51	0-00.0153S	145-02.9452E		

Sum File (MR98-K02)

Station No.		Date (Start)	Time (Strat)	Date (Stop)	Time (Stop)		Location (Start)	Location (Stop)	Depth (m)
4	UTC	5-Jan-99	1:26	5-Jan-99	2:57	Latitude	0-00.0120S	0-00.0532S	4591
	Ship Time	5-Jan-99	11:26	5-Jan-99	12:57	Longitude	147-53.1694E	147-52.8812E	
	Japan Time	5-Jan-99	10:26	5-Jan-99	11:57				

Wind Direction	Wind Speed	Weather	Temp (dry)	Temp (wet)	Water Temp	Pressure (hpa)	Time (Ship)
East	8.0m/sec	bc	31.0° C	26.0° C	29.6° C	1010.7	12:00

Observation Menu	Status & Position	Date Ship Time	Time Ship Time	Latitude	Longitude	Sensor Depth m	Remark
CTD	Start	1/5	11:26	0-00.0120S	147-53.1694E		9802041.DAT
Shallow Cast 6	Max Depth		11:35	0-00-0073S	147-53.1386E	200	
	Stop		12:01	0-00.0088N	147-53.0941E		
Sea Surface	Start	1/5	11:29	00-00.0030S	147-53.1568E		Bucket Temp
Sampling	Stop		11:42	00-00.0278S	147-53.1167E		29.6° C
Freefall	Start	1/5	12:20	0-00.0070S	147-52.9808E		
	Max Depth		12:23	0-00.0259S	147-52.9649E	200	
	Stop		12:26	0-00.0047S	147-52.9722E		
	Start	1/5	12:28	0-00.0052S	147-52.9716E	200	
	Max Depth		12:31	0-00.0028S	147-52.9830E		
	Stop		12:33	0-00.0225S	147-52.9696E		

Sum File (MR98-K02)

Station No.		Date (Start)	Time (Strat)	Date (Stop)	Time (Stop)		Location (Start)	Location (Stop)	Depth (m)
5	UTC	6-Jan-99	1:02	6-Jan-99	2:50	Latitude	0-00.0643S	0-00.1421N	4153
	Ship Time	6-Jan-99	11:02	6-Jan-99	12:50	Longitude	153-15.8214E	153-15.5039E	
	Japan Time	6-Jan-99	10:02	6-Jan-99	11:50				

Wind Direction	Wind Speed	Weather	Temp (dry)	Temp (wet)	Water Temp	Pressure (hpa)	Time (Ship)
SE	6.0m/sec	bc	31.0° C	27.0° C	30.1° C	1009.8	12:00

Observation Menu	Status & Position	Date Ship Time	Time Ship Time	Latitude	Longitude	Sensor Depth m	Remark
CTD	Start	1/6	11:02	0-00.0643S	153-15.8214E		9802051.DAT
Shallow Cast 5	Max Depth		11:11	0-00.0574S	153-15.8106E		
	Stop		11:33	0-00.1520S	153-15.8931E		
Sea Surface Sampling	Start	1/6	11:03	0-00.0654S	153-15.8161E		Bucket Temp 30.1° C
	Stop		11:24	0-00.1233S	153-15.9009E		
Freefall	Start	1/6	11:53	0-00.1023S	153-15.8844E		
	Max Depth		11:53	0-00.0920S	153-15.8834E		
	Stop		11:58	0-00.0898S	153-15.8825E		
Hyper-Buoy	Start	1/6	12:32	0-00.0949N	153-15.5106E		
	Stop		12:50	0-00.1421N	153-15.5039E		

Sum File (MR98-K02)

Station No.		Date (Start)	Time (Strat)	Date (Stop)	Time (Stop)		Location (Start)	Location (Stop)	Depth (m)
6	UTC	7-Jan-99	6:50			Latitude	0-00.1003N		2800
	Ship Time	7-Jan-99	17:50			Longitude	160-00.0212E		
	Japan Time	7-Jan-99	15:50						

Wind Direction	Wind Speed	Weather	Temp (dry)	Temp (wet)	Water Temp	Pressure (hpa)	Time (Ship)
SE	8m/sec	bc	30.0° C	26.5° C	29.0° C	1012.7	12:00

Observation Menu	Status & Position	Date Ship Time	Time Ship Time	Latitude	Longitude	Sensor Depth m	Remark
CTD	Start	1/7	17:52	0-00.1003N	160-00.0212E		9802061.DAT
Shallow Cast 1	Max Depth		17:58	0-00.1677N	160-00.0137E	200	
	Stop		18:11	0-00.2602N	160-00.0264E		
Sea Surface	Start	1/7	17:55	0-00.1477N	160-00.0013E		Bucket Temp
Sampling	Stop		18:08	0-00.2541N	160-00.3130E		29.0° C
CTD	Start	1/7	18:27	0-00.2976N	159-59.9252E		9802062.DAT
Shallow Cast 2	Max Depth		18:33	0-00.3146N	159-59.8923E	200	
	Stop		18:54	0-00.2398N	159-59.7877E		
Incubation	Deploy	1/7	19:17	0-00.2534N	159-59.6687E		
	Recover	1/8	19:13	0-04.0828N	159-56.0822E		
CTD	Start	1/7	20:32	0-00.2602N	159-59.6555E		9802064.DAT
deep cast	Max Depth		21:20	0-00.9169N	159-59.6271E	2830	
	Stop		22:36	0-01.0748N	159-59.7588E		
Plankton Net	Start	1/7	23:57	0-01.3831N	159-59.8806E		
	Stop	1/8	2:47	0-02.7412N	159-59.4695E		
Sea Surface	Start	1/8	2:51	0-02.7412N	159-59.4463E		Bucket Temp
Sampling	Stop		2:56	0-02.7781N	159-59.4463E		
Sediment Trap	Deploy	1/8	6:48	0-04.3708N	159-58.7132E		
	Recover		7:40	0-02.8077N	159-57.1271E	2802	
CTD	Start	1/8	10:04	0-04.0912N	159-57.7278E		9802063.DAT
Shallow Cast 3	Max Depth		10:10	0-04.0972N	159-57.6883E	200	
	Stop		10:33	0-04.1497N	159-57.6466E		
Sea Surface	Start	1/8	10:06	0-04.0976N	159-57.7144E		Bucket Temp
Sampling	Stop		10:19	0-04.1243N	159-57.6830E		28.85° C
	Start	1/8	10:21	0-04.1321N	159-57.6811E		Bucket Temp
	Stop		10:36	0-04.1295N	159-57.6568E		
Radio Sonde		1/8	10:39	0-04.1675N	159-57.5699E		
Freefall	Start	1/8	11:29	0-04.5940N	159-57.9344E		
	Max Depth		11:31	0-04.6324N	159-57.9750E	200	
	Stop		11:36	0-04.6898N	159-57.9835E		
	Start	1/8	11:36	0-04.6898N	159-57.9835E		
	Max Depth		11:39	0-04.7003N	159-57.9891E	200	
	Stop		11:45	0-04.7502N	159-57.0445E		
Sea Surface	Start	1/8	11:53	0-04.8245N	159-58.0759E		
Sampling	Stop		11:56	0-04.8435N	159-58.1003E		
in-situ	Start	1/8	13:33	0-03.0758N	159-57.8799E		
Filtration	Stop		16:53	0-02.9153N	159-58.2044E		
Sea Surface	Start	1/8	14:32	0-03.2471N	159-57.9301E		
Sampling	Stop		15:28	0-03.9922N	159-57.3594E		

Sum File (MR98-K02)

Station No.		Date (Start)	Time (Strat)	Date (Stop)	Time (Stop)		Location (Start)	Location (Stop)	Depth (m)
7	UTC	9-Jan-99	0:00	9-Jan-99	2:07	Latitude	0-00.0021S	0-00.3487N	4463
	Ship Time	9-Jan-99	11:00	9-Jan-99	13:07	Longitude	163-36.0940E	163-35.4522E	
	Japan Time	9-Jan-99	9:00	9-Jan-99	11:07				

Wind Direction	Wind Speed	Weather	Temp (dry)	Temp (wet)	Water Temp	Pressure (hpa)	Time (Ship)
NE	5.0m/sec	bc	30.0° C	25.0° C	28.5° C	1013.8	12:00

Observation Menu	Status & Position	Date Ship Time	Time Ship Time	Latitude	Longitude	Sensor Depth m	Remark
CTD	Start	1/9	11:02	0-00.0021S	163-36.0940E		9802071.DAT
Shallow Cast 5	Max Depth		11:09	0-00.0026N	163-36.6422E	200	Fail
	Stop		11:33	0-00.0808N	163-36.0050E		
	Start	1/9	11:42	0-00.0808N	163-36.0050E		9802072.DAT
	Max Depth		11:48	0-00.0891N	163-35.9957E		
	Stop		12:04	0-00.1420N	163-35.9957E		
Sea Surface Sampling	Start	1/9	11:03	0-00.0059S	163-36.0751E		Bucket Temp
	Stop		11:18	0-00.6838N	163-36.0431E		28.45° C
Freefall	Start	1/9	12:30	0-00.2070N	165-35.6610E		
	Max Depth		12:34	0-00.2177N	165-35.6235E	200	
	Stop		12:37	0-00.2115N	165-35.6115E		
	Start	1/9	12:39	0-00.2080N	165-35.5899E		
	Max Depth		12:42	0-00.2277N	165-35.5650E	200	
	Stop		12:48	0-00.2526N	165-35.4728E		
Hyper Buoy	Start	1/9	12:56	0-00.2753N	163-35.4522E		
	Stop		13:07	0-00.3487N	163-35.4522E		

Sum File (MR98-K02)

Station No.		Date (Start)	Time (Strat)	Date (Stop)	Time (Stop)		Location (Start)	Location (Stop)	Depth (m)
8	UTC	10-Jan-99	0:00	10-Jan-99	1:26	Latitude	0-00.2997S	0-00.1240S	4317
	Ship Time	10-Jan-99	11:00	10-Jan-99	12:26	Longitude	168-55.9350E	168-56.2092E	
	Japan Time	10-Jan-99	9:00	10-Jan-99	10:26				

Wind Direction	Wind Speed	Weather	Temp (dry)	Temp (wet)	Water Temp	Pressure (hpa)	Time (Ship)
SE	5.0m/sec	bc	29.0° C	26.0° C	27.5° C	1013.7	12:00

Observation Menu	Status & Position	Date Ship Time	Time Ship Time	Latitude	Longitude	Sensor Depth m	Remark
CTD	Start	1/10	11:01	0-00.2997S	168-55.9350E		9802081.DAT
Shallow Cast 5	Max Depth		11:08	0-00.3255S	168-55.9580E	200	
	Stop		11:27	0-00.4312S	168-55.0367E		
Sea Surface Sampling	Start	1/10	11:02	0-00.2933S	168-55.9397E		Bucket Temp
	Stop		11:21	0-00.3802S	168-56.0298E		27.45° C
Freefall	Start	1/10	11:54	0-00.6089S	168-56.0704E		
	Max Depth		11:57	0-00.6470S	168-56.0854E		
	Stop		12:05	0-00.7186S	168-56.1149E		
Hyper Buoy	Start	1/10	12:09	0-00.8455S	168-56.1257E		
	Stop		12:26	0-00.1240S	168-56.2092E		

Sum File (MR98-K02)

Station No.		Date (Start)	Time (Strat)	Date (Stop)	Time (Stop)		Location (Start)	Location (Stop)	Depth (m)
9	UTC	11-Jan-99	3:50			Latitude	0-00.0522N		4831
	Ship Time	11-Jan-99	15:50			Longitude	174-59.7182E		
	Japan Time	11-Jan-99	12:50						

Wind Direction	Wind Speed	Weather	Temp (dry)	Temp (wet)	Water Temp	Pressure (hpa)	Time (Ship)
East	5.8m/sec	bc	28.0° C	24.0° C	27.8° C	1012.9	12:00

Observation Menu	Status & Position	Date Ship Time	Time Ship Time	Latitude	Longitude	Sensor Depth m	Remark
CTD Shallow Cast 1	Start	1/11	15:54	0-00.0505N	174-59.6967E		9802091.DAT
	Max Depth		15:59	0-00.0734N	174-59.6047E	200	
	Stop		16:12	0-00.1704N	174-59.4078E		
Sea Surface Sampling	Start	1/11	15:57	0-00.0727N	174-59.6642E		Bucket Temp
	Stop		16:12	0-00.1704N	174-59.4078E		26.80° C
CTD Shallow Cast 2	Start	1/11	16:29	0-00.1810N	174-59.1264E		9802092.DAT
	Max Depth		16:35	0-00.1606N	174-59.0445E		
	Stop		16:55	0-00.1368N	174-58.8705E		
Sea Surface Sampling	Start	1/11	16:38	0-00.1626N	174-59.0197E		Bucket Temp
	Stop		16:40				
Incubation	Deploy	1/11	17:22	0-00.1488N	174-58.5884E		
	Recover	1/12	17:37	0-03.0677N	174-54.9259E		
CTD deep cast	Start	1/11	18:24	0-01.4486N	174-57.6889E		9802093.DAT
	Max Depth		19:41	0-01.7394N	174-57.8370E	4812	4827m
	Stop		21:30	0-01.9142N	174-58.2789E		
Plankton Net	Start	1/11	23:55	0-01.9603N	174-58.7492E		
	Stop	1/12	3:24	0-03.1963N	174-55.0095E		
Sea Surface Sampling	Start	1/12	3:29	0-03.2186N	174-54.9338E		
	Stop		3:35	0-03.2412N	174-54.8247E		
Sediment Trap	Deploy	1/12	6:18	0-02.2798N	174-55.5611E		
	Recover		7:55	0-02.3427N	174-56.4321E	4828	
Calibration	Start	1/12	8:50	0-02.6096N	174-56.0394E		
	Stop		9:36	0-03.1451N	174-55.4925E		
CTD Shallow Cast 3	Start	1/12	10:01	0-03.5504N	174-54.8251E		9802094.DAT
	Max Depth		10:17	0-03.5566N	174-54.7946E	200	
	Stop		10:29	0-03.6414N	174-54.6973E		
Sea Surface Sampling	Start	1/12	10:01	0-03.5423N	174-54.8235E		Bucket Temp
	Stop		10:15	0-03.6063N	174-54.7463E		26.45° C
Hyper Buoy	Start	1/12	10:44	0-03.5908N	174-54.6419E		
	Stop		11:03	0-03.7376N	174-54.6586E		
Freefall	Start	1/12	11:30	0-03.8774N	174-54.6466E		
	Max Depth		11:33	0-03.9100N	174-54.6764E	200	
	Stop		11:37	0-03.9166N	174-54.6840E		
	Start	1/12	11:37	0-03.9166N	174-54.6840E		
	Max Depth		11:41	0-03.9147N	174-54.6655E	200	
	Stop		11:44	0-03.9336N	174-54.6644E		
in-situ Filtration	Start	1/12	12:45	0-03.6799N	174-54.7185E	4500	
	Stop		16:48	0-03.1382N	174-54.9788E		

Sum File (MR98-K02)

Station No.		Date (Start)	Time (Strat)	Date (Stop)	Time (Stop)		Location (Start)	Location (Stop)	Depth (m)
10	UTC	12-Jan-99	23:00	13-Jan-99	0:19	Latitude	0-00.0523S	0-00.1615S	5451
	Ship Time	13-Jan-99	11:00	13-Jan-99	12:19	Longitude	178-47.7580E	178-46.0633E	
	Japan Time	13-Jan-99	8:00	13-Jan-99	9:19				

Wind Direction	Wind Speed	Weather	Temp (dry)	Temp (wet)	Water Temp	Pressure (hpa)	Time (Ship)
East	6.0m/sec	bc	26.0° C	23.5° C	26.0° C	1014.8	12:00

Observation Menu	Status & Position	Date Ship Time	Time Ship Time	Latitude	Longitude	Sensor Depth m	Remark
CTD	Start	1/13	11:02	0-00.0523S	178-47.7580E		9802101.DAT
Shallow Cast 5	Max Depth		11:08	0-00.0911S	178-47.5743E	200	
	Stop		11:31	0-00.1324S	178-47.1858E		
Sea Surface	Start	1/13	11:03	0-00.0561S	178-47.7444E		Bucket Temp
Sampling	Stop		11:18	0-00.1303S	178-47.1858E		26.1° C
Freefall	Start	1/13	11:51	0-00.1387S	178-46.7431E		
	Max Depth		11:54	0-00.1454S	178-46.6704E	200	
	Stop		11:58	0-00.1338S	178-46.5551E		
Hyper Buoy	Start	1/13	12:03	0-00.1479S	178-46.4434E		
	Stop		12:19	0-00.1615S	178-46.0633E		

Sum File (MR98-K02)

Station No.		Date (Start)	Time (Strat)	Date (Stop)	Time (Stop)		Location (Start)	Location (Stop)	Depth (m)
11	UTC	13-Jan-99	23:00			Latitude	0-00.0821N		5558
	Ship Time	13-Jan-99	11:00			Longitude	176-17.3996W		
	Japan Time	14-Jan-99	8:00						

Wind Direction	Wind Speed	Weather	Temp (dry)	Temp (wet)	Water Temp	Pressure (hpa)	Time (Ship)
					26.0° C		12:00

Observation Menu	Status & Position	Date Ship Time	Time Ship Time	Latitude	Longitude	Sensor Depth m	Remark
CTD	Start	1/13	11:03	0-00.0821N	176-17.3996W		9802111.DAT
Shallow Cast 5	Max Depth		11:09	0-00.0295N	176-17.4637W	200	
	Stop		11:32	0-00.0593S	176-17.6147W		
Sea Surface Sampling	Start	1/13	11:04	0-00.0733N	176-17.3996W		Bucket Temp 25.90° C
	Stop		11:19	0-00.0024S	176-17.4751W		
Freefall	Start	1/13	11:52	0-00.1767S	176-17.9486W		
	Max Depth		11:56	0-00.1878S	176-17.9682W	200	
	Stop		12:01	0-00.2170S	176-17.0220W		
	Start	1/13	12:02	0-00.2205S	176-18.0345W		
	Max Depth		12:06	0-00.2360S	176-18.0857W		
	Stop		12:10	0-00.2325S	176-18.1108W		
Hyper Buoy	Start	1/13	12:12	0-00.2327S	176-18.1301W		
	Stop		12:31	0-00.3178S	176-18.2854W		

Sum File (MR98-K02)

Station No.		Date (Start)	Time (Strat)	Date (Stop)	Time (Stop)		Location (Start)	Location (Stop)	Depth (m)
12	UTC	15-Jan-99	3:00	16-Jan-99	11:30	Latitude	0-00.0450S		5397
	Ship Time	14-Jan-99	16:00	16-Jan-99	0:30	Longitude	170-05.0679W		
	Japan Time	15-Jan-99	12:00	16-Jan-99	20:30				

Wind Direction	Wind Speed	Weather	Temp (dry)	Temp (wet)	Water Temp	Pressure (hpa)	Time (Ship)
ESE	7.4m/sec	bc	26.5° C	24.0° C	25.9° C	1012.3	16:00

Observation Menu	Status & Position	Date Ship Time	Time Ship Time	Latitude	Longitude	Sensor Depth m	Remark
Floating Sediment Trap	Deploy	1/14	16:32	0-00.1017S	170-04.9305W		
	Recover	1/15	19:00	0-09.8553S	169-59.7230W		
CTD Shallow Cast 1	Start	1/14	16:44	0-00.2050N	170-04.9323W		9802121.DAT
	Max Depth		16:51	0-00.2242N	170-05.0158W		
	Stop		17:10	0-00.1995N	170-05.0445W		
Sea Surface Sampling	Start	1/14	16:47	0-00.2070N	170-04.9626W		Bucket Temp 25.1° C
	Stop		16:59	0-00.1834N	170-05.0411W		
CTD Shallow Cast 2	Start	1/14	17:30	0-00.1877N	170-05.1059W		9802122.DAT
	Max Depth		17:37	0-00.1732N	170-05.1080W		
	Stop						
Incubation	Deploy	1/14	18:15	0-00.4031N	170-05.2718W		
	Recover	1/15	16:46	0-03.9461S	170-08.1822W		
CTD deep cast	Start	1/14	19:10	0-00.2374N	170-05.4514W		9802123.DAT
	Max Depth		20:24	0-00.0960N	170-05.1310W	5368	
	Stop		22:18	0-00.1403S	170-04.3001W		
Plankton Net	Start	1/15	0:07	0-00.5126S	170-07.8836W		
	Stop		2:25	0-00.2091S	170-07.5593W		
Sediment Trap	Deploy	1/15	7:00	0-02.5S	170-10.8W		
	Recover		8:50	0-02.3058S	170-09.7051W		
CTD Shallow Cast 3	Start	1/15	10:34	0-02.8753S	170-10.9810W		9802124.DAT
	Max Depth		10:42	0-02.9516S	170-11.0287W	200	
	Stop		11:04	0-03.1795S	170-11.1049W		
Sea Surface Sampling	Start	1/15	10:35	0-02.8854S	170-11.0012W		Bucket Temp 25.10° C
	Stop		10:54	0-03.1014S	170-10.9912W		
Hyper Buoy	Start	1/15	11:27	0-03.3684S	170-11.1788W		
	Stop		11:29	0-03.3908S	170-11.2199W		
Freefall	Start	1/15	11:45	0-03.3459S	170-11.1892W		
	Max Depth		11:49	0-03.3319S	170-11.1828W	200	
	Stop		11:52	0-03.3182S	170-11.1589W		
	Start	1/15	11:53	0-03.3131S	170-11.1488W		
	Max Depth		11:57	0-03.3314S	170-11.1043W	200	
	Stop		12:05	0-03.3314S	170-11.1043W		
in-situ Filtration	Start	1/15	12:17	0-03.3115S	170-11.1681W	5000	
	Stop		16:32	0-03.9108S	170-08.0269W		

2.3 List of Participants

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21	Hidekazu Ohta	KEEC	TECHNICIAN	1-3-5 Azuti-machi Chuo-ku Osaka 541-0052 JAPAN
22	Munehito Kimura	KEEC	TECHNICIAN	1-3-5 Azuti-machi Chuo-ku Osaka 541-0052 JAPAN
23	Ken-ichi Masaki	KEEC	TECHNICIAN	1-3-5 Azuti-machi Chuo-ku Osaka 541-0052 JAPAN
24	Akifumi Shimamoto	KEEC	TECHNICIAN	1-3-5 Azuti-machi Chuo-ku Osaka 541-0052 JAPAN
25	Kiminori Shitashima	CRIEPI	SENIOR RESEARCHER	1646 Abiko Abiko Chiba 270-1194 JAPAN
26	Masanori Imamura	CRIEPI	SENIOR RESEARCHER	1646 Abiko Abiko Chiba 270-1194 JAPAN
27	Yoshiaki Maeda	RITE	SENIOR RESEARCHER	1646 Abiko Abiko Chiba 270-1194 JAPAN
28	Akinori Uchiyama	GODI	TECHNICIAN	3-65 Oppamahigashi-cho Yokosuka Kanagawa 237-0065 JAPAN
29	Naoto Morioka	GODI	TECHNICIAN	3-65 Oppamahigashi-cho Yokosuka Kanagawa 237-0065 JAPAN
30	Makoto Yamasaki	Kumamoto Univ.	Graduate Studente	2-39-1 Kurokami Kumamoto 860 JAPAN
31	Rumiko Tazoe	Kumamoto Univ.	Student	2-39-1 Kurokami Kumamoto 860 JAPAN
32	Atsushi Kumata	Hokkaido Univ.	Graduate Studente	N10 W8 Sapporo Hokkaido 060-0810 Japan
33	Naoki Fujitani	Kyushu Univ.	Graduate Studente	6-10-1 Hakozaki Higashi-ku Fukuoka 812-8581 JAPAN
34	Hiroshi Asahi	Kyushu Univ.	Graduate Studente	6-10-1 Hakozaki Higashi-ku Fukuoka 812-8581 JAPAN
35	Erina Hatakeyama	Univ. of Tokyo	Graduate Studente	1-1-1 Yayoi Bunkyo-ku 113-8657 JAPAN

36	Neelam Ramaiah	Univ. of Tokyo	Graduate Studente	1-1-1 Yayoi Bunkyo-ku 113-8657 JAPAN
37	Tomoyuki Tanaka	Nagoya Univ.	Graduate Studente	Furo-cho Chikusa-ku Nagoya 464-8601 JAPAN
38	Yoshihisa Mino	Nagoya Univ.	Graduate Studente	Furo-cho Chikusa-ku Nagoya 464-8601 JAPAN
39	Takayoshi Seike	MWJ	TECHNICIAN	2-15 Natsushima-cho Yokosuka 237-0061 JAPAN
40	Yasuhiro Suzuki	MWJ	TECHNICIAN	2-15 Natsushima-cho Yokosuka 237-0061 JAPAN
41	Takashi Nishimura	MWJ	TECHNICIAN	2-15 Natsushima-cho Yokosuka 237-0061 JAPAN
42	Takayuki Kuji	MWJ	TECHNICIAN	2-15 Natsushima-cho Yokosuka 237-0061 JAPAN
43	Taeko Oohama	MWJ	TECHNICIAN	2-15 Natsushima-cho Yokosuka 237-0061 JAPAN

JAMSTEC:Japan Marine Science and Technology Center

MRI: Meteorological Research Institute

NHE: Nippon Hakuyo Engineering

KEEC: Kansai Environmentral Engineering Center CO. , LTD

SNFRI: Seikai National Fisheries Research Institute

NIRS: National Institute of Radiological Sciences

MWJ: Marine Works Japan

CRIEPI: Central Research Institute of Electric Power Industry

GODI: Global Ocean Development. Inc

GSJ: Geological Survey of Japan

RITE: Research Institute of Innovative Technology for the Earth

3.1 Meteorological Observation

3.1.1 Meteorological Station

Naoto Morioka（G. O. D. Ｉ. ）

Parameters

- JST（UTC＋9hours）throughout the cruise
-Atmospheric pressure calibrated to the sea surface level (hPa)
-Atmospheric temperature ［deg-C］
-Dew point temperature [deg-C]
-Relative Humidity [％]
-Precipitation [mm]
-10 minutes averaged wind direction at the time ［degree］
-10 minutes averaged wind speed at the time [m／s]
-Sea Surface temperature ［deg-C］
-Significant wave height measured first 20 minutes at every 3hours
（0200,0500,0800, 1100, 1400, 1700, 2000, 2300 UTC）
-Period of Wv. HT [sec]

Method

We observed some surface meteorological parameters during the cruise by using KOAC－7800 weather data processor and some sensors assembled by KoshinDenki, Japan. Sensors are listed below.

Anemometer	：KE－500	Koshin Denki, Japan
Thermometer	：FT	Koshin Denki, ∫apan
Dew point meter	：DW－1	Koshin Denki, Japan
Barometer	：F－4Sl	Yokogawa, Japan
Rain gauge	：SO202	Young, U. S. A.
Optical Rain Gauge	：ORG－11DR	SCTI, U. S. A.
Radiometer	：MS－801（shortwave）	Eiko Seiki, Japan
	：MS－200（10ng WaVe）	Eiko Seiki, Japan
Wave height meter	：WM－2	Tsurumiseiki, Japan

Data archive

Surface meteorological data will be submitted to the DMO（Data Management Office）. Six－Second, 10－minutes and one hour averaged data are recorded.

3.1.2 Doppler radar observation

Naoto Morioka (G.O.D.I.)

Objectives

Main theme to use Doppler radar is to investigate the precipitation mechanism of convection which develop over the ocean. In addition, rainfall map would be produced tocontribute to the fresh water budget over the tropical western Pacific ocean.

Parameters

Radar reflectivity(dBZ),which usually translated into rainfall rate (mm/hr) using Z-R relation equation , is measured within 200km as Intensity mode.

Radar reflectivity and radial velocity (m/s) of precipitation particles are measured within 100km range Doppler mode.

Methods

Doppler radar operation consists of three operational mode ; PPI (Plan Position Indicator, which measure the precipitation at one angle), Cappy (Constant Altitude PPI, which measure the precipitation at constant altitude changing radar antenna elevation), and RHI (Range Height Indicator, vertical cross section at constant azimuth)

In the present cruise, we observe rainfall by CAPPI mode and PPI mode from 3rd January to 18th January.

Major specification of the Doppler radar as follows;

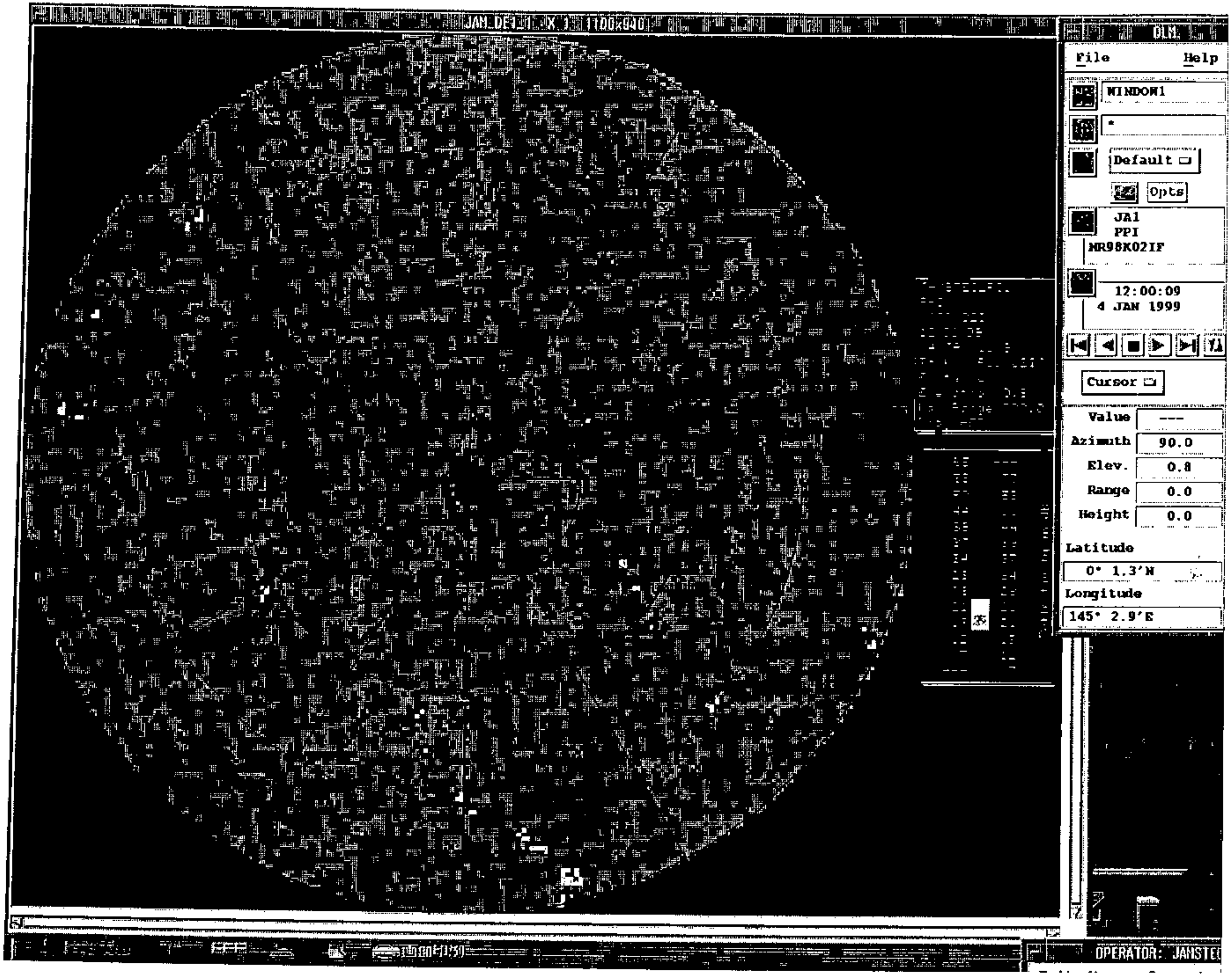
Type :	RC-52B(Mitsubishi Electric Co. Ltd.,Japan)
Frequency :	5290MHz
Beam Width :	Better than 1.5 degrees
Output Power:	250Kw
Signal Processor :	RVP-6(Sigmet ,Inc. U.S.A.)
Application S/W	IRIS/OPENS(Sigmet ,Inc. ,U.S.A)
Inertial navigation unit :	DRUH(Honeyewll ,Inc. U.S.A.)

Result

The preliminary result is shown PPI radar images fig.1

Data archive

Doppler Radar data obtained in this cruise will be submitted to the DMO.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Help
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Default
Opts
JA1
PPI
MR98K02IF
12:00:09
4 JAN 1999
Cursor
Value ---
Azimuth 90.0
Elev. 0.8
Range 0.0
Height 0.0
Latitude
0° 1.3'N
Longitude
145° 2.9'E
OPERATOR:

3.1.3 Atmospheric Sounding

Naoto Morioka (G.O.D.I.)

Objectives

To evaluate the environmental atmospheric condition from surface to tropopause.

Measured parameters

The range and accuracy of parameters measured by the radiosonde are follows;

Parameter	Range	Accuracy
Pressure	1060 - 3hPa	0.5hPa
Temperature	-90 - +60degC	0.2deg-C
Relative Humidity	0 – 100%	3%
Wind speed	0 - 180 m/s	0.5m/s

Method

I observed vertical profiles of pressure, temperature, relative humidity ,and wind speed/direction by using VAISALA Digicora MW11 semi-Automatic Radiosonde System. The system consists of Main processor (MW11), UHF Telemetry Antenna (RB21), PC Recorder (PCMF12), Printer (EPSPN LX-1050), Balloon Launcher(ASAP) and GPS Radiosonde(RS80G)

The surface data were measured by using handy humidity temperature meter (YOKOGAWA2451-01), onboard Resonator digital barometer(YOKOGAWA AP-100) and wind speed/direction meter (HOSHIN KC1570A).

I also utilized a humidity calibrator (VAPORPAK H-31, Digilog Instruments) when I calibrate sensor before launching.

It is also worth to note about our procedure to launch the balloons. Namely , in order to avoid (or at least reduce) the influence of sensor arm heating and/or launching from the air-conditioned sea container over tropical ocean, which mainly cause the surface humidity error, the inside of launcher room of container was ventilated well before launching until sensor showed appropriate value(difference are less then 0.5℃ and 3%) comparing to outside man-measured temperature and humidity.

We launched the radiosonde with balloon every day at 00Z from 6th January 1999 to 12th January 1999. Next Page shows radiosonde launch log.

Primary results

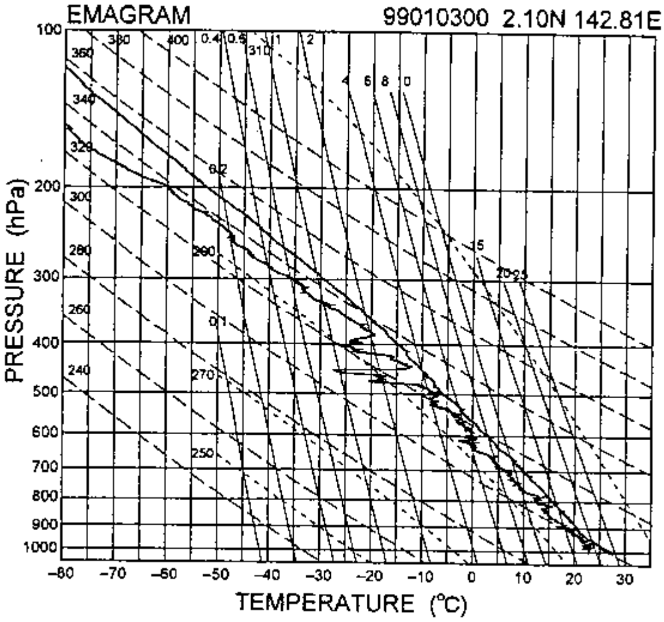
Next pages shows the EMAGRAM with sounding time (YYMMDDTT UTC) and position.

Data archive

All sounding data have been sent through GTS to meteorological agencies in the world.

Raw data stored in magneto optical disk in ASCII format and available through JAMSTEC DMO.

No.	TIME(UTC)				Position		Surface					Max	Altitude	Cloud	
							Press	Temp	RH	W.D.	W.S.				
	YY	MM	DD	HH	Lat	Lon	(hPa)	deg C	(%)	deg	(m/s)	hPa	(m)	Amount	Type
1	99	01	03	00	2.06N	142.83E	1007.1	28.1	82	137	5.0	39.7	21904	5	Cu
2	99	01	04	00	0.01S	145.01E	1007.7	29.5	80	124	4.6	91.8	17092	5	Cu
3	99	01	05	00	0.00N	147.48E	1007.2	29.8	71	93	8.4	30.8	23443	1	Cu,Cs
4	99	01	06	00	0.02N	152.89E	1006.5	29.5	75	144	5.1	17.9	27011	3	Cu
5	99	01	07	00	0.03N	158.20E	1007.0	28.5	74	129	7.9	24.3	25000	2	Cu
6	99	01	08	00	0.06N	159.96E	1008.9	29.5	71	115	8.7	59.9	19464	3	Cu,Ci
7	99	01	09	00	0.00N	163.46E	1010.1	28.1	62	51	4.6	47.5	20591	1	Cu
8	99	01	10	00	0.01S	168.93E	1010.0	28.0	76	163	3.2	18.2	26945	6	Cu,Ci
9	99	01	11	00	0.01N	173.99E	1010.9	27.0	70	119	5.2	20.0	26234	1	Cu,Ci
10	99	01	12	00	0.07N	174.91E	1010.0	28.0	68	72	5.1	22.0	25676	5	Cu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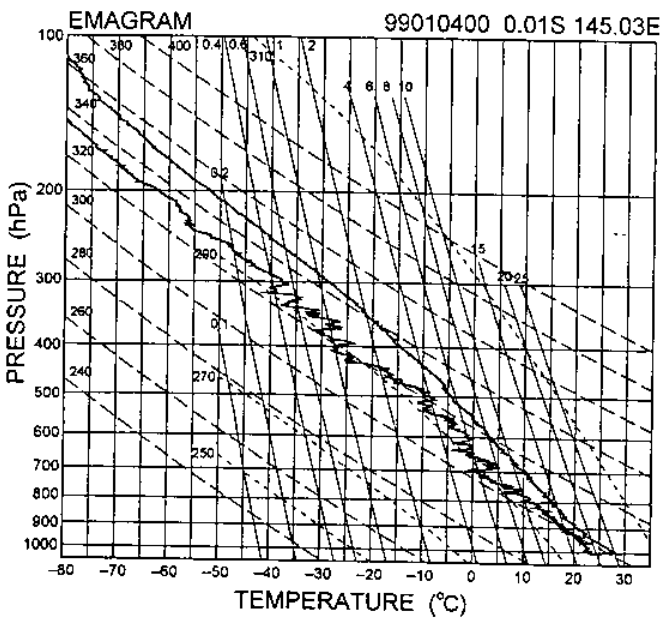
PRESSURE (hPa)
TEMPERATURE (°C)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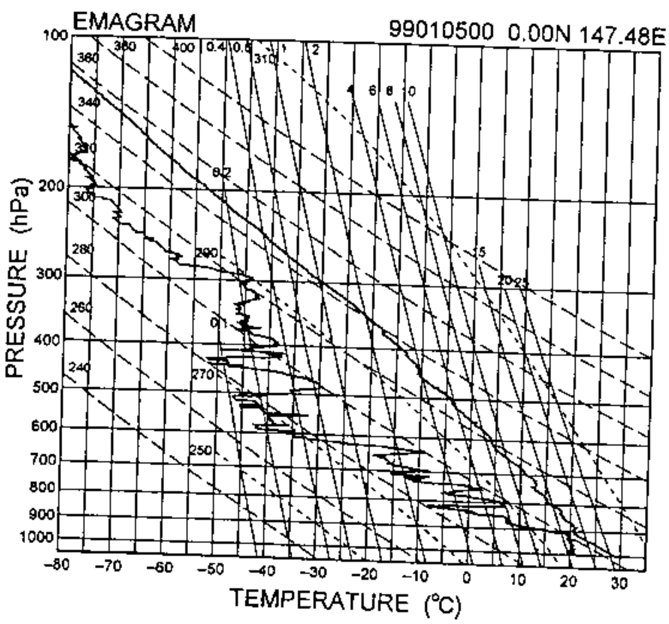
TEMPERATURE (°C)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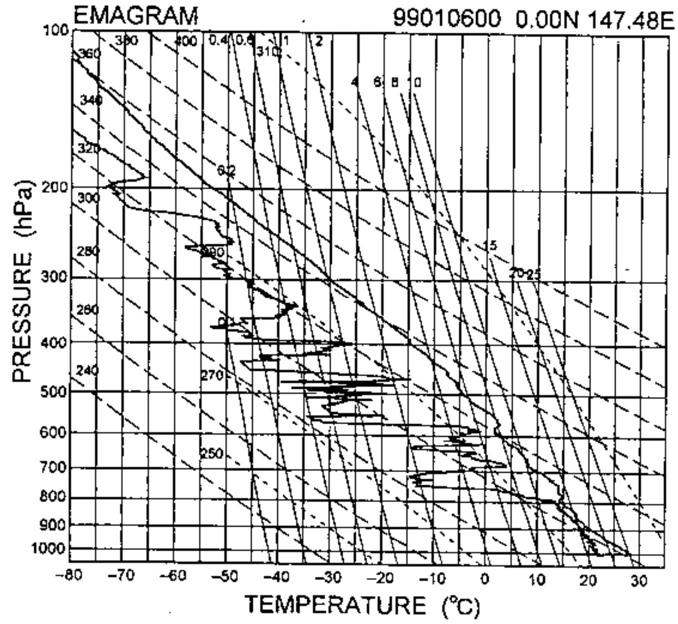
TEMPERATURE (°C)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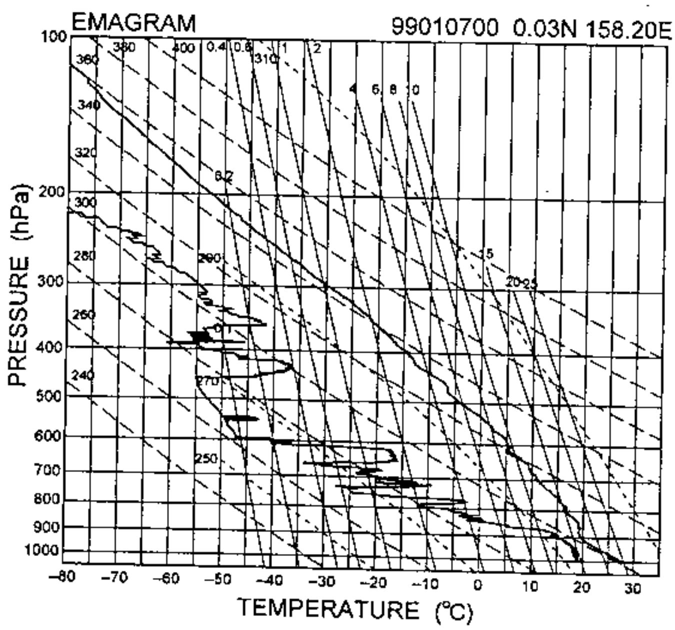
PRESSURE (hPa)
TEMPERATURE (°C)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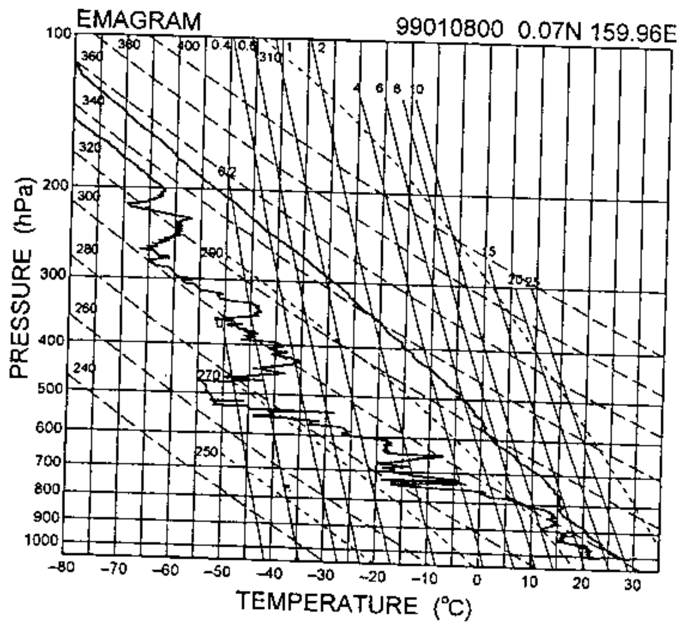
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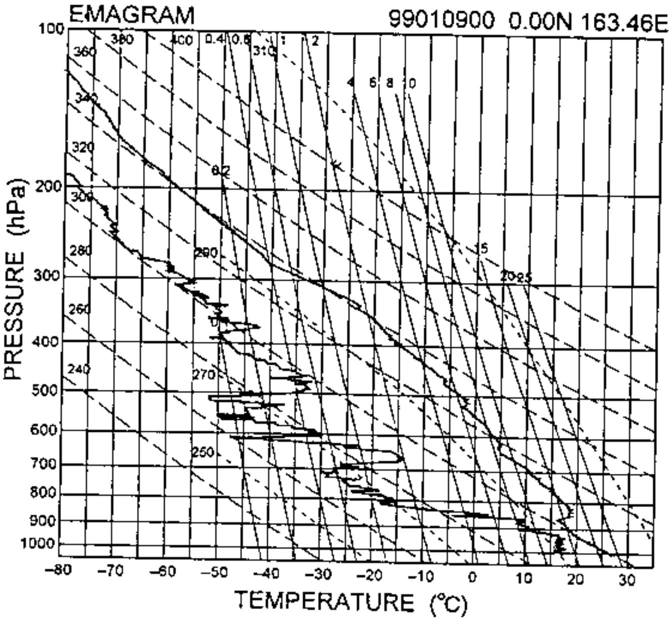
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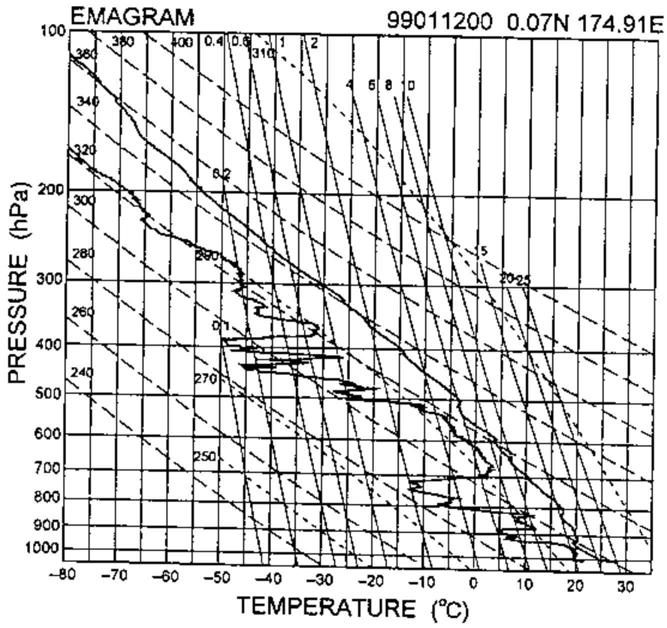
TEMPERATURE (°C)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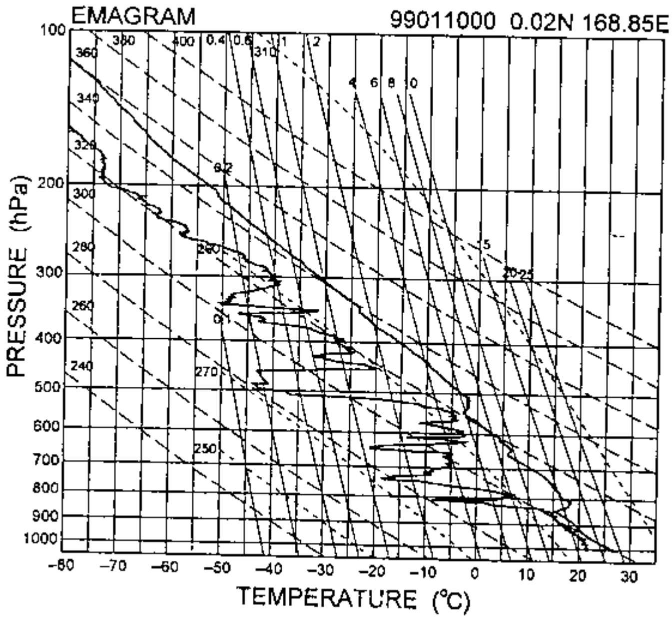
PRESSURE (hPa)
TEMPERATURE (°C)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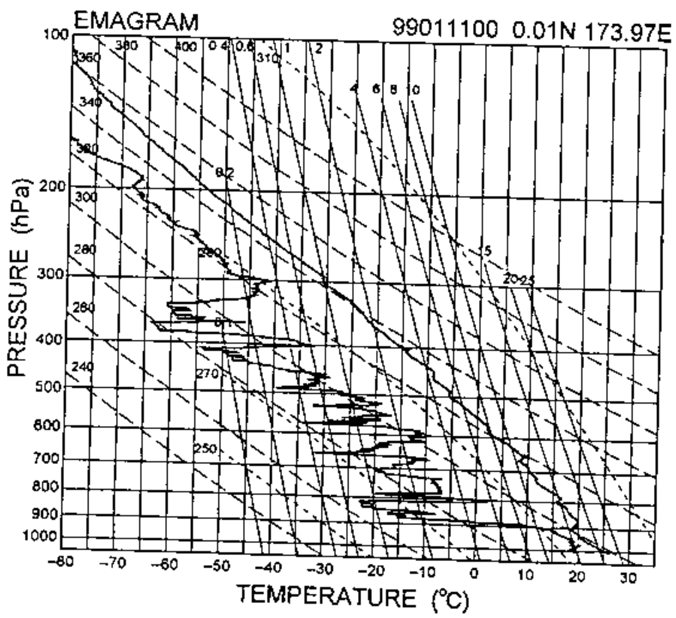
TEMPERATURE (°C)


EMAGRAM
99011100 0.01N 173.97E
PRESSURE (hPa)
TEMPERATURE (°C)

3.2 Physical Parameters

3.2.1 CTD/RMS Observation.

Masayuki Fujisaki 1), Nobuharu Komai 1), Tak Kawano 2)

1) Marine Works Japan Ltd.
2) Japan Marine Science and Technology Center (JAMSTEC)

Objectives:

To measure vertical profiles of temperature, salinity, fluorescence, beam transmittance, active fluorescence and PAR in the central equatorial Pacific using by CTD with Fluorometer and Transmissometer, FRRF(Fast Repetion Rate Fluorometer) and PAR(Photocynthesis Available Radiation) sensor.

Method:

1) SBE911plus shallow cast to 200 meters depth with fluorometer, transmissometer, FRRF and PAR sensor.

We observed vertical profile of conductivity, temperature, fluorescence, and light transmittance, active fluorescence and PAR from surface to 200m by CTD/RMS (Rosette Multi-bottle array water sampling System). FRRF and PAR sensor were attached on the CTD/RMS frame.

24 places rosette sampler with 30 liters Niskin bottle were deployed at each station for the chemical analysis of general water properties. Water sampling were made during up cast by sending command from computer.

CTD/RMS were deployed and recovered from the stern of R/V MIRAI using A-frame. The decent rate was 0.7 m/s. After a cast, CTD/RMS was lifted down from upper deck to the Water Drawing Room on 2nd deck and sea water was drawn from each bottle.

The TS data was processed by DATCNV, ROSSUM, and BINAVG version 4.226 provided by Sea-Bird Electronics, Inc. We made 1 meter averaged bin data for down cast.

2) SBE911plus full depth cast

Deep casts were conducted by the same SBE911plus underwater unit without fluorometer, transmissometer, FRRF and PAR sensor from the stern. At five stations, stn.02, stn.03, stn.06, stn.09, stn.12, the CTD was deployed to 10-20 meters above sea floor.

The operation and data processing were also same as the shallow cast as stated above. The decent rate ranged 0.7 m/s to 1.5 m/s depending stability of decent rate.

3) SBE911plus shallow cast to 200 meters depth for in situ incubation.

We observed vertical profile of conductivity, temperature, fluorescence, and light transmittance from surface to 200m by CTD/RMS.

12 places rosette sampler with 12 liters Niskin bottle were deployed at stn.2, stn.3, stn.6, stn.9, stn.12. for in situ incubation and the chemical analysis.

CTD/RMS was deployed and recovered from the starboad of R/V MIRAI using the Gallows.

Instruments

Specification of the sensors were listed below.

1) CTD:SBE 911plus CTD system

Under water unit:CTD 9plus (S/N 09P9833-0358, Sea-Bird Electronics, Inc.)

Temperature sensor:SBE3-04/F Primary Sensor (S/N 031464, Sea-Bird Electronics, Inc.)

Conductivity sensor:SBE4-04/0 Primary Sensor (S/N 041206, Sea-Bird Electronics, Inc.)

Oxygen sensor:MODEL 13-04-B (S/N 130338, Sea-Bird Electronics, Inc.)

Transmissometer:C Star Transmissometer (S/N CST-207RD, WET Labs, Inc.)

Fluorometer:Seapoint Chlorophyll Fluorometer (S/N 2148 Seapoint Sensors, Inc.)

Fluorometer:Sea Tech Fluorometer (S/N 132S SEA TECH INC.)

F.R.R.F.: F.R.R.F.(S/N 182026 CHELSEA INSTRUMENT LTD)

PAR sensor:PAR sensor (S/N 046036 CHELSEA INSTRUMENT LTD)

Deck unit:SBE11(Sea-Bird Electronics, Inc.)

Altimeter:MODEL 2110-2 (S/N 205, BENTHOS Inc.)

We changed Seapoint Chlorophyll Fluorometer into Sea Tech Fluorometer and Transmissometer was taken away from CTD/RMS system at shallow cast 3 of Stn.03 because of Seapoint Chlorophyll Fluorometer was not good condition.

2) CTD:SBE 911plus CTD system

Under water unit:CTD 9plus (S/N 09P9833-0357, Sea-Bird Electronics, Inc.)

Temperature sensor:SBE3-04/F Primary Sensor (S/N 031525, Sea-Bird Electronics, Inc.)

Conductivity sensor:SBE4-04/0 Primary Sensor (S/N 041205, Sea-Bird Electronics, Inc.)

Oxygen sensor:MODEL 13-04-B (S/N 130339, Sea-Bird Electronics, Inc.)

Fluorometer:Sea Tech Fluorometer (S/N 237, SEA TECH INC.)

Transmissometer:SeaTech-25cm(S/N551, SEA TECH INC.)

Deck unit:SBE11(Sea-Bird Electronics, Inc.)

Altimeter:MODEL 2110-2 (S/N 206, BENTHOS Inc.)

Result

Vertical profiles of temperature, salinity, density and fluorescence at each station were shown in Figures 1-23 for shallow casts.

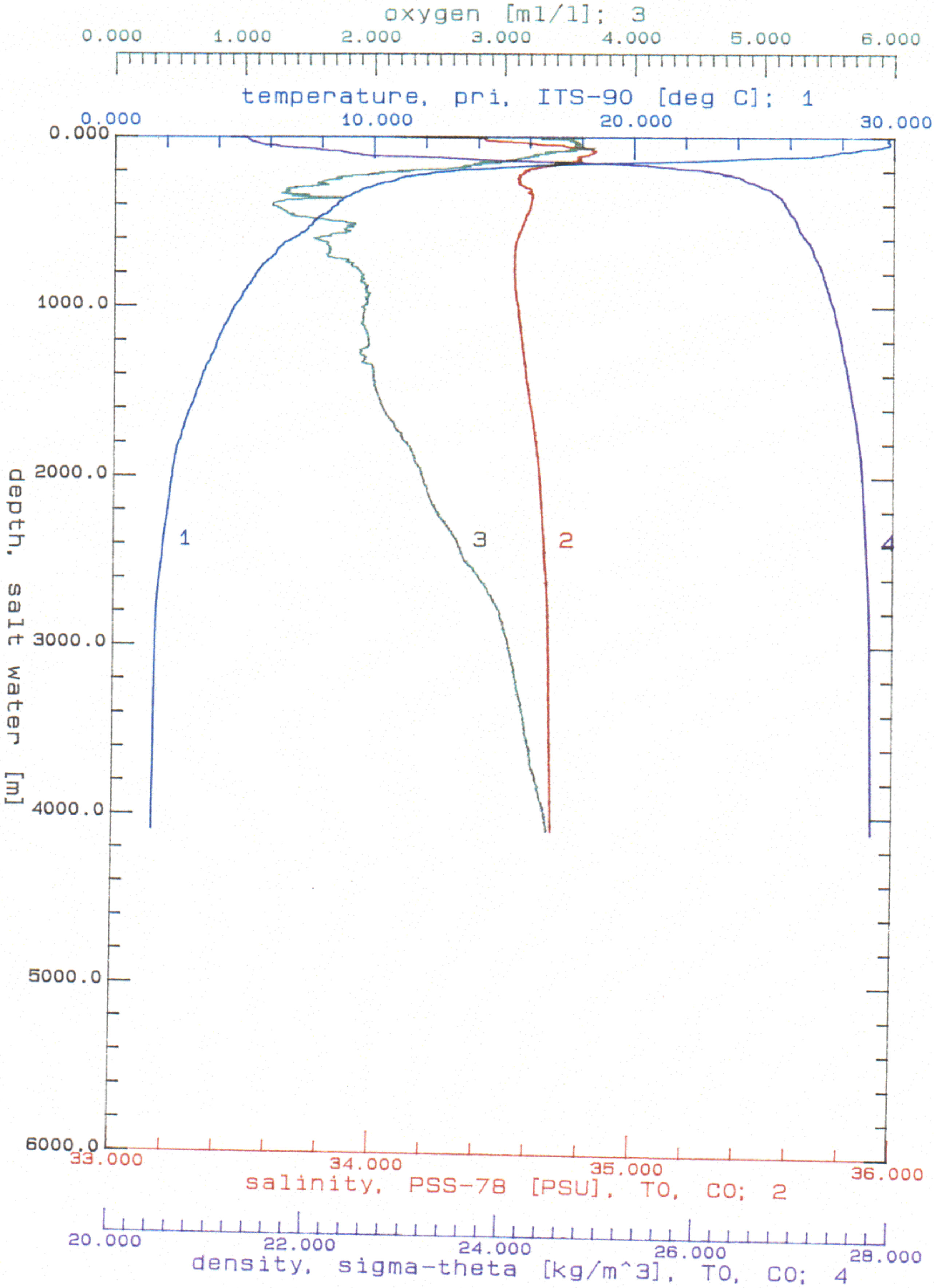
Sea surface temperature (SST) was ca. 30 deg-C at stn.01-05 and at stn.05, SST was more than 30 deg-C and the highest during this cruise. After stn.05, SST decreased as going to eastward and salinity in vicinity of surface exceed 35.0 PSU.

The maximum of fluorescence was distributed from 60m to 90m depth at stn.01 to stn.06. After stn.07, however, the maximum layer distributed widely.

Vertical profiles of temperature, salinity, density and D.O. for full depth were shown in Figures 24-29.

File Name List

see Table 1.



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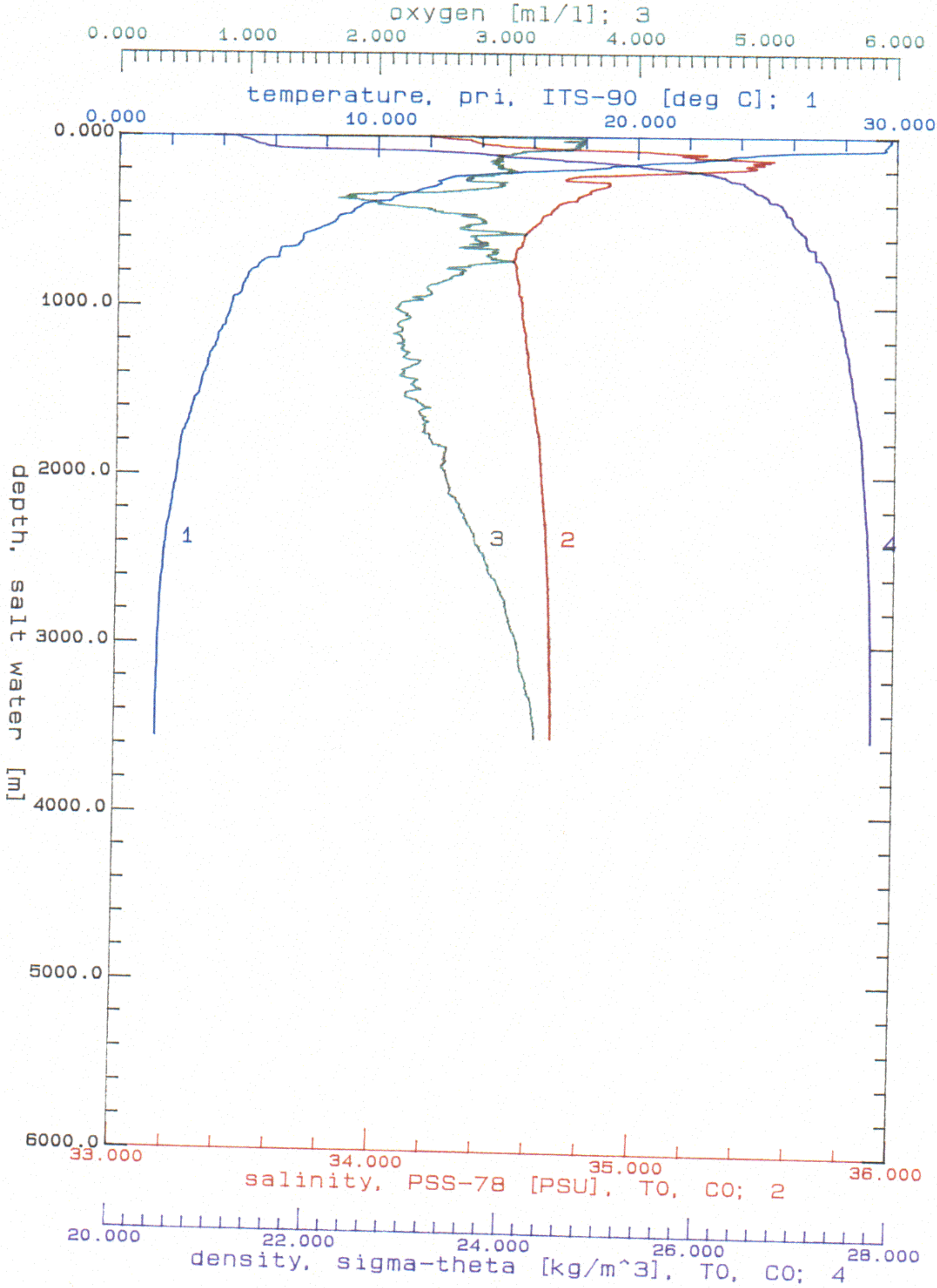
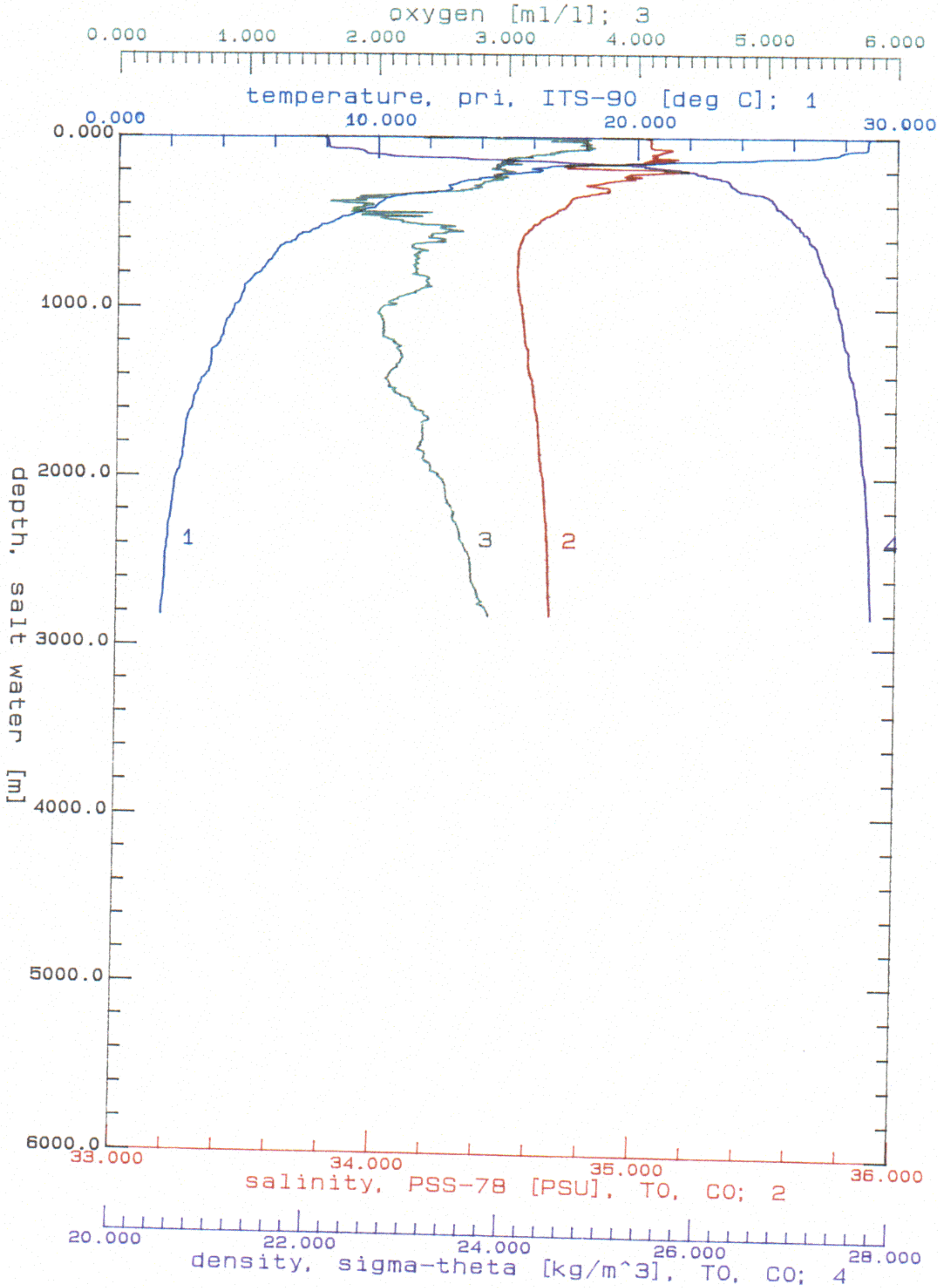
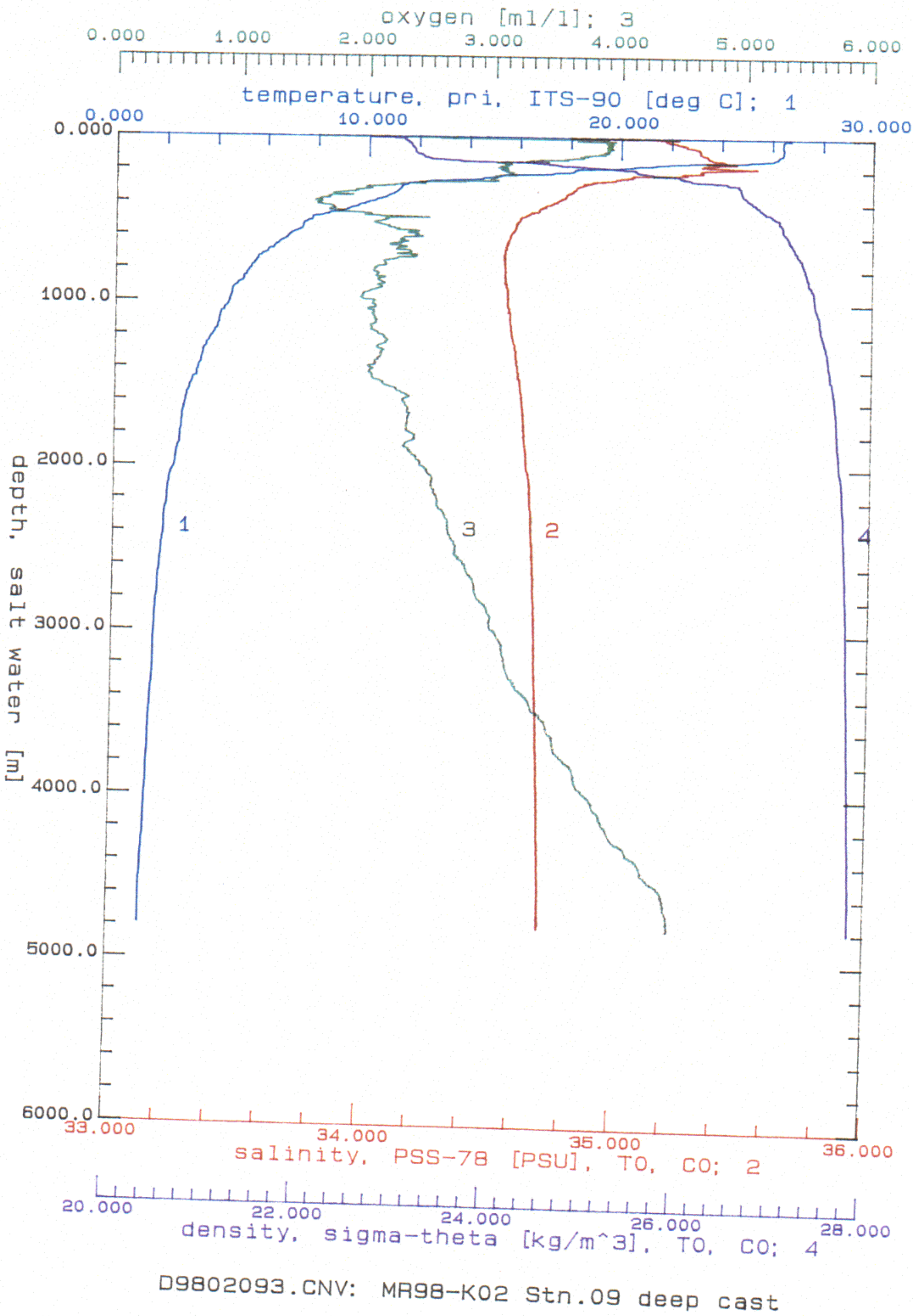


D9802033.CNV: MR98-K02 Stn.03 deep cast



D9802063.CNV: MR98-K02 Stn.06 deep cast


oxygen [ml/l]; 3
0.000
1.000
2.000
3.000
4.000
5.000
6.000
temperature, pri, ITS-90 [deg C]: 1
0.000
10.000
20.000
30.000
depth, salt water [m]
0.000
1000.0
2000.0
3000.0
4000.0
5000.0
6000.0
1
3
2
4
33.000
34.000
35.000
36.000
salinity, PSS-78 [PSU], TO, CO; 2
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density, sigma-theta [kg/m^3], TO, CO; 4
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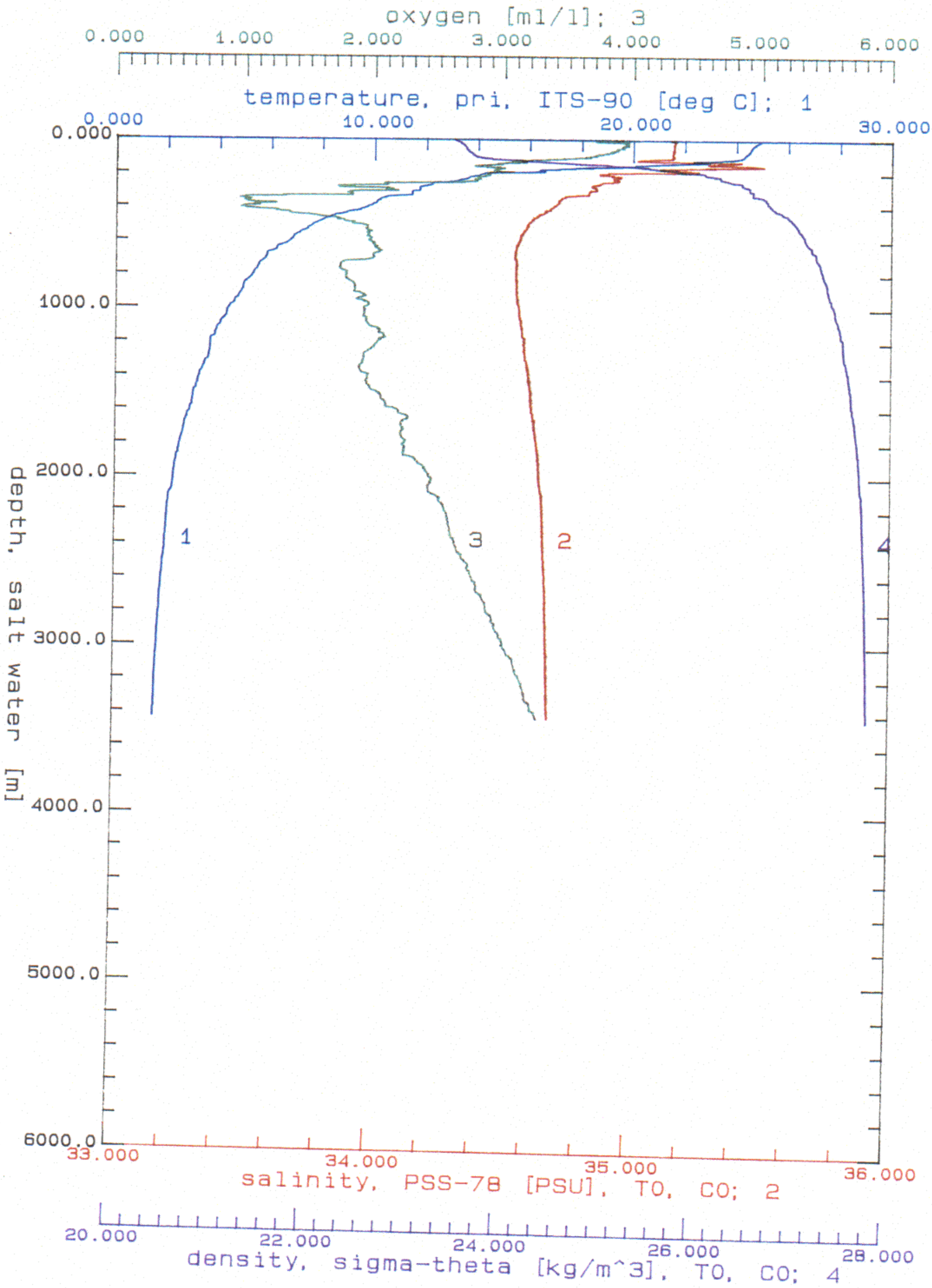
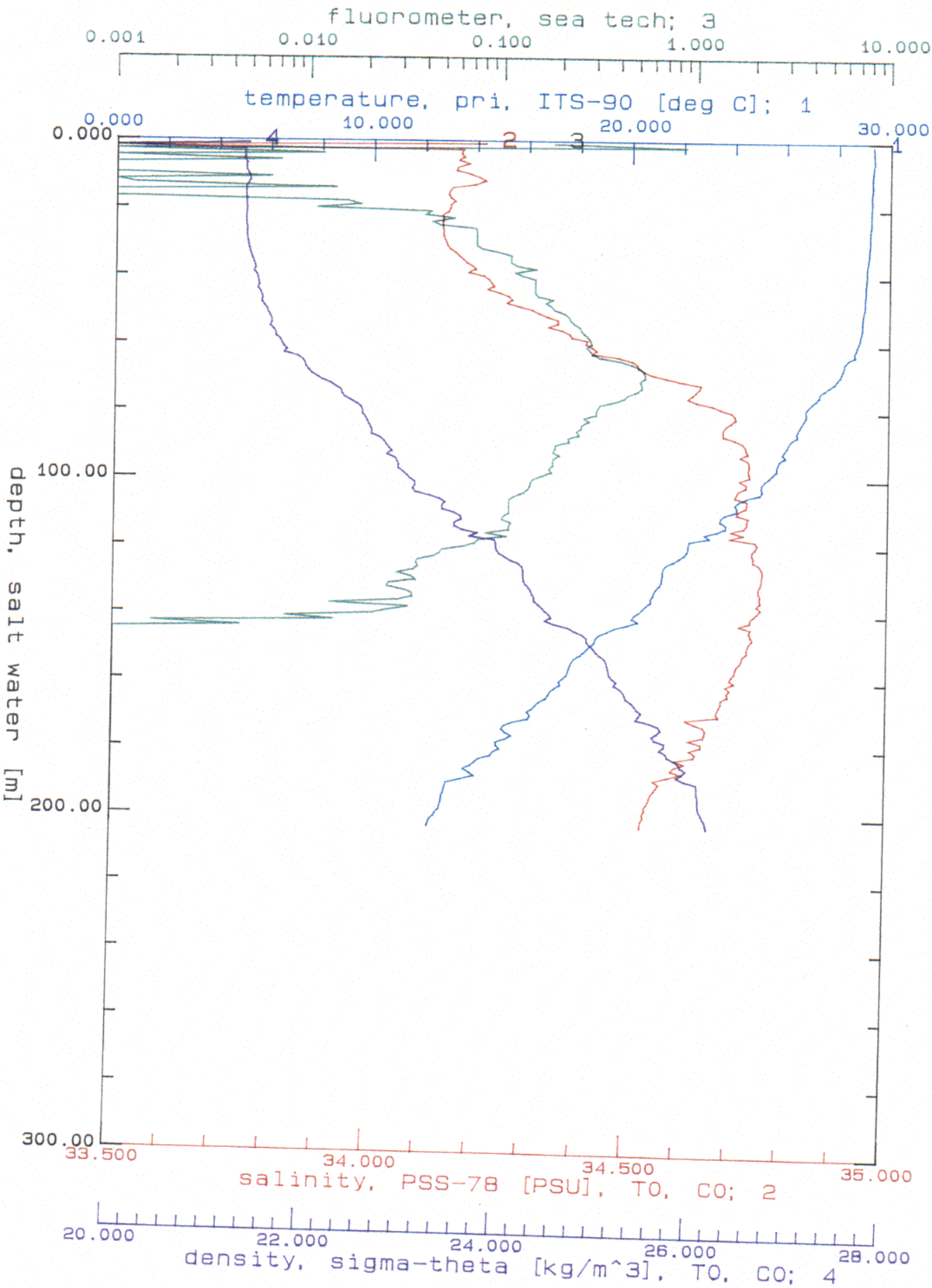
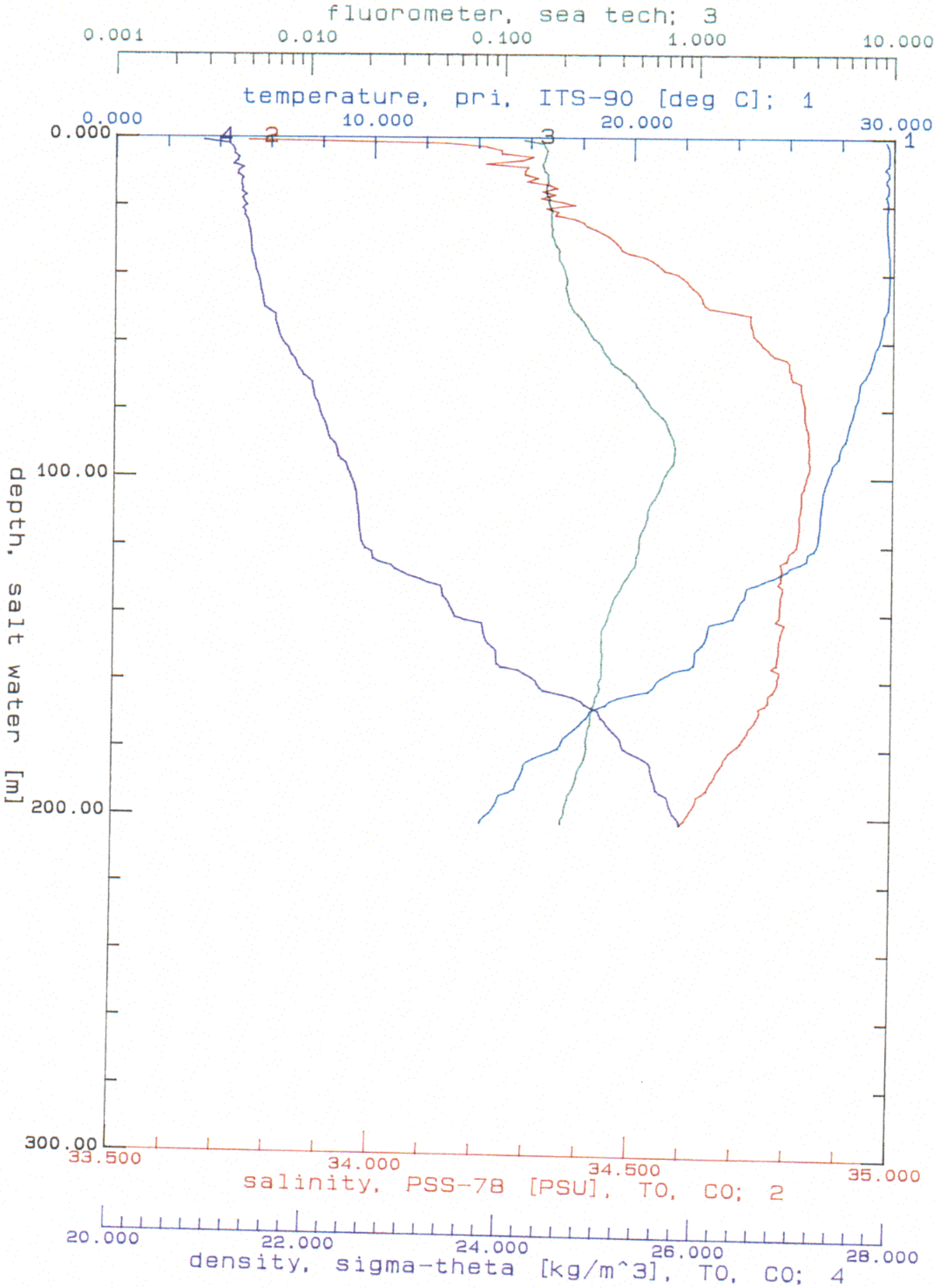


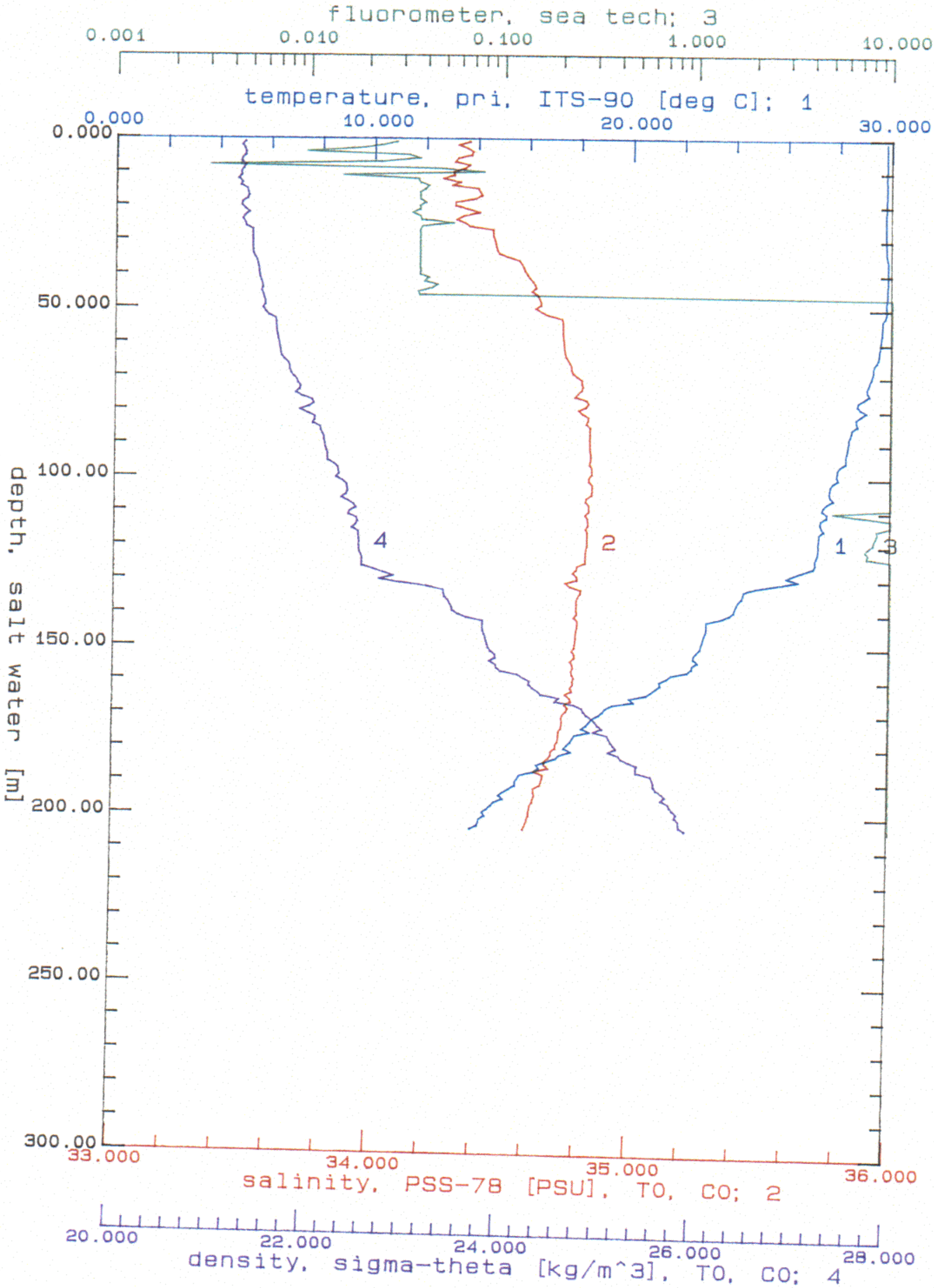
D9802123.CNV: MR98-K02 Stn.12 deep cast



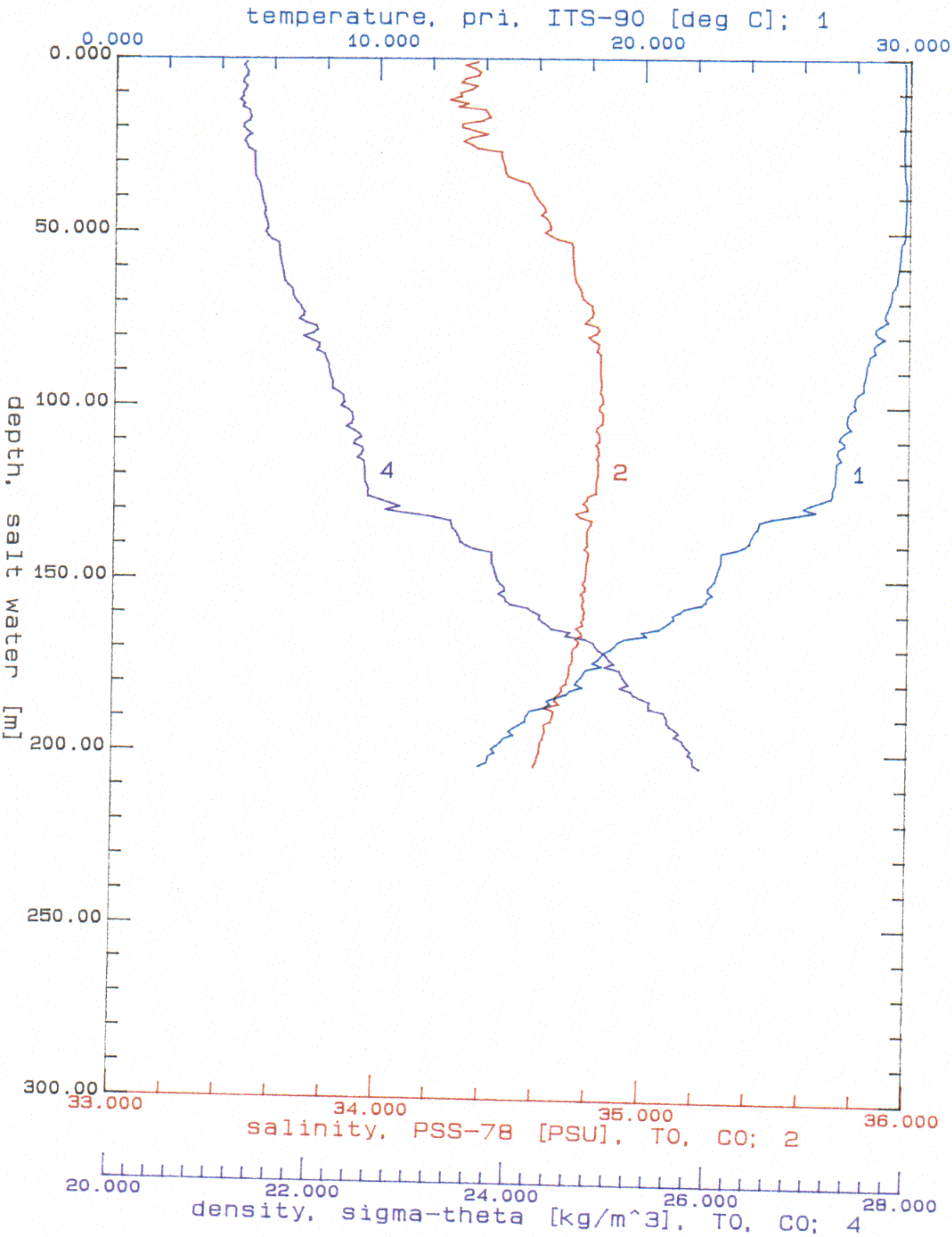
D9802011.CNV: MR98-K02 Stn.01 shallow cast 4



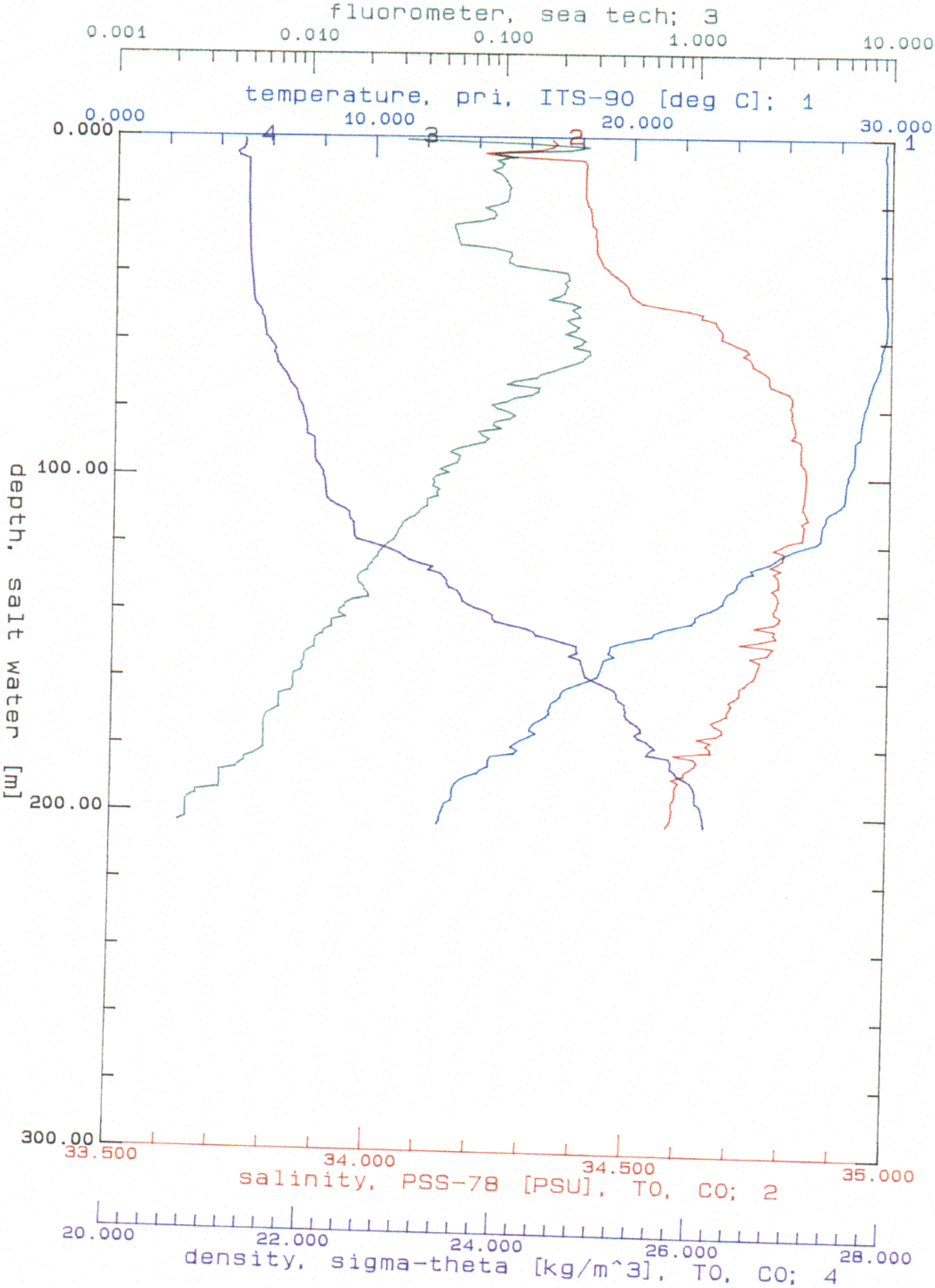
D9802021.CNV: MR98-K02 Stn.02 shallow cast 1



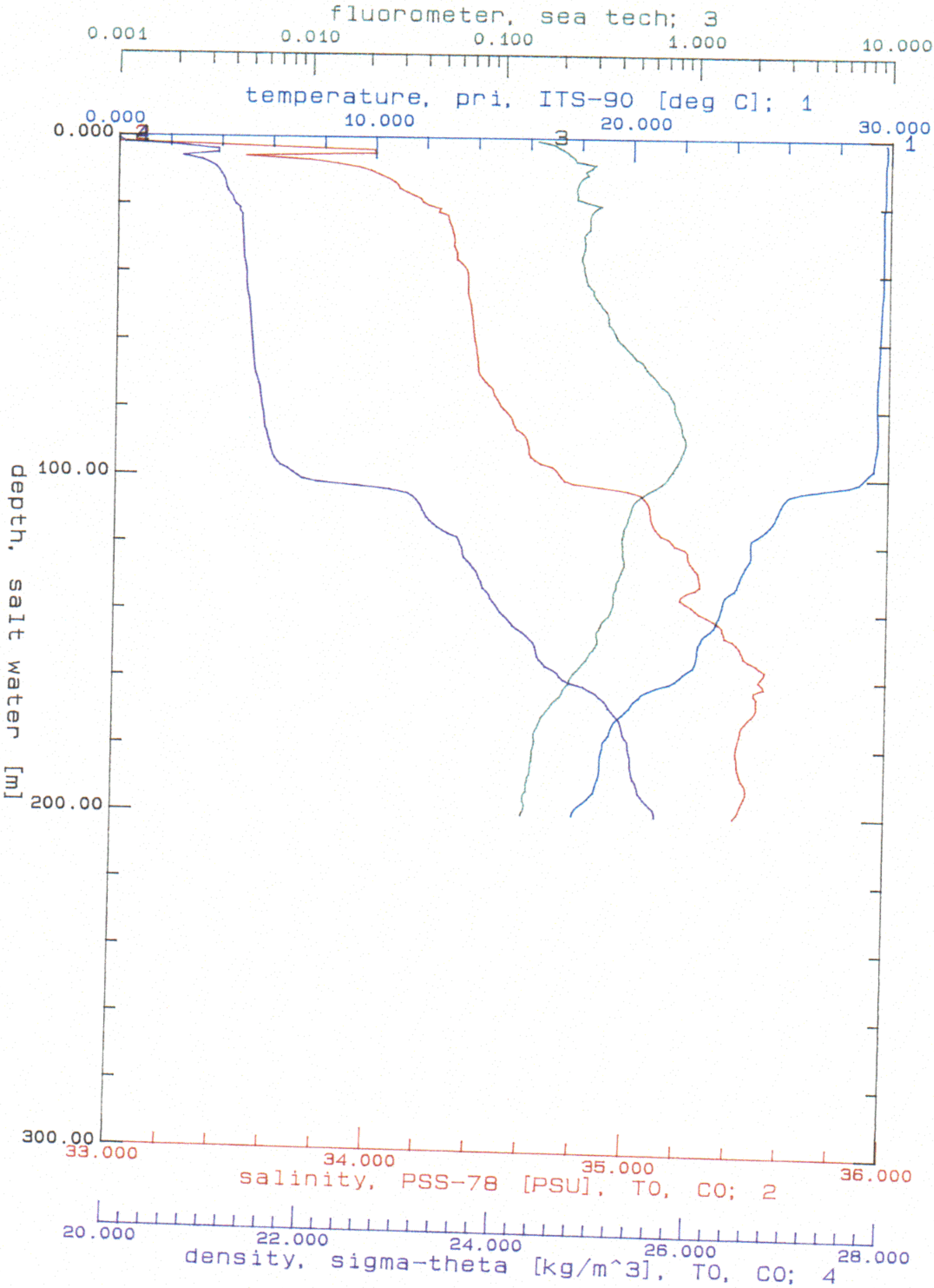
D9802022.CNV: MR98-K02 Stn.02 shallow cast 2



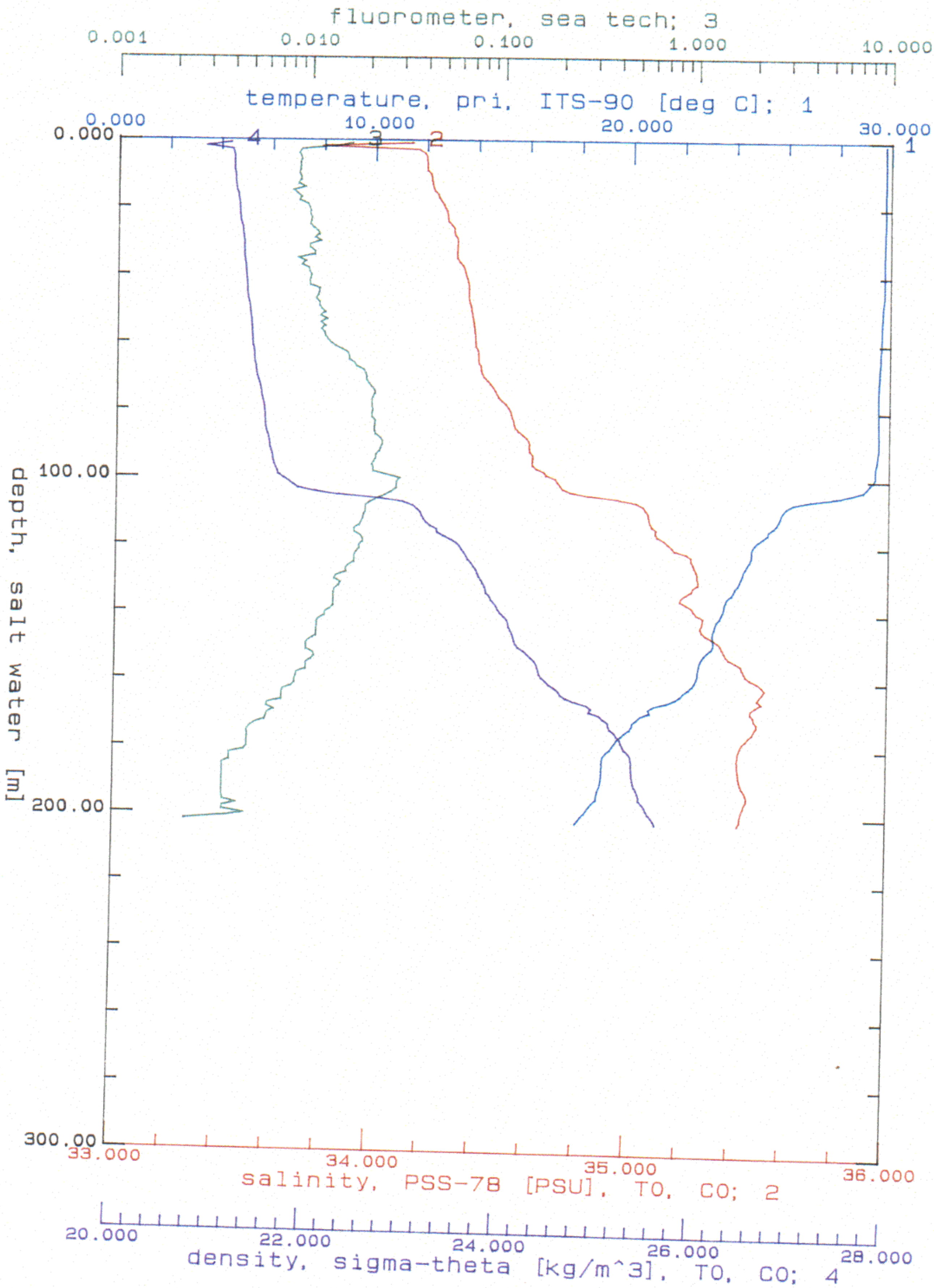
D9802022.CNV: MR98-K02 Stn.02 shallow cast 2



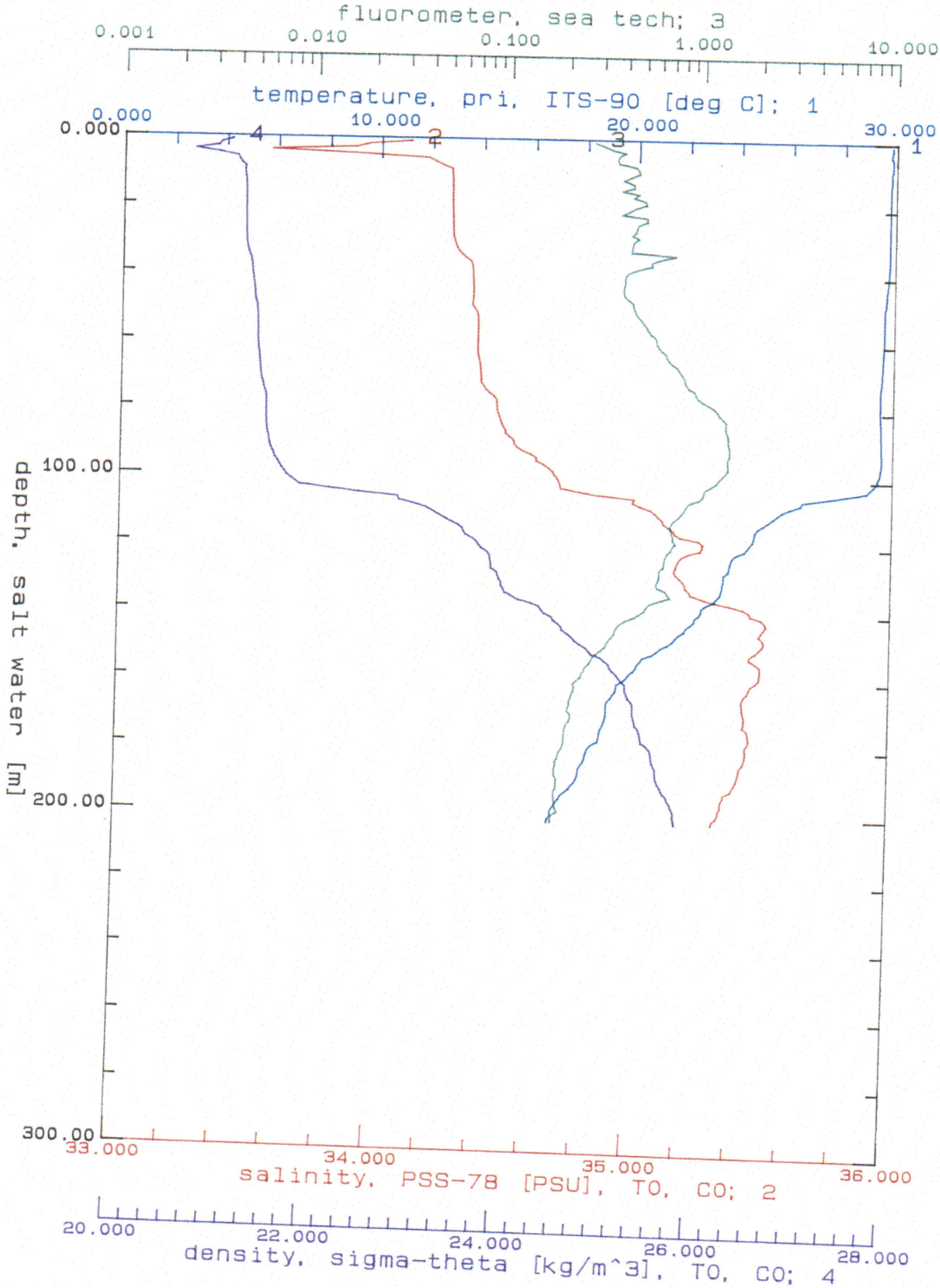
D9802024.CNV: MR98-K02 Stn.02 shallow cast 3



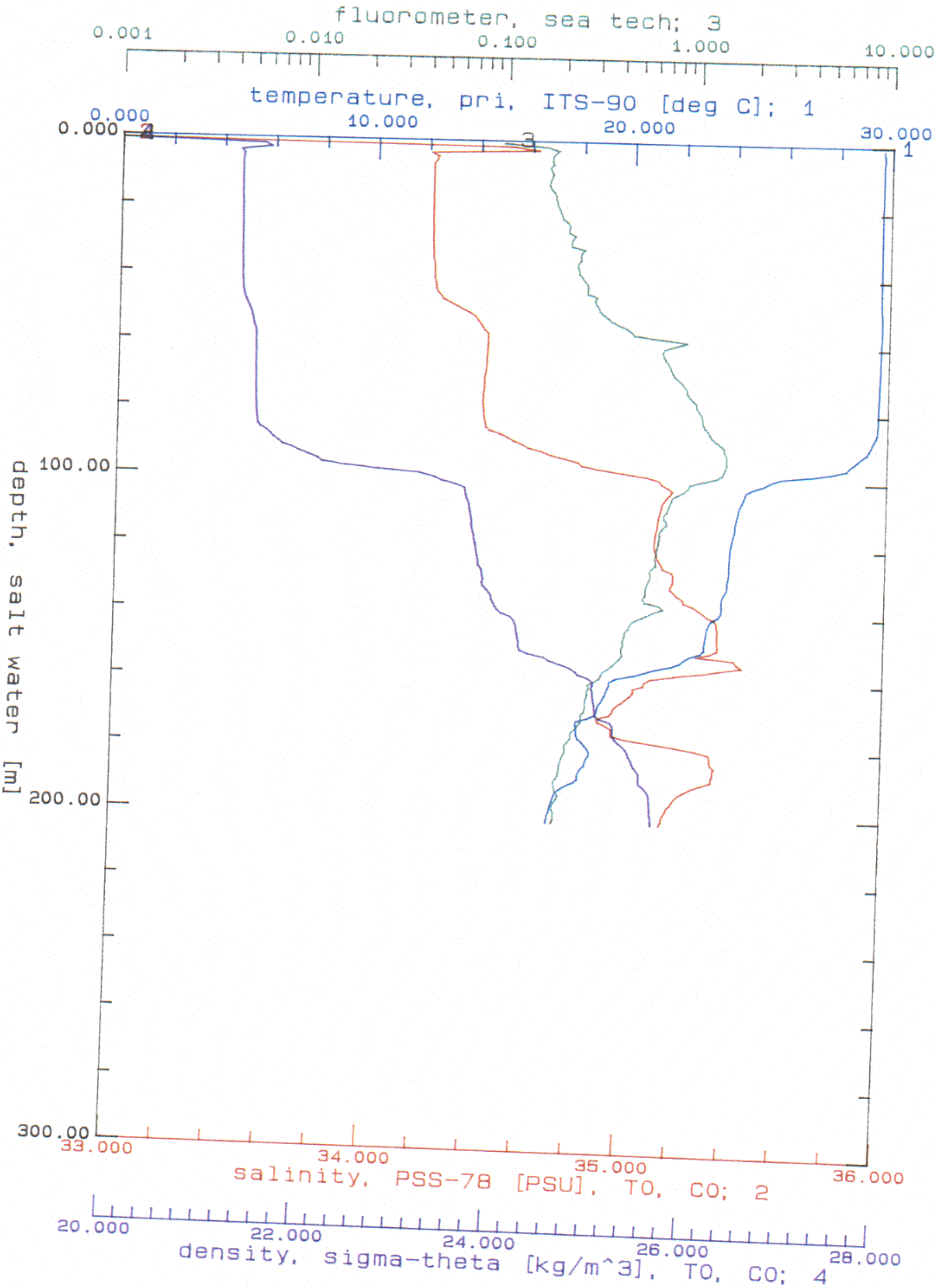
D9802031.CNV: MR98-K02 Stn.03 shallow cast 1



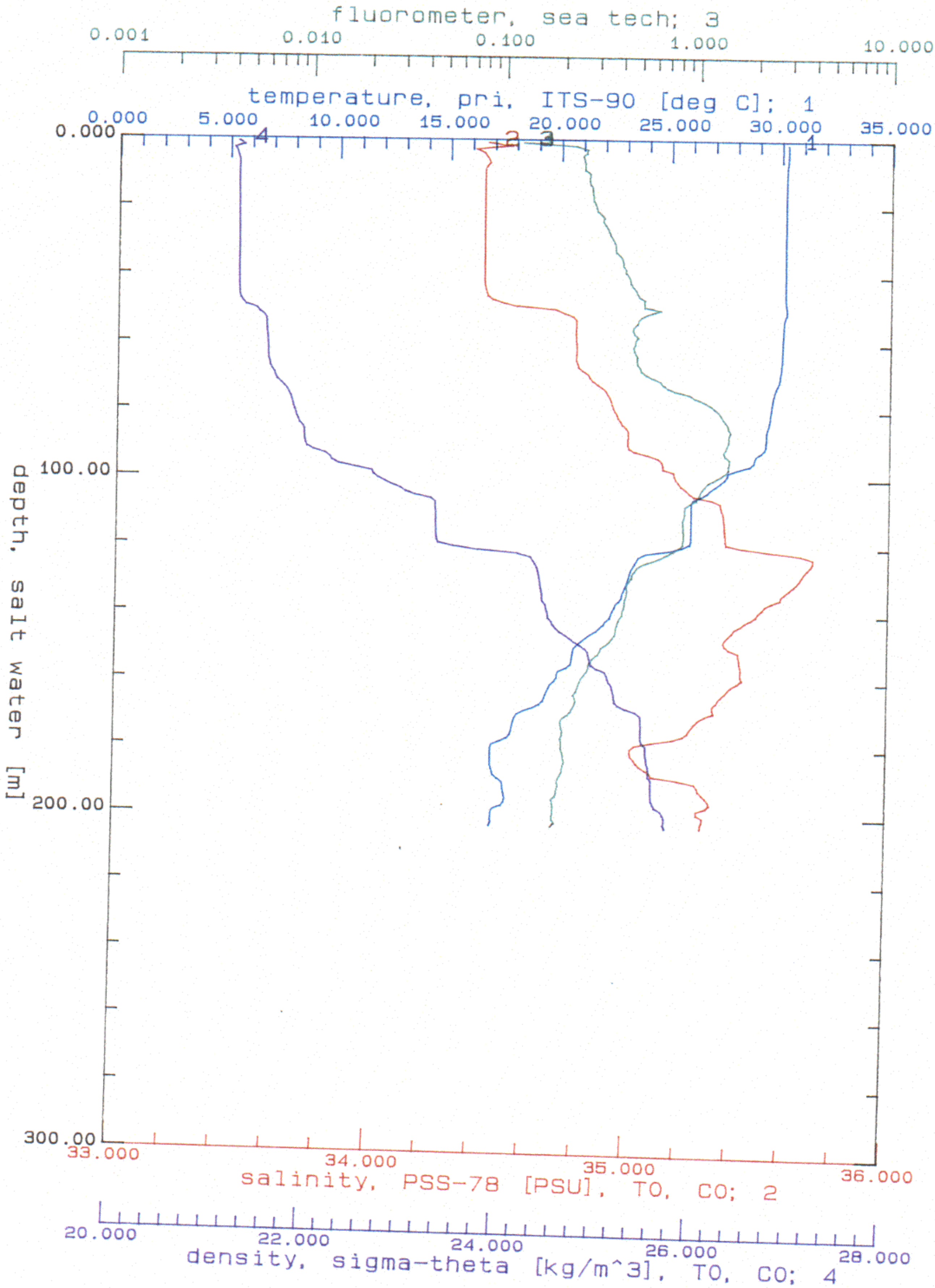
D9802032.CNV: MR98-K02 Stn.03 shallow cast 2



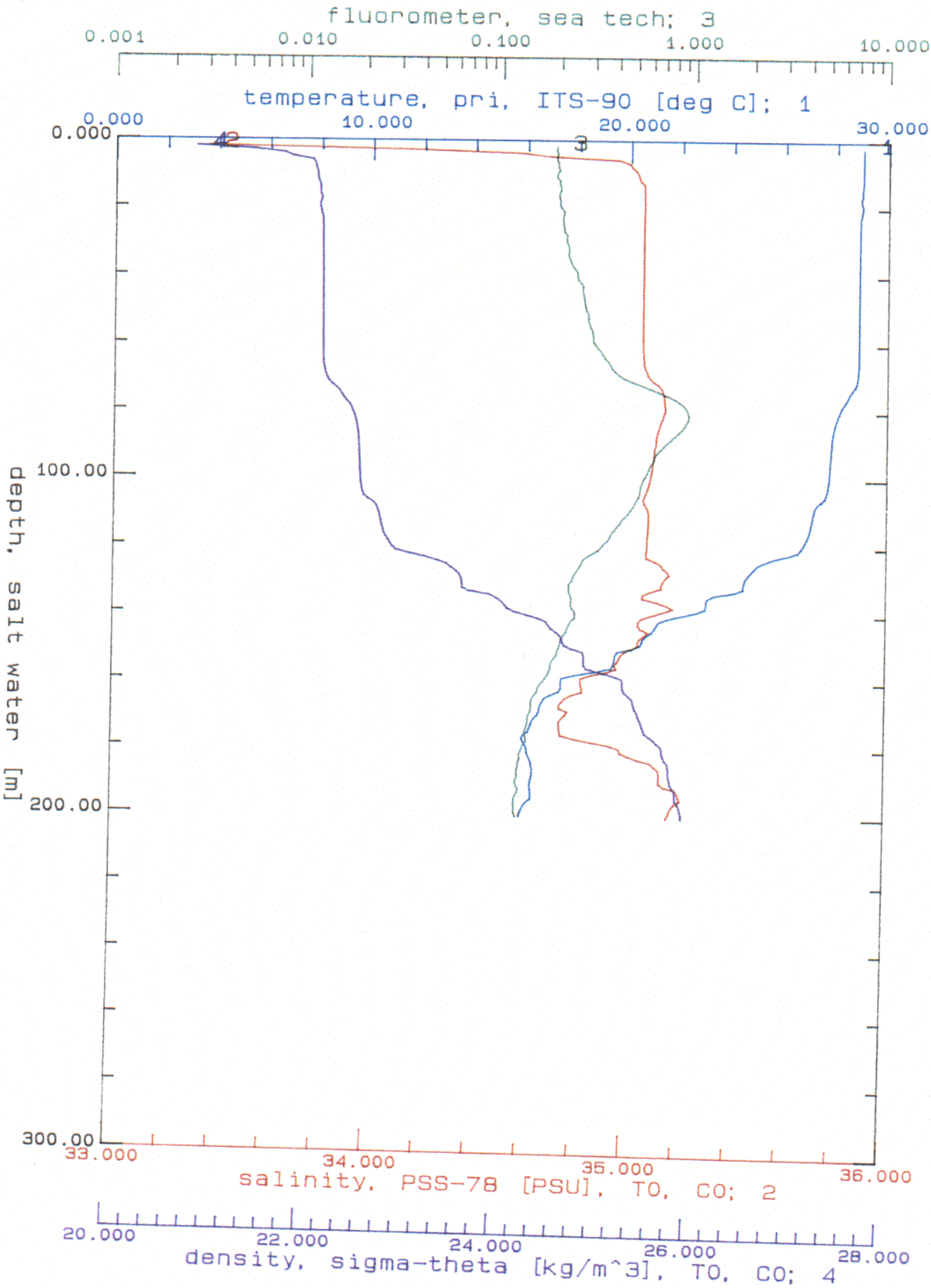
D9802034.CNV: MR98-K02 Stn.03 shallow cast 3



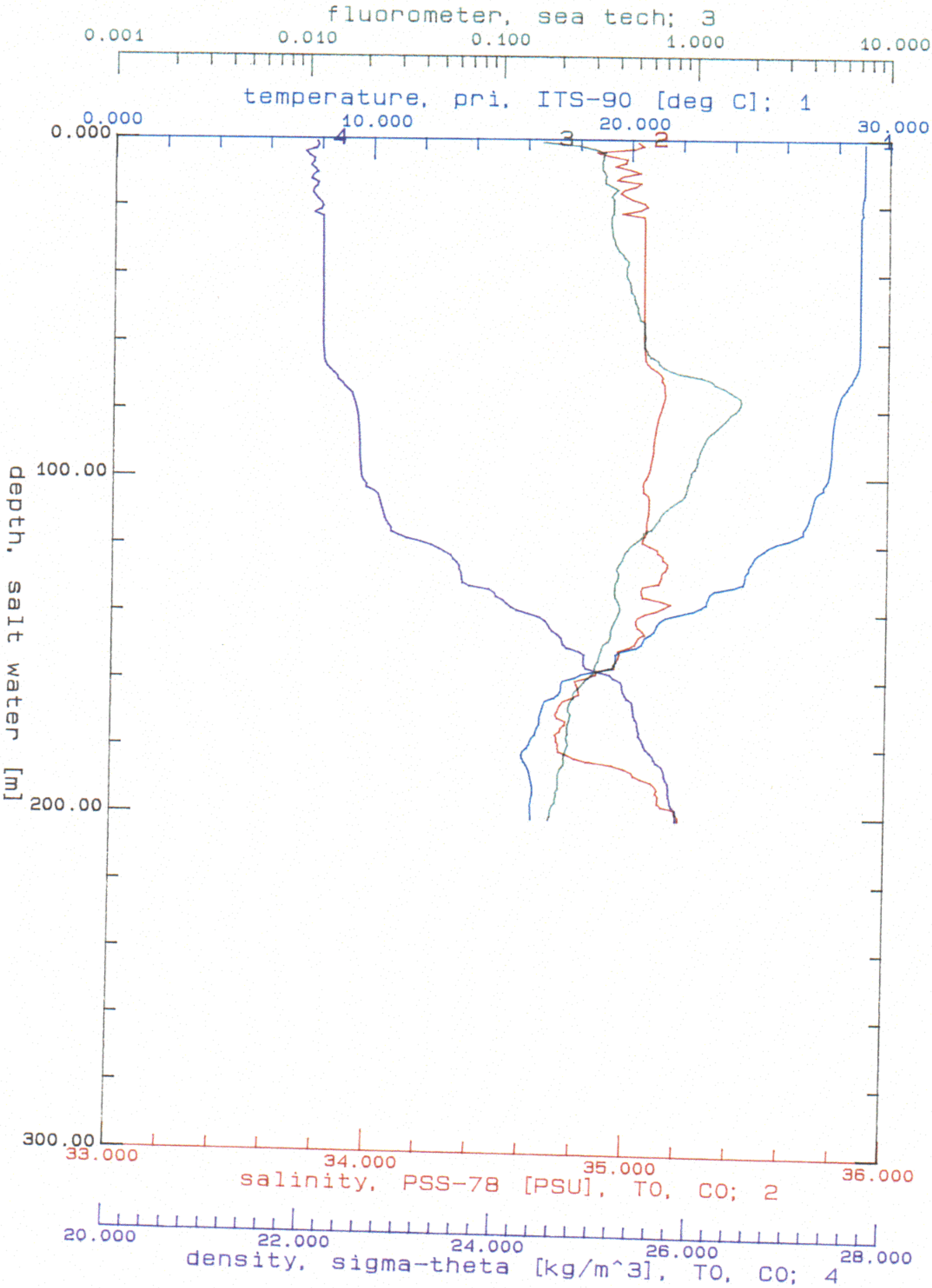
D9802041.CNV: MR98-K02 Stn.04 shallow cast 6



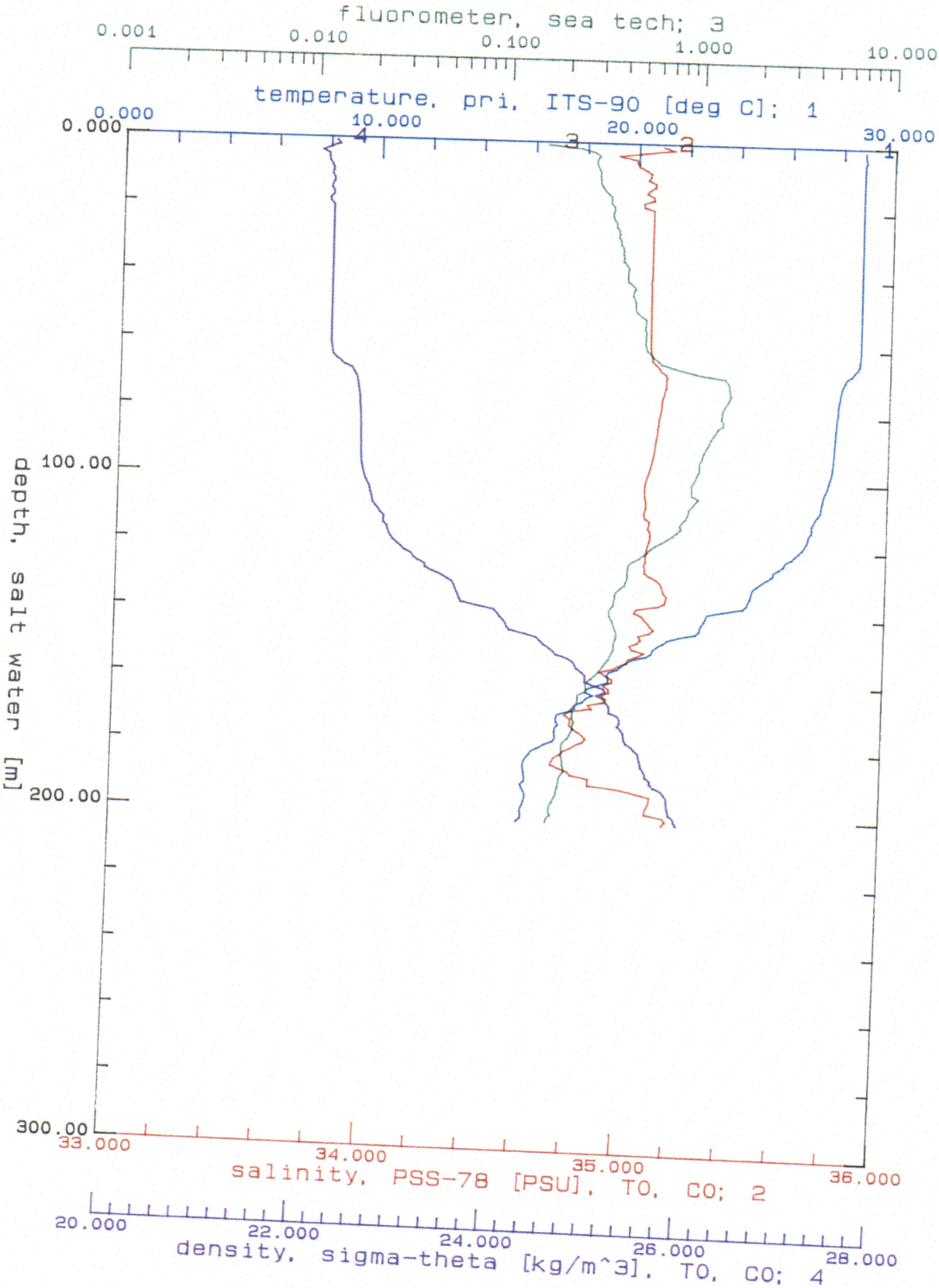
D9802051.CNV: MR98-K02 Stn.05 shallow cast 5



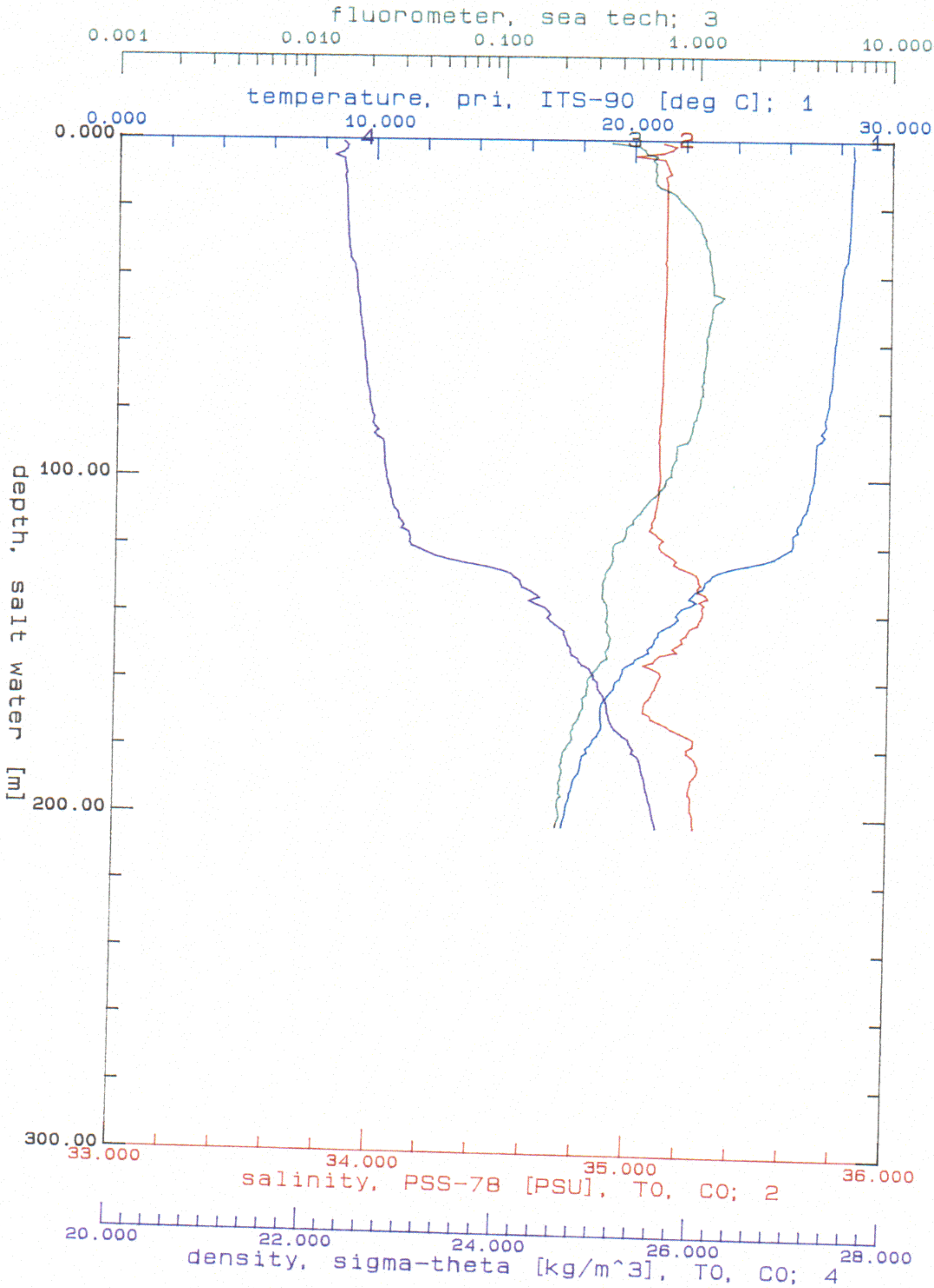
D9802061.CNV: MR98-K02 Stn.06 shallow cast 1



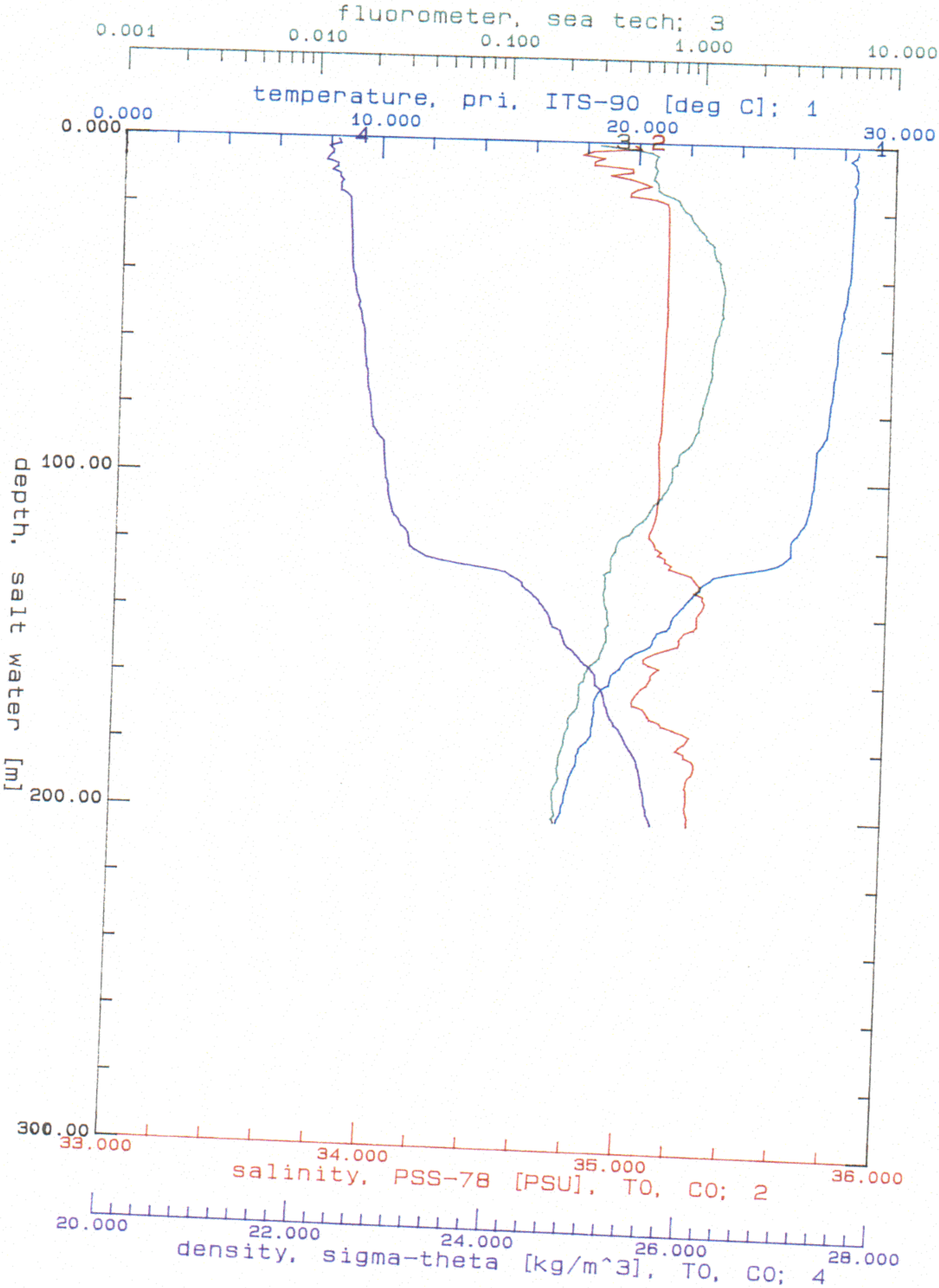
D9802062.CNV: MR98-K02 Stn.06 shallow cast 2



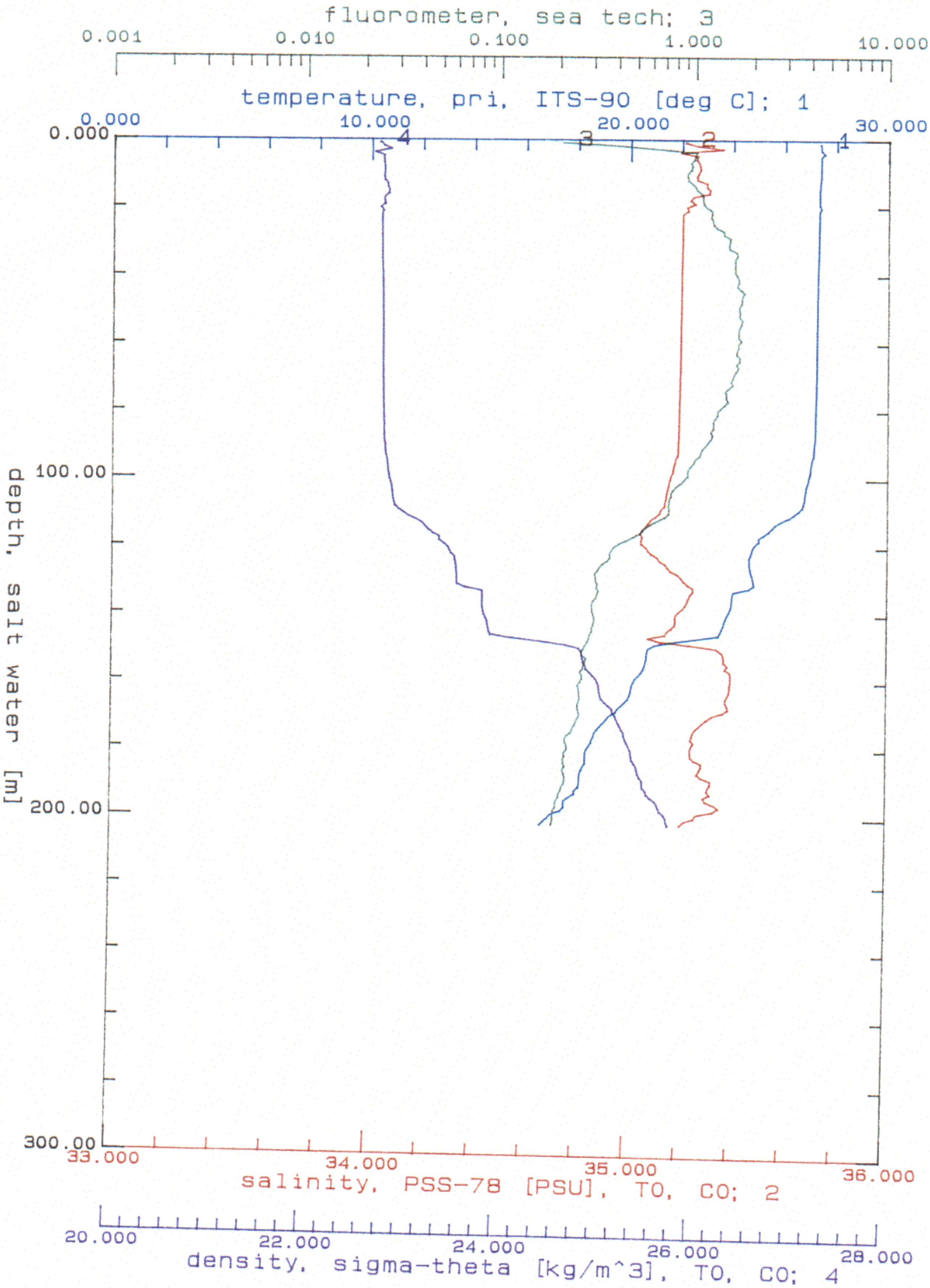
D9802064.CNV: MR98-K02 Stn.06 shallow cast 3



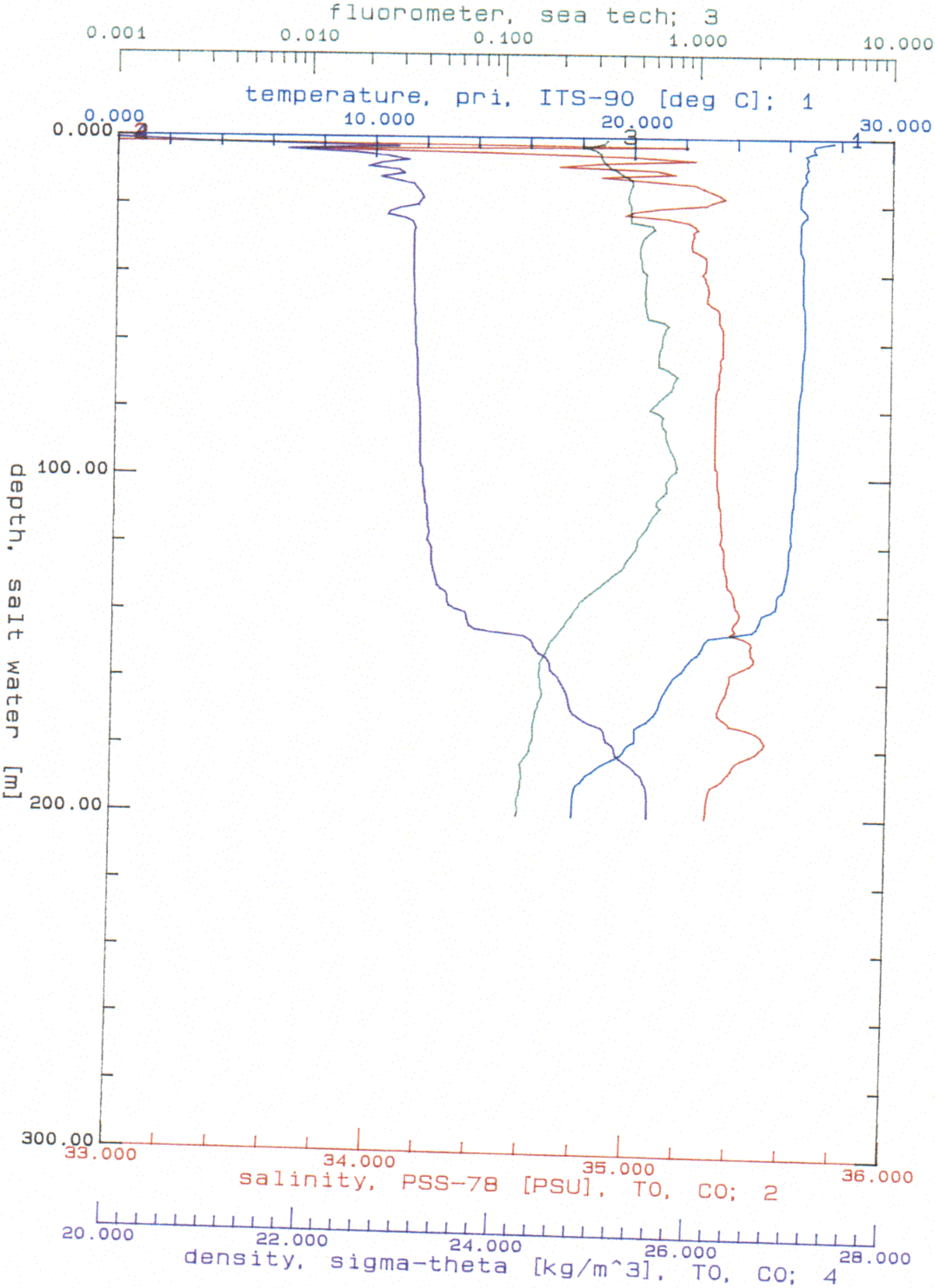
D9802071.CNV: MR98-K02 Stn.07 shallow cast 5



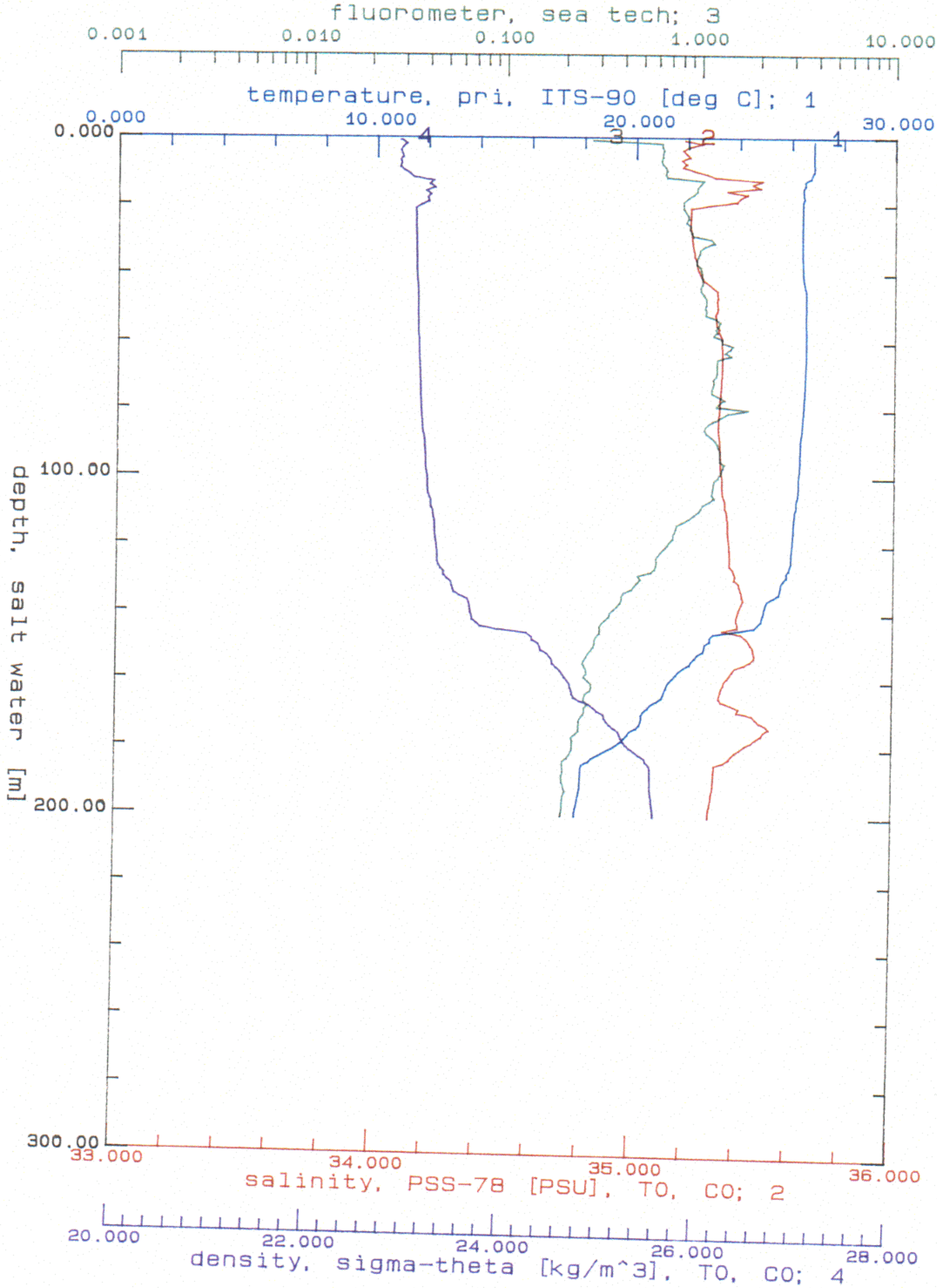
D9802072.CNV: MR98-K02 Stn.07 shallow cast 5 (retry the cast



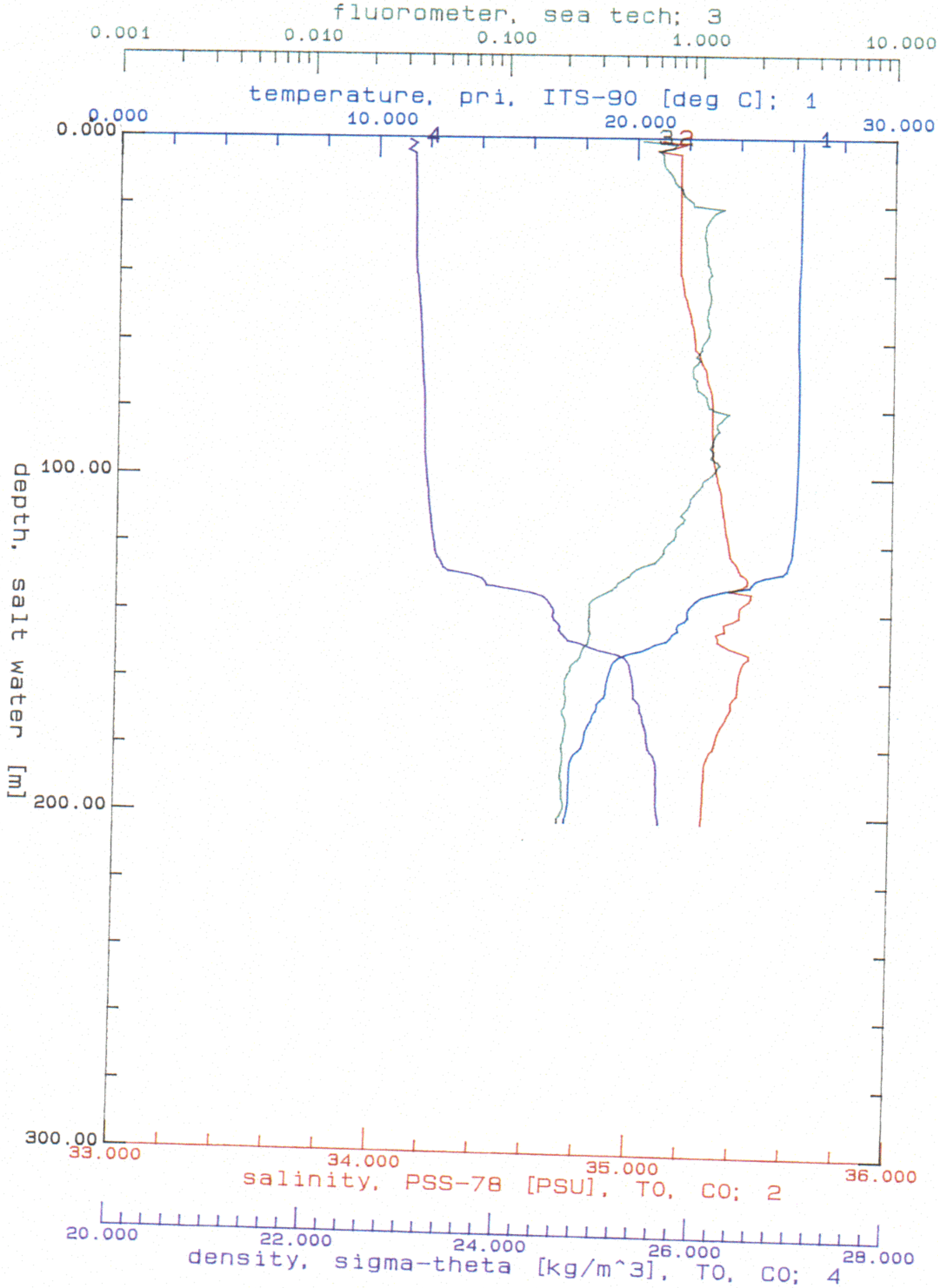
D9802081.CNV: MR98-K02 Stn.08 shallow cast 5



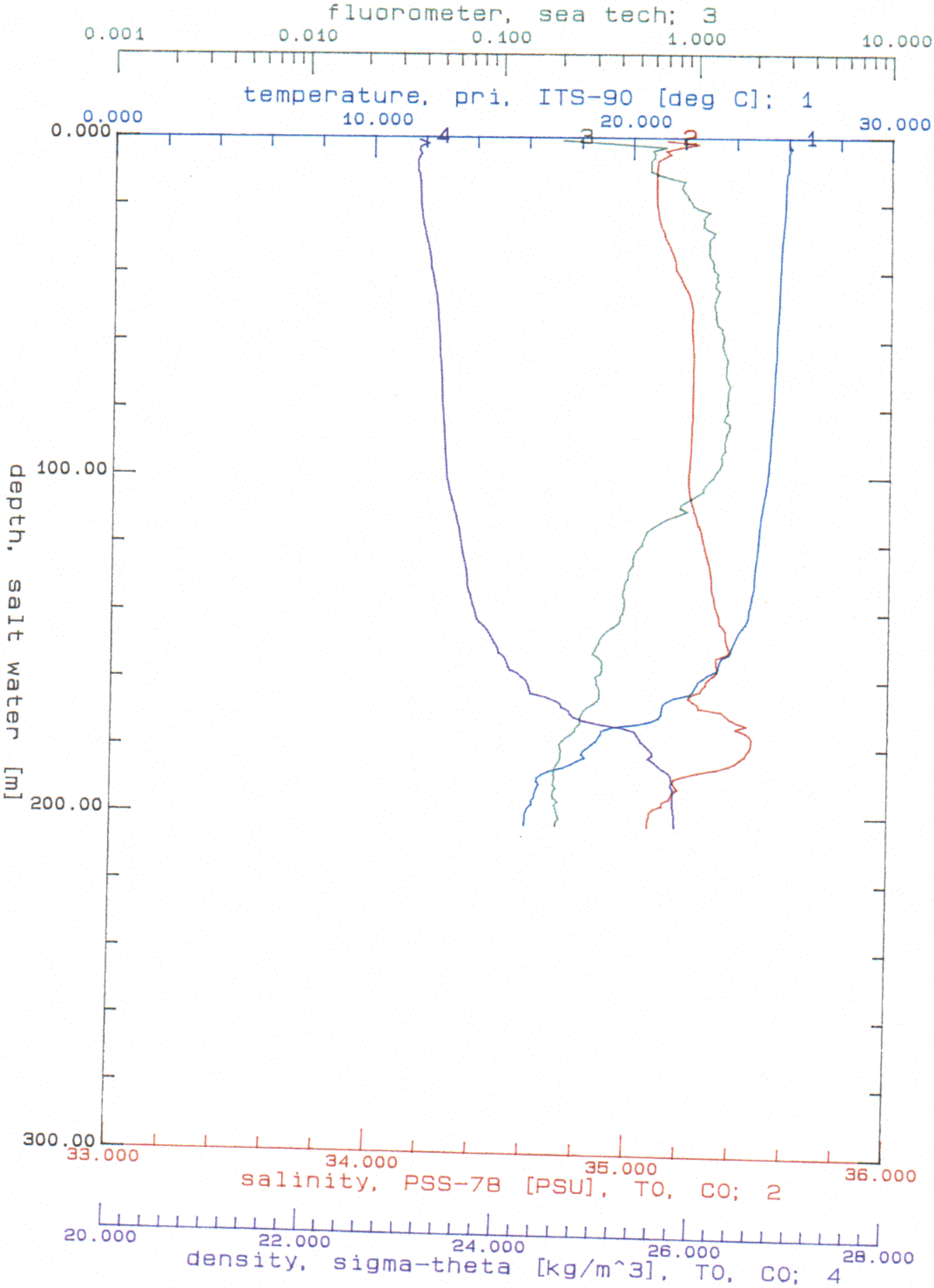
D9802091.CNV: MR98-K02 Stn.09 shallow cast 1



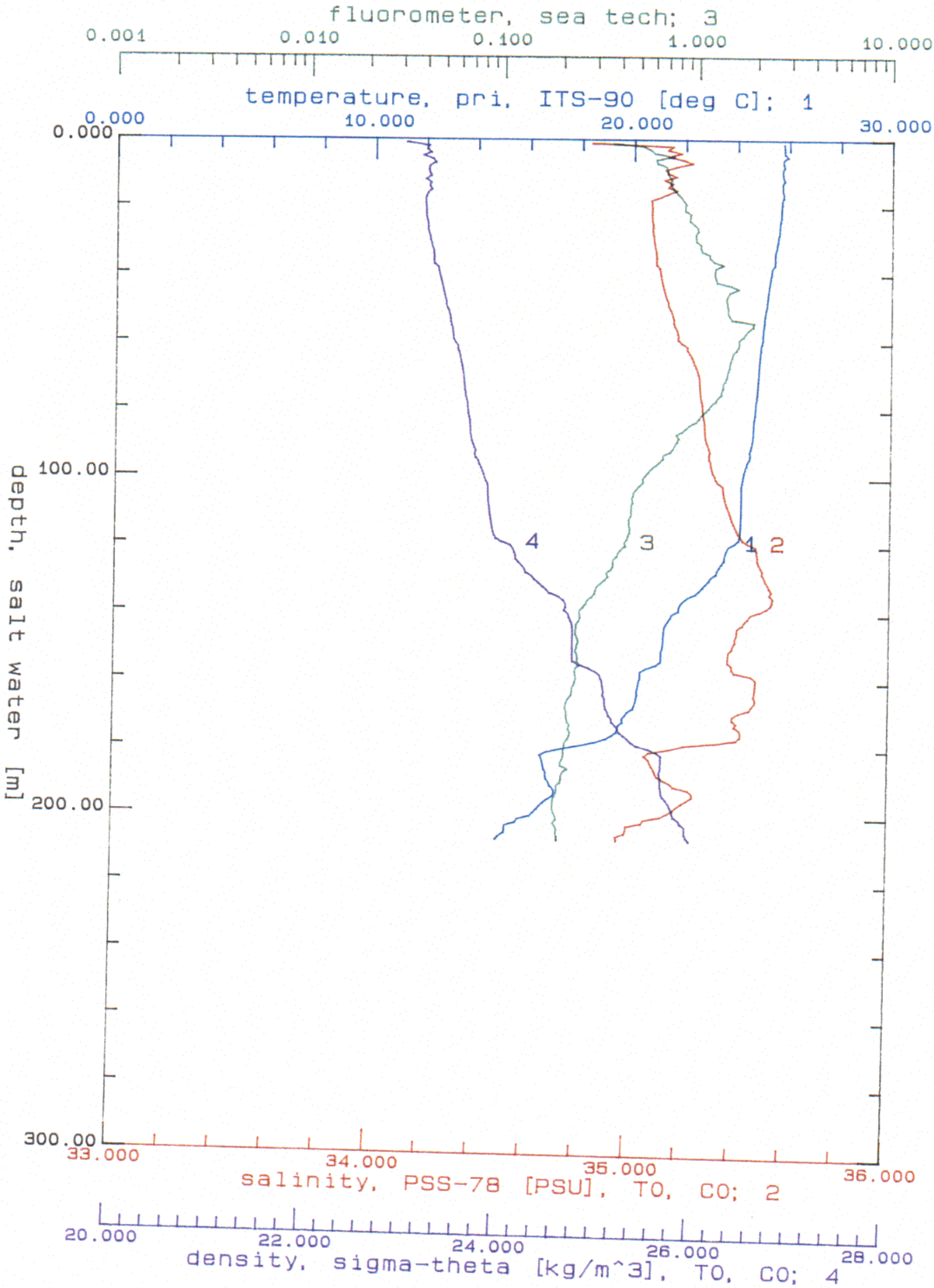
D9802092.CNV: MR98-K02 Stn.09 shallow cast 2



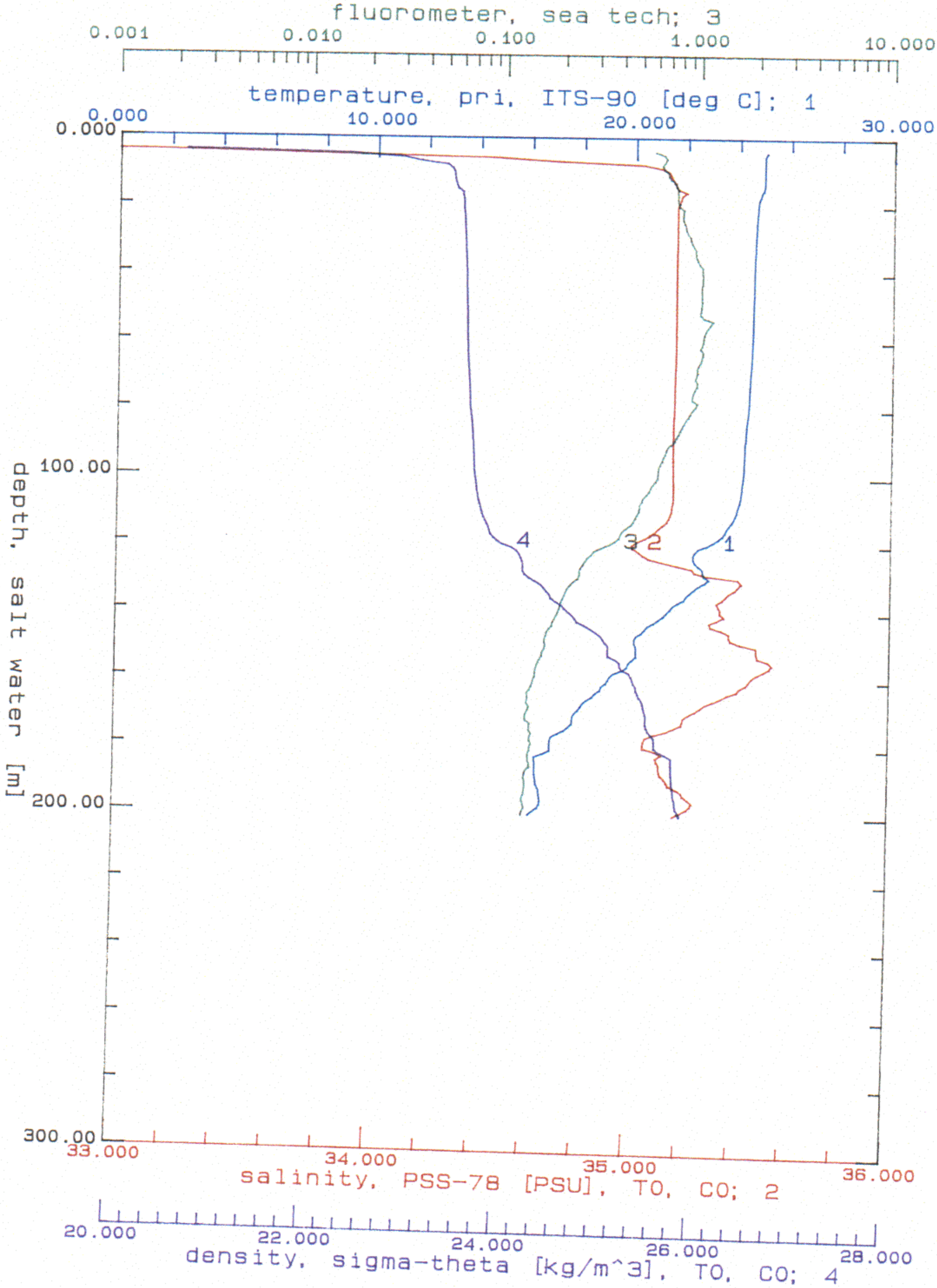
D9802094.CNV: MR98-K02 Stn.09 shallow cast 3



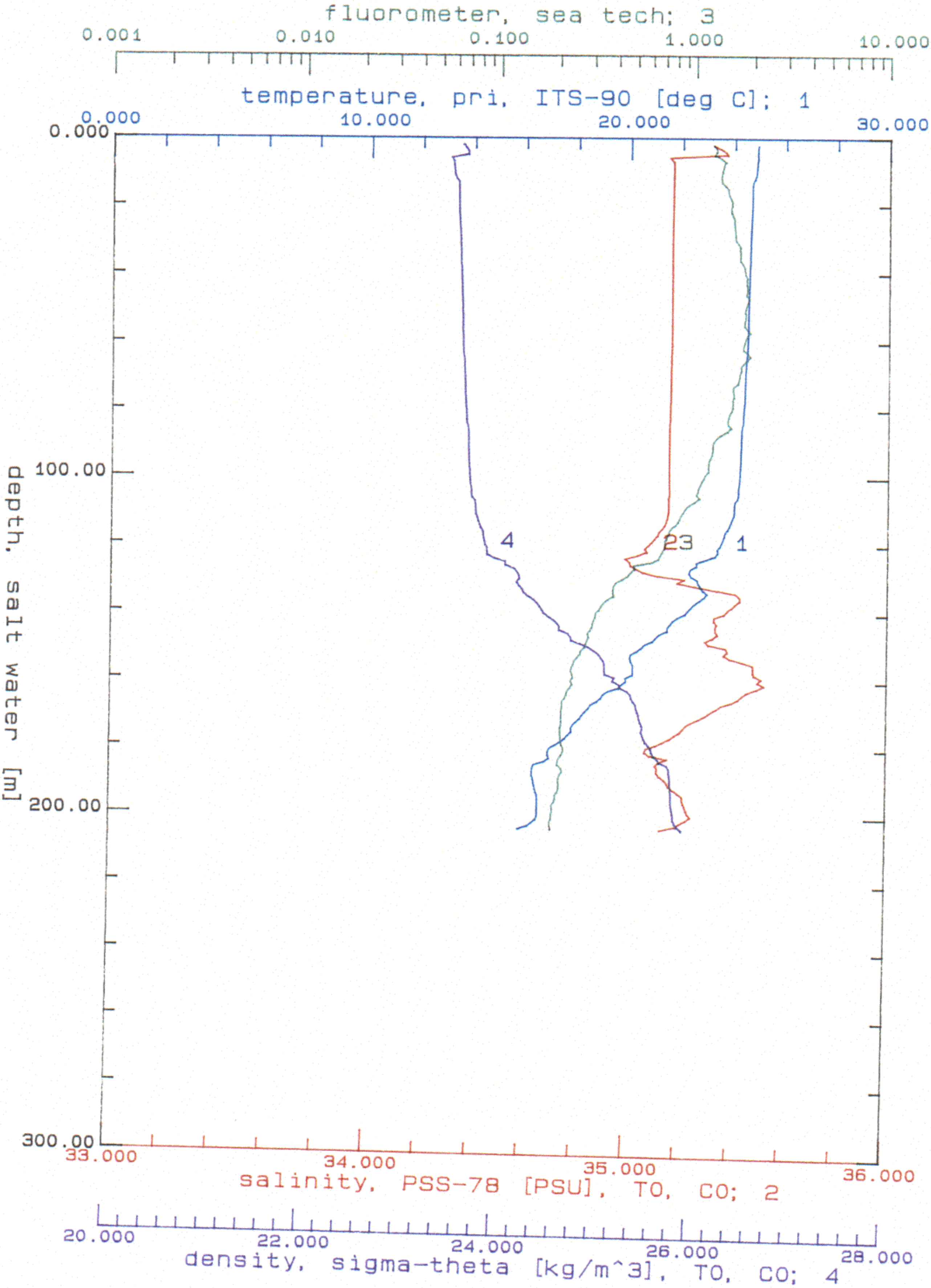
D9802101.CNV: MR98-K02 Stn.10 shallow cast 5



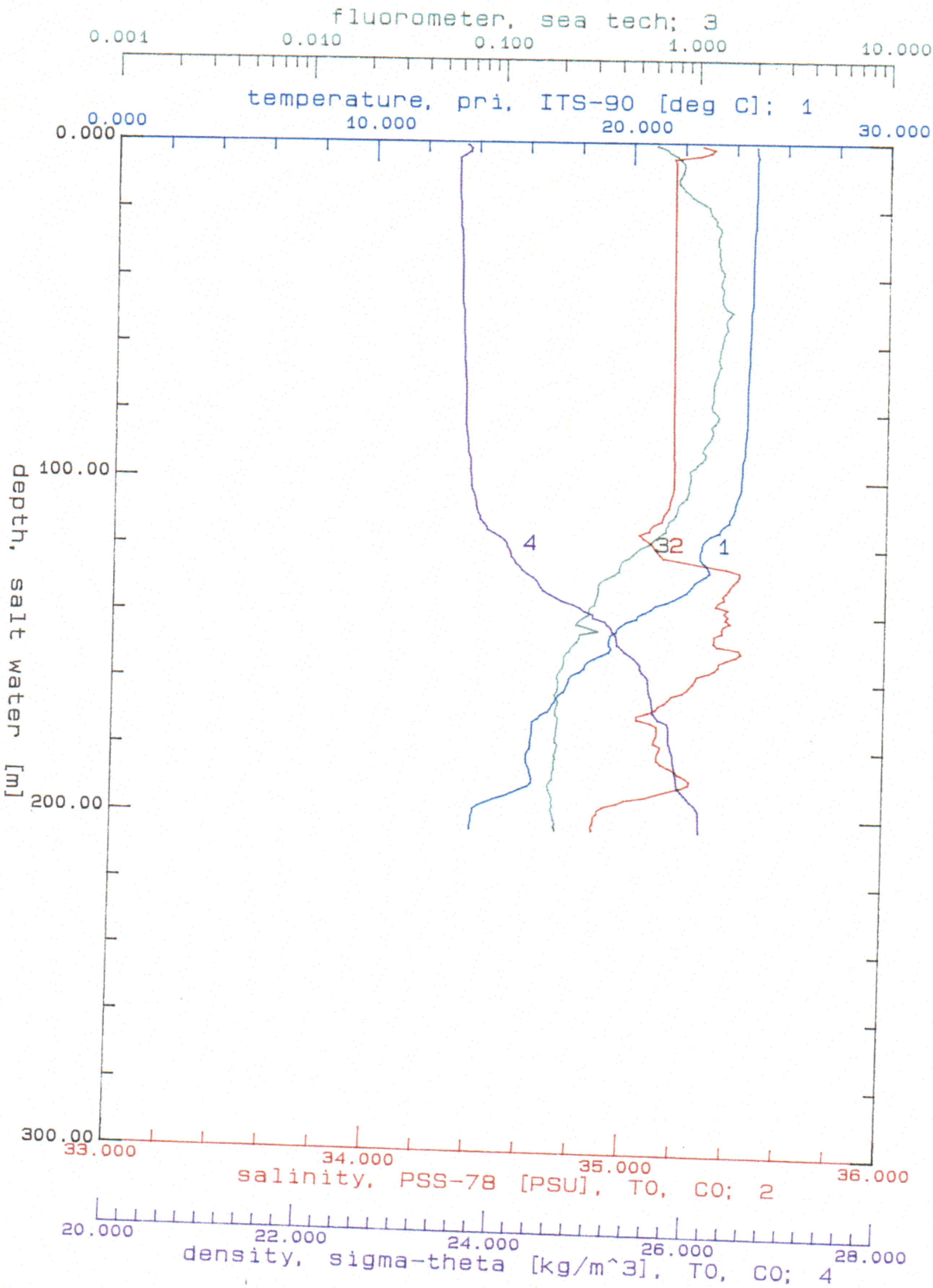
D9802111.CNV: MR98-K02 Stn.11 shallow cast 5



D9802121.CNV: MR98-K02 Stn.12 shallow cast 1



D9802122.CNV: MR98-K02 Stn.12 shallow cast 2



D9802124.CNV: MR98-K02 Stn.12 shallow cast 3

File Name List

Stn.	Cast	File name (raw data)	Start Position Latitude	Longitude	Date(UTC)	Time (UTC) Start	End	remarks
1	shallow 4	9802011.dat	04-02.86N	135-01.19E	12/31/'98	02:50	03:24	
2	shallow 1	9802021.dat	05-01.11N	140-01.85E	1/1/'99	08:17	08:42	
2	shallow 2	9802022.dat	05-01.19N	140-02.01E	1/1/'99	09:25	———	Down cast only
2	shallow 2	9802022u.dat	———	———	———	———	10:12	Up cast only
2	deep	9802023.dat	05-01.98N	140-05.56E	1/1/'99	12:05	14:59	
2	shallow 3	9802024.dat	05-02.17N	140-06.24E	1/2/'99	01:03	01:40	
3	shallow 1	9802031.dat	00-00.32N	144-59.81E	1/3/'99	12:11	12:29	
3	shallow 2	9802032.dat	00-00.43N	144-59.88E	1/3/'99	13:15	13:49	
3	deep	9802033.dat	00-01.66N	144-59.84E	1/3/'99	17:47	20:02	
3	shallow 3	9802034.dat	00-00.39N	145-01.22E	1/4/'99	01:12	01:44	
4	shallow 6	9802041.dat	00-00.01S	147-53.17E	1/5/'99	01:26	02:00	
5	shallow 5	9802051.dat	00-00.06S	153-15.82E	1/6/'99	01:03	01:34	
6	shallow 1	9802061.dat	00-00.09N	160-00.05E	1/7/'99	06:52	07:11	
6	shallow 2	9802062.dat	00-00.29N	159-59.92E	1/7/'99	07:27	07:55	
6	deep	9802063.dat	00-00.60N	159-59.67E	1/7/'99	09:29	11:35	
6	shallow 3	9802064.dat	00-04.09N	159-59.72E	1/7/'99	23:04	23:33	
7	shallow 5	9802071.dat	00-00.00N	163-36.09E	1/8/'99	00:02	00:35	discontinuance during up cast
7	shallow 5	9802072.dat	00-00.08N	163-36.00E	1/8/'99	00:42	01:04	retry
8	shallow 5	9802081.dat	00-00.30S	168-55.93E	1/9/'99	00:00	00:27	new pylon
9	shallow 1	9802091.dat	00-00.05N	174-59.72E	1/11/'99	03:53	04:12	
9	shallow 2	9802092.dat	00-00.19N	174-59.16E	1/11/'99	04:26	04:55	
9	deep	9802093.dat	00-01.42N	174-57.71E	1/11/'99	06:22	09:30	
9	shallow 3	9802094.dat	00-03.53N	174-54.82E	1/11/'99	22:02	22:29	
10	shallow 5	9802101.dat	00-00.05S	178-47.76E	1/12/'99	23:01	23:32	
11	shallow 5	9802111.dat	00-00.08N	176-17.38W	1/13/'99	23:03	23:32	
12	shallow 1	9802121.dat	00-00.21N	170-04.96W	1/15/'99	03:47	04:10	
12	shallow 2	9802122.dat	00-00.19N	170-05.10W	1/15/'99	04:30	04:59	
12	deep	9802123.dat	00-00.21N	170-05.50W	1/15/'99	06:14	09:19	
12	shallow 3	9802124.dat	00-02.87S	170-10.96W	1/15/'99	21:34	22:05	

Table 1

3.2.2 XCTD

Naoto Morioka(G.O.D.I.)

Objective

To supplement CTD casting data from St.4 to St.12

Instruments

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

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

8 magazine Auto launcher (T.S.K. Tsurumi Seiki)

Measured parameter

Temperature

Conductivity

Method

I launched the XCTD every 12 hour at 11 ,23 from 5th January to 16th January. But if the time was during observation, I did not launch.

Preliminary results

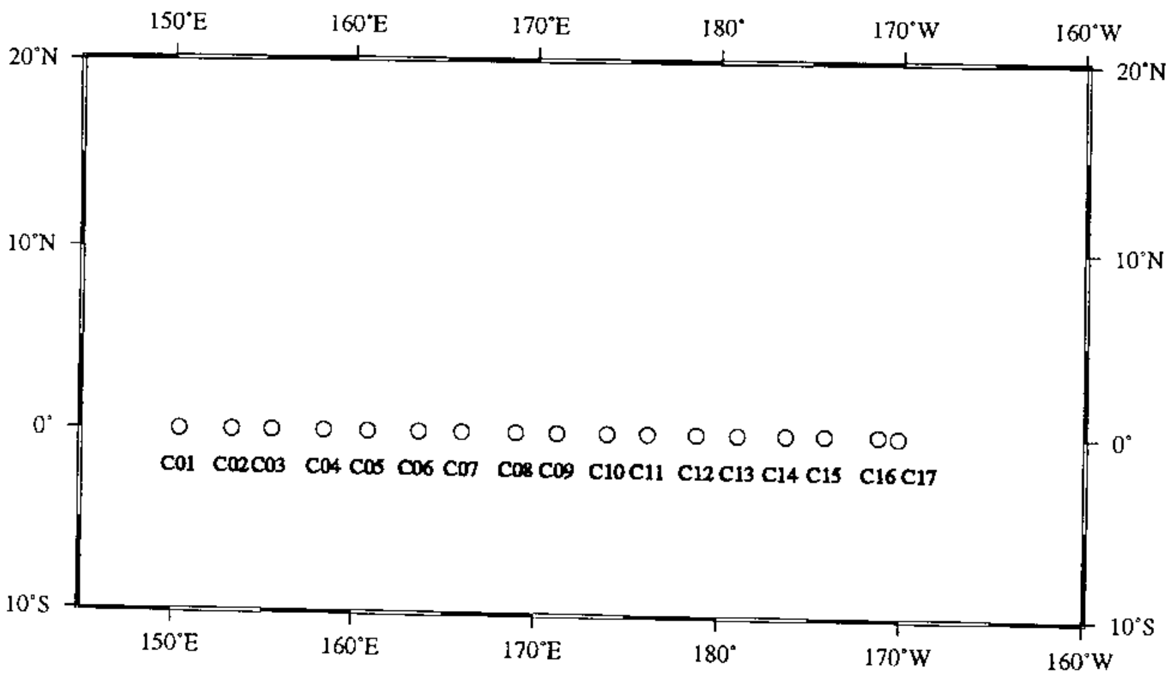
Vertical profiles of temperature and salinity are shown in the next page.

Data archive

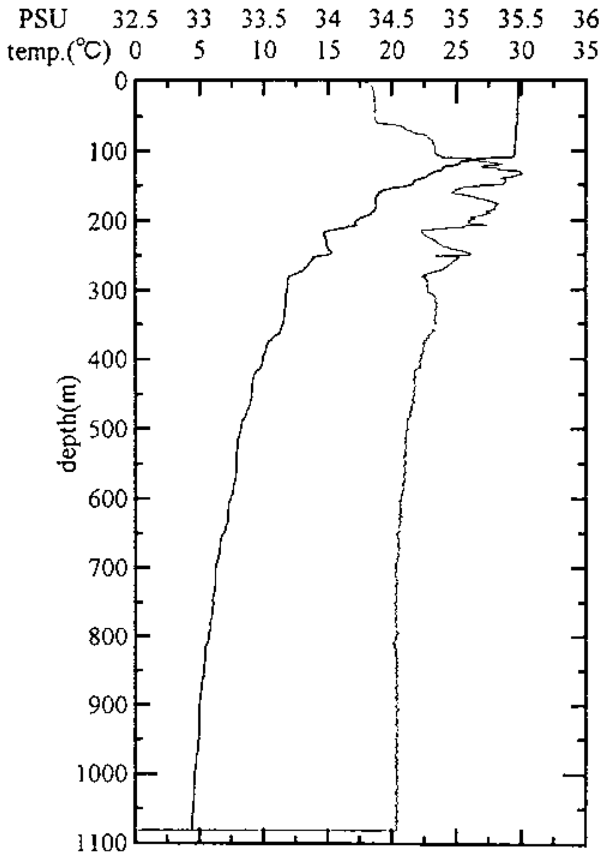
XCTD data will be submitted to the DMO.

XCTD Casting Points

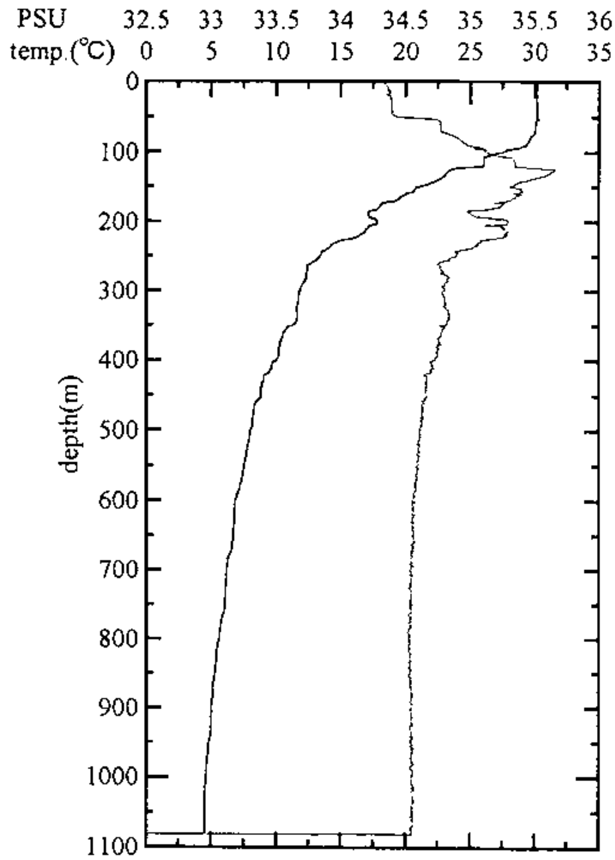
No.	DATE	TIME(UTC)	Position	
C01	99/01/05	13:00	00-02N	150-20E
C02	99/01/06	00:46	00-00S	153-15E
C03	99/01/06	11:57	00-00N	155-27E
C04	99/01/06	23:57	00-01N	158-21E
C05	99/01/08	11:58	00-01N	160-47E
C06	99/01/08	23:45	00-00N	163-35E
C07	99/01/09	11:57	00-00N	165-57E
C08	99/01/09	23:46	00-00S	168-55E
C09	99/01/10	10:56	00-01N	171-10E
C10	99/01/10	22:57	00-01N	173-55E
C11	99/01/12	10:58	00-00S	176-09E
C12	99/01/12	22:45	00-00S	178-47E
C13	99/01/13	11:03	00-00N	178-58W
C14	99/01/13	22:44	00-00N	176-19W
C15	99/01/14	09:53	00-00S	174-11W
C16	99/01/14	21:58	00-00S	171-15W
C17	99/01/16	09:12	00-02S	170-10W



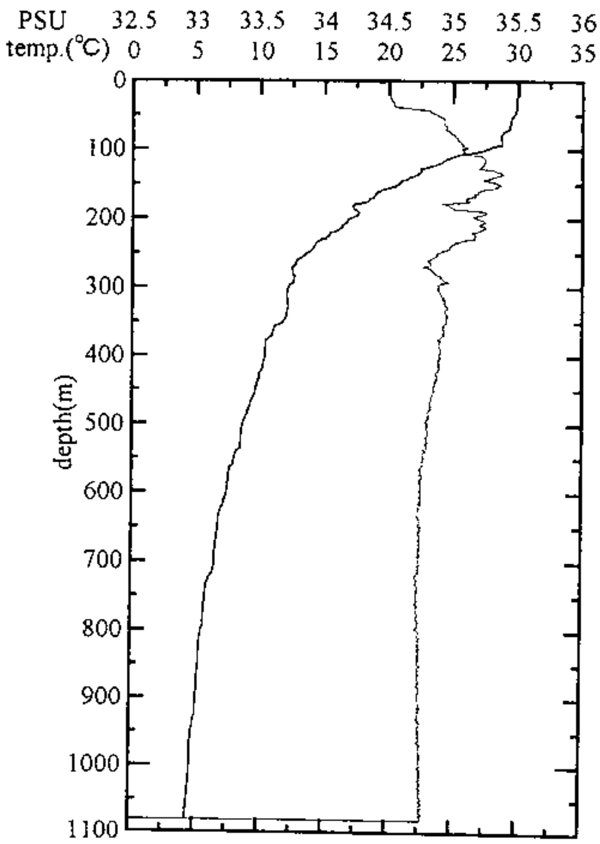
C01(00–02N,150–20E) 99/01/05/13:00



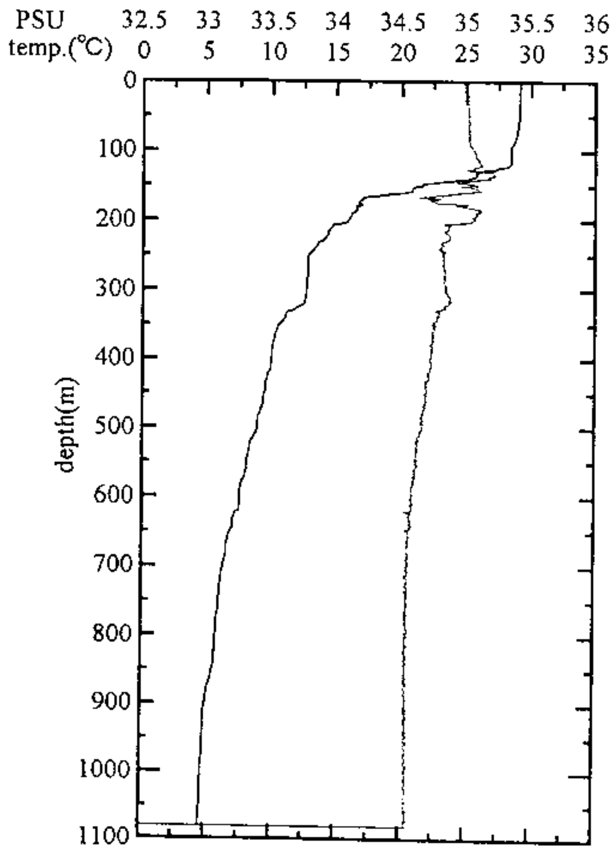
C02(00–00N,155–27E) 99/01/06/11:57

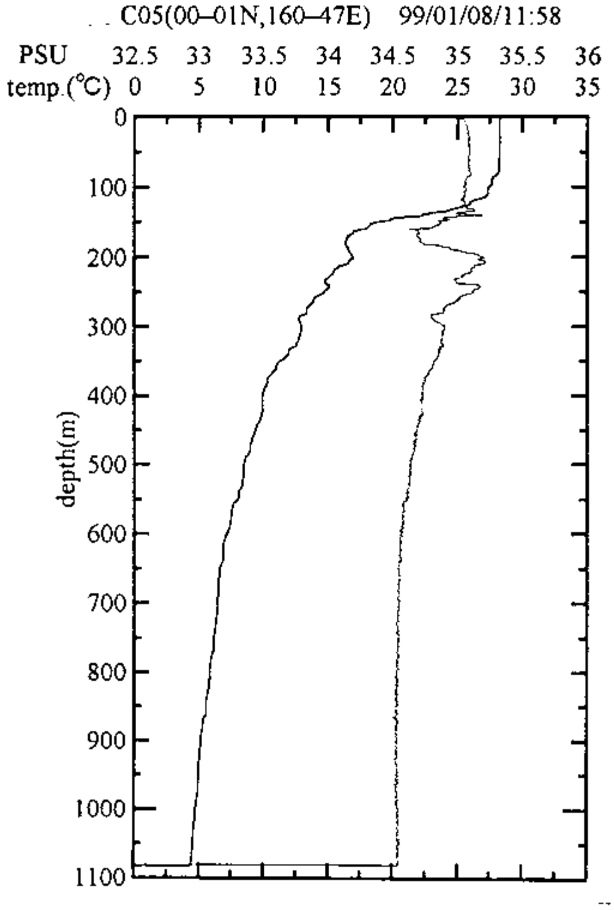


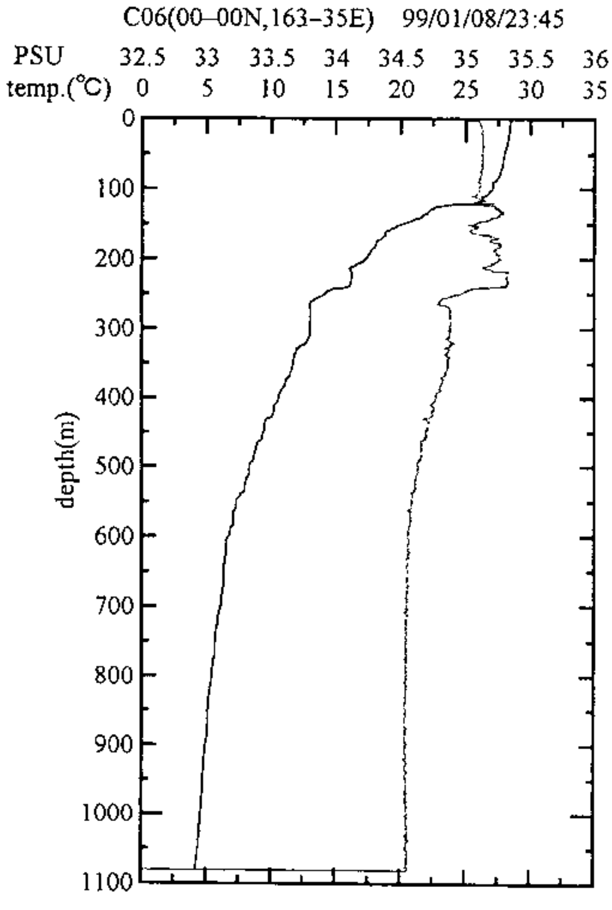
C03(00–00N,155–27E) 99/01/06/11:57

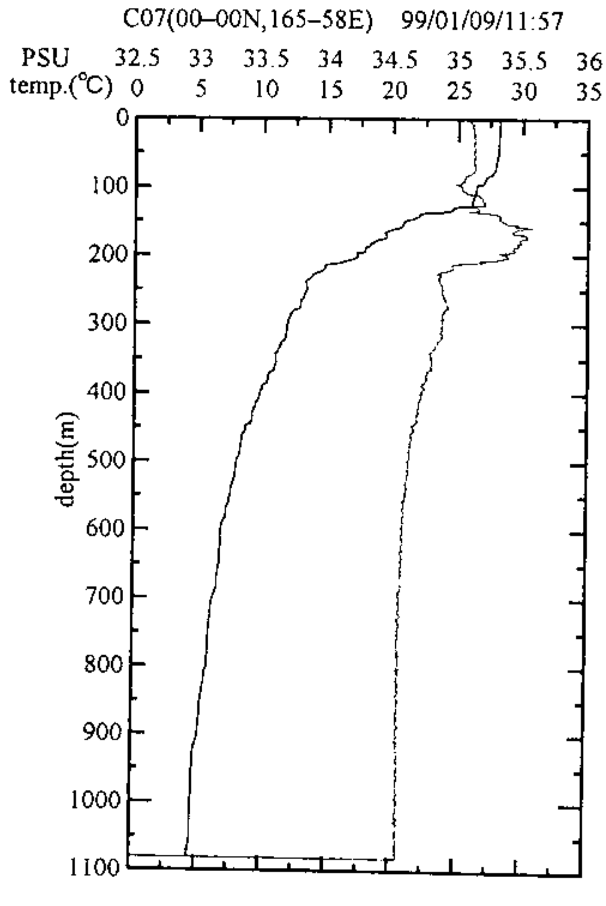


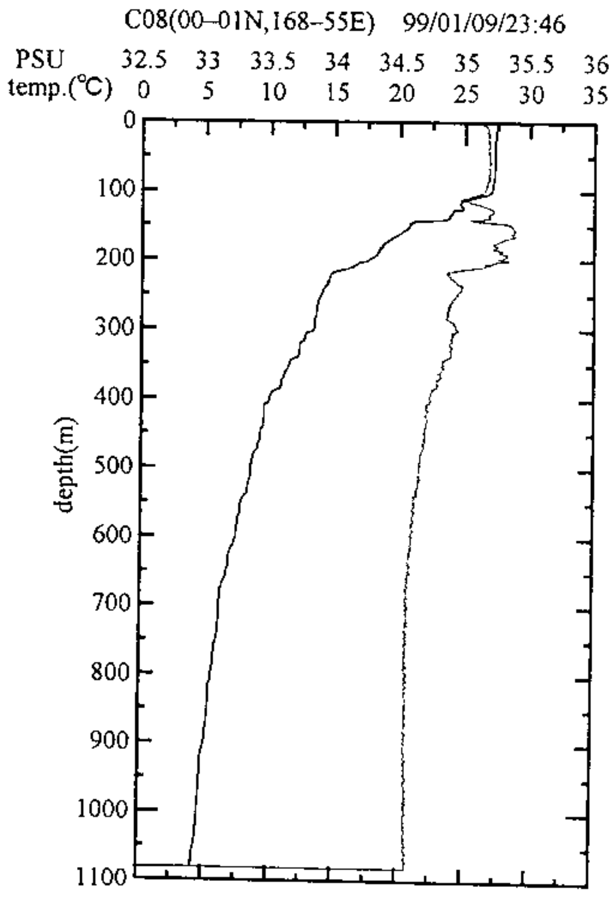
C04(00–01N,158–21E) 99/01/06/23:57

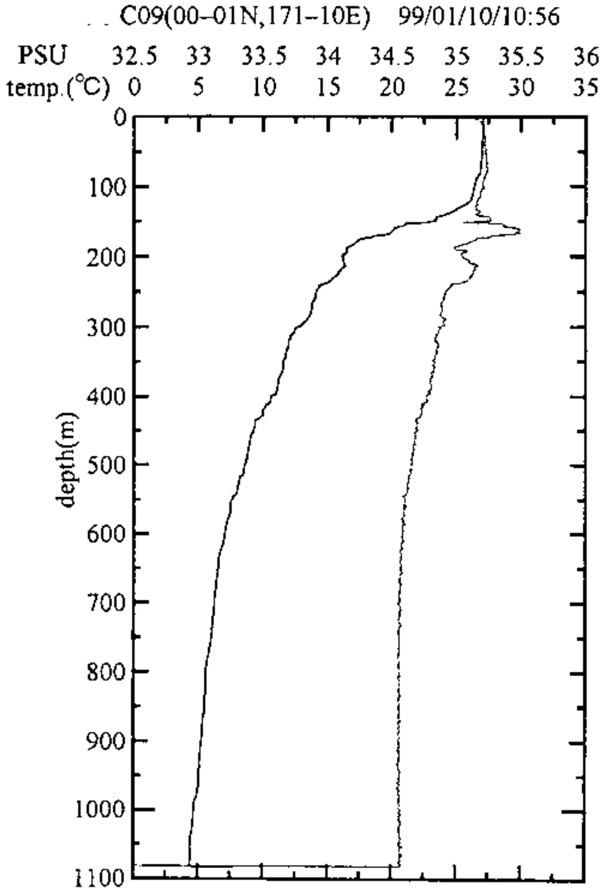


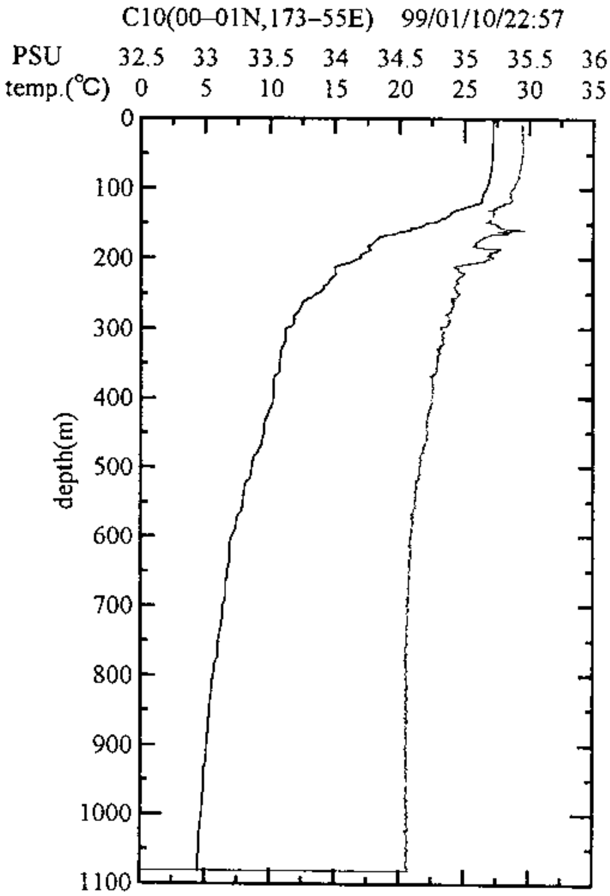

C05(00–01N,160–47E) 99/01/08/11:58
PSU 32.5 33 33.5 34 34.5 35 35.5 36
temp.(°C) 0 5 10 15 20 25 30 35
depth(m)
0 100 200 300 400 500 600 700 800 900 1000 1100

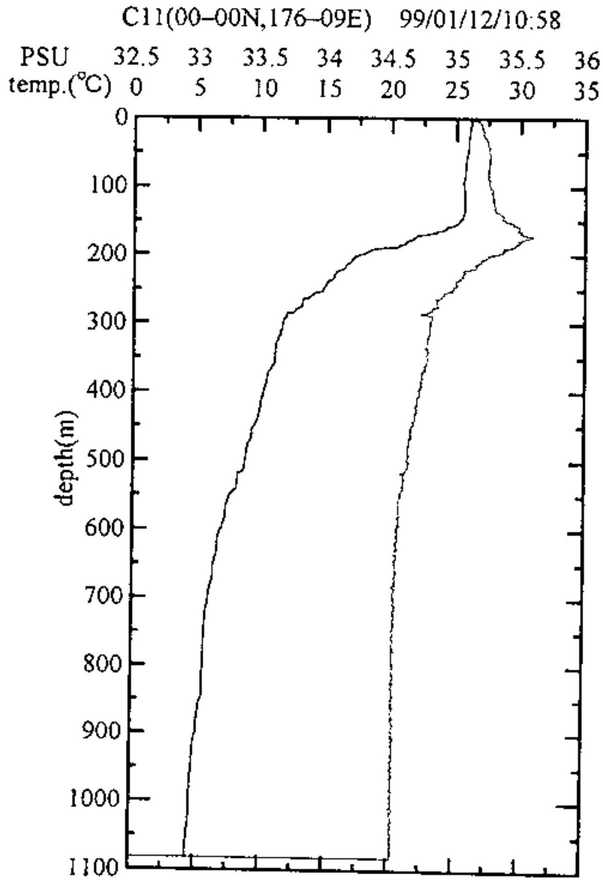

C06(00–00N,163–35E) 99/01/08/23:45
PSU 32.5 33 33.5 34 34.5 35 35.5 36
temp.(°C) 0 5 10 15 20 25 30 35
depth(m)
0 100 200 300 400 500 600 700 800 900 1000 1100

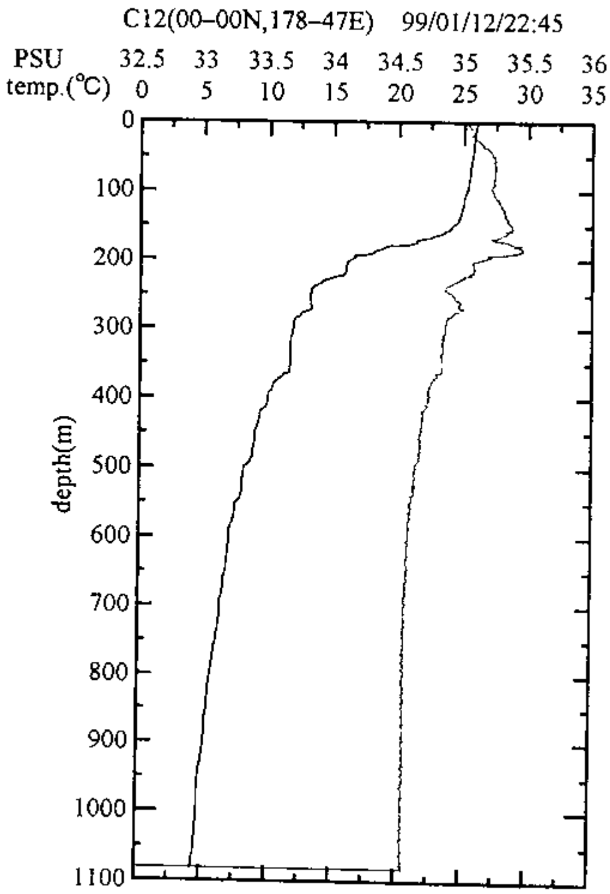

C07(00–00N,165–58E) 99/01/09/11:57
PSU 32.5 33 33.5 34 34.5 35 35.5 36
temp.(°C) 0 5 10 15 20 25 30 35
depth(m)
0 100 200 300 400 500 600 700 800 900 1000 1100


C08(00–01N,168–55E) 99/01/09/23:46
PSU 32.5 33 33.5 34 34.5 35 35.5 36
temp.(°C) 0 5 10 15 20 25 30 35
depth(m)
0 100 200 300 400 500 600 700 800 900 1000 1100

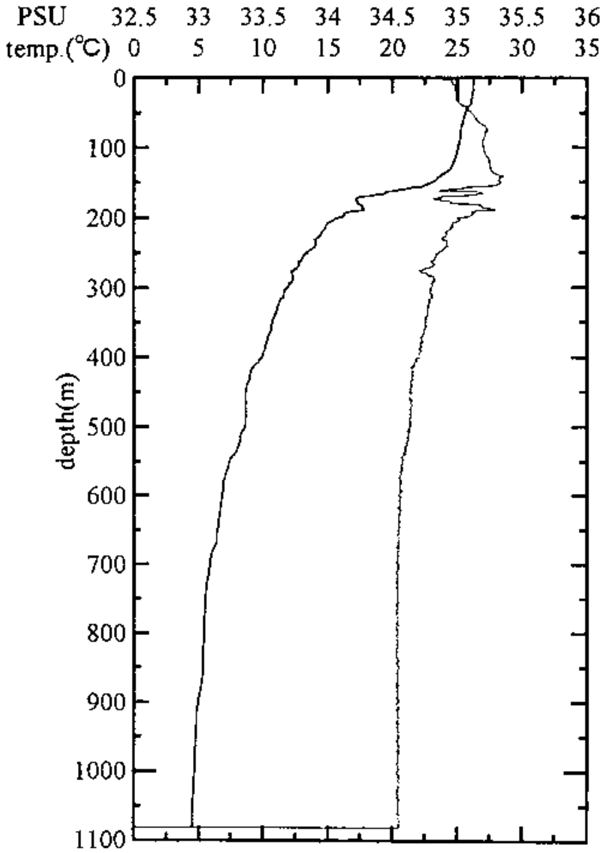

C09(00-01N,171-10E) 99/01/10/10:56
PSU 32.5 33 33.5 34 34.5 35 35.5 36
temp.(°C) 0 5 10 15 20 25 30 35
depth(m)
0 100 200 300 400 500 600 700 800 900 1000 1100


C10(00-01N,173-55E) 99/01/10/22:57
PSU 32.5 33 33.5 34 34.5 35 35.5 36
temp.(°C) 0 5 10 15 20 25 30 35
depth(m)
0 100 200 300 400 500 600 700 800 900 1000 1100

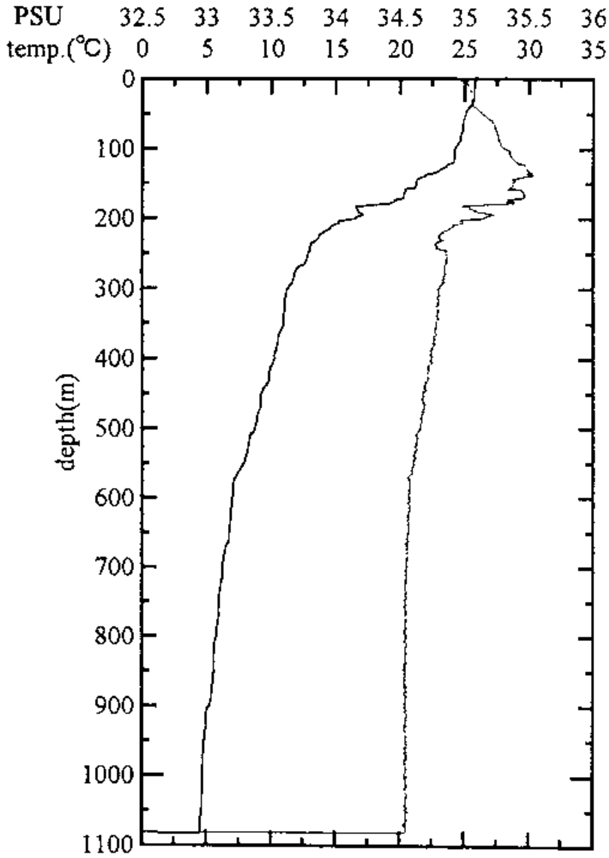

C11(00-00N,176-09E) 99/01/12/10:58
PSU 32.5 33 33.5 34 34.5 35 35.5 36
temp.(°C) 0 5 10 15 20 25 30 35
depth(m)
0 100 200 300 400 500 600 700 800 900 1000 1100


C12(00-00N,178-47E) 99/01/12/22:45
PSU 32.5 33 33.5 34 34.5 35 35.5 36
temp.(°C) 0 5 10 15 20 25 30 35
depth(m)
0 100 200 300 400 500 600 700 800 900 1000 1100

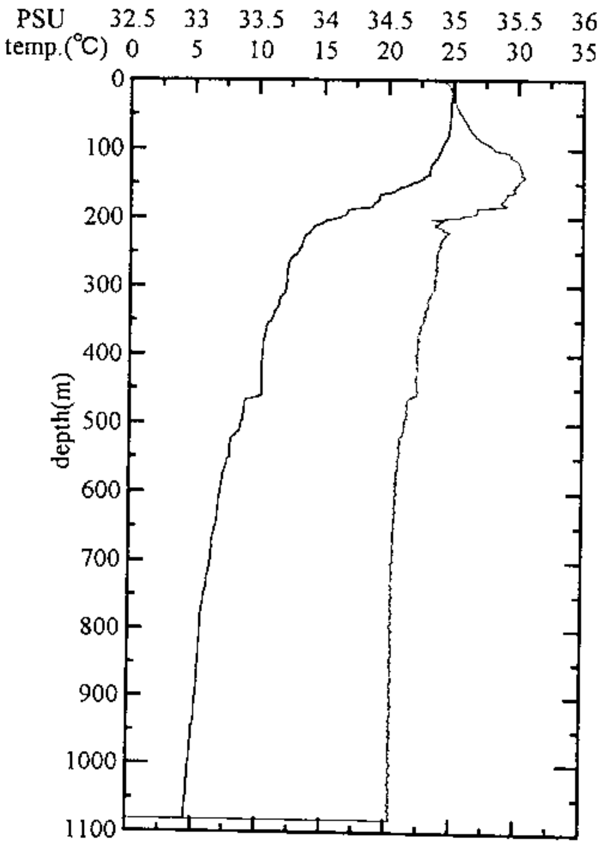
C13(00–00N,178–58W) 99/01/13/11:03



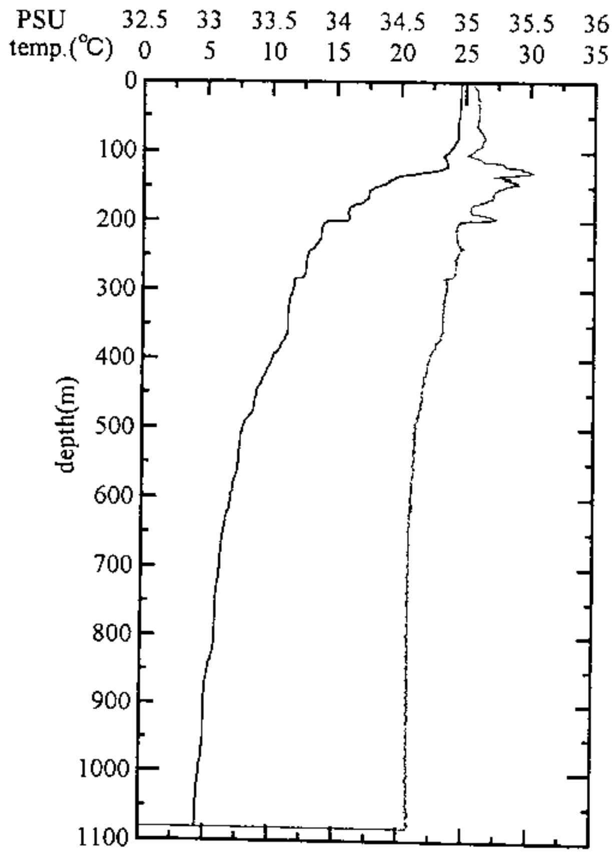
C14(00–00N,176–19W) 99/01/13/22:44



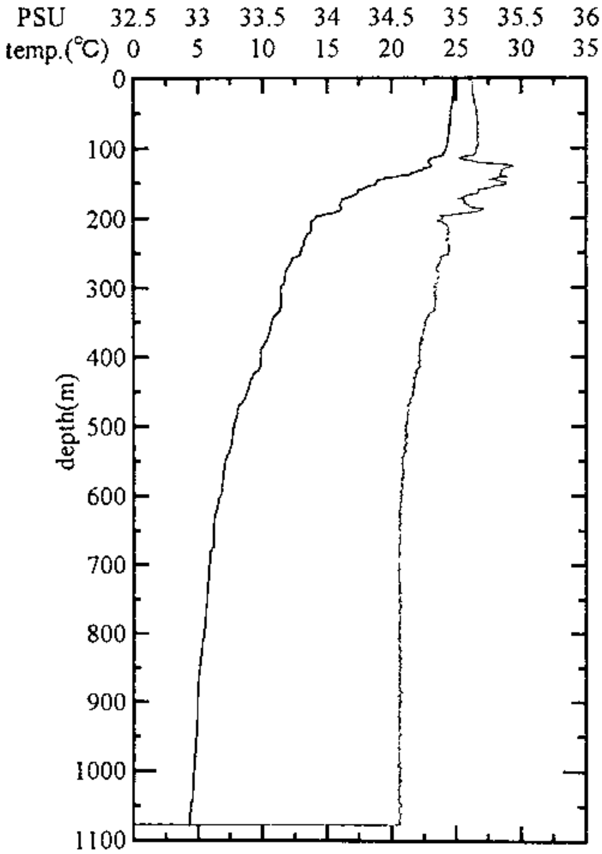
C15(00–00N,174–11W) 99/01/14/09:53

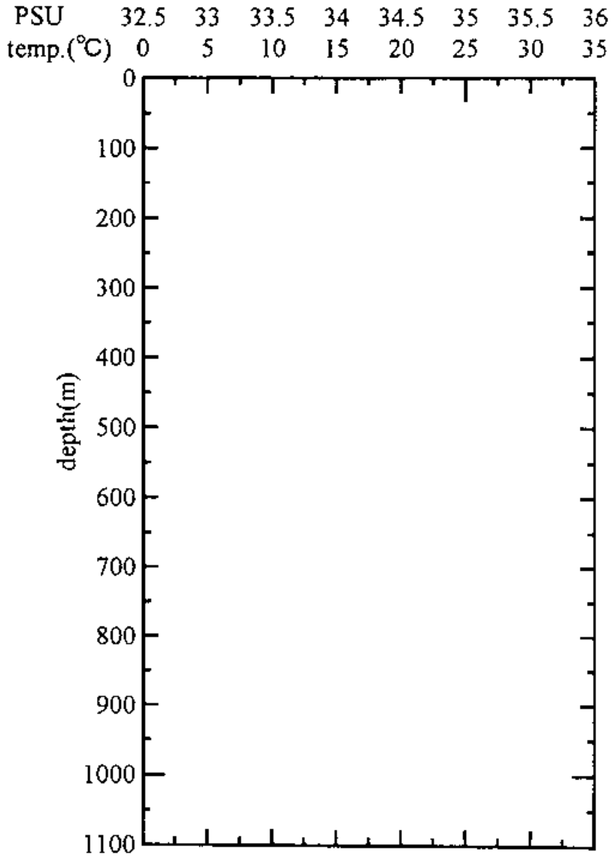


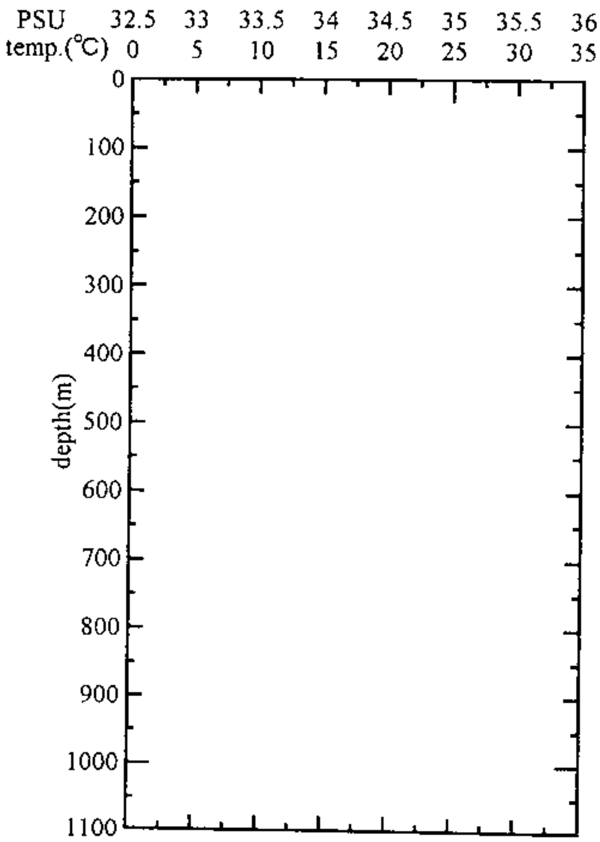
C16(00–00N,171–15W) 99/01/14/21:58

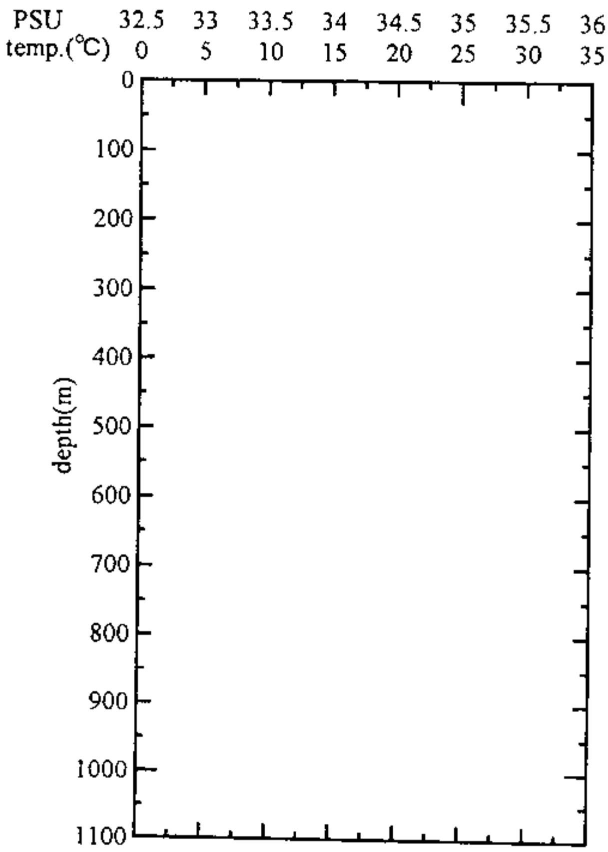


. . C17(00–02S,170–10W)   99/01/16/09:12









3.2.3 Shipboard ADCP

Naoto Morioka (G.O.D.I.)

Measured Parameters

N-S(North-South) and E-W (East-West) velocity components of each depth cell [cm/s]

ECHO intensity of each depth cell [dB]

Methods

We measured sea water current profiles by VM-75 (RD Instruments ,Inc. USA) shipboard ADCP (Acoustic Doppler Current Profiler) throughout MR98K02 cruise from departure of Hachinohe December 23 1998 to the arrival of Sekinehama 1 February 1999 .

Major parameters for the measurement configuration are as follows

Frequency:	75KHz
Average:	every 300sec
Depth cell length:	1600cm
No. of depth cells:	40
First depth cell position:	32.6m
Last depth cell position:	656.6m
ADCP ensemble time:	51.9 s
Ping per ADCP raw data	16

Preliminary results

Fig-1,Fig-4 show current profiles of 170E,175E,180E and 175W on the equator.

These figs are found the equatorial undercurrent about 200m depth.

Data archives

5-minute averaged data , navigation data and raw data were reocorded in the 3.5”MO disk. These data will be submitted to the DMO (Data Management Office)

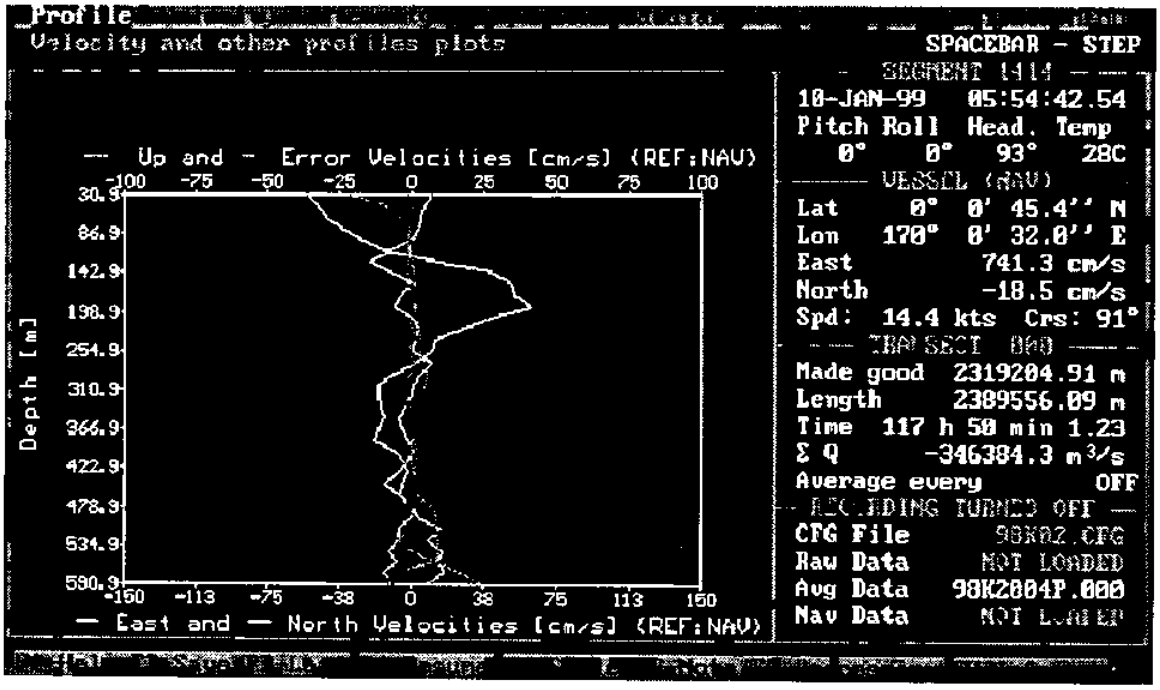


Fig.1 Zonal and meridional velocity-profile and percent good near Eq. 170E

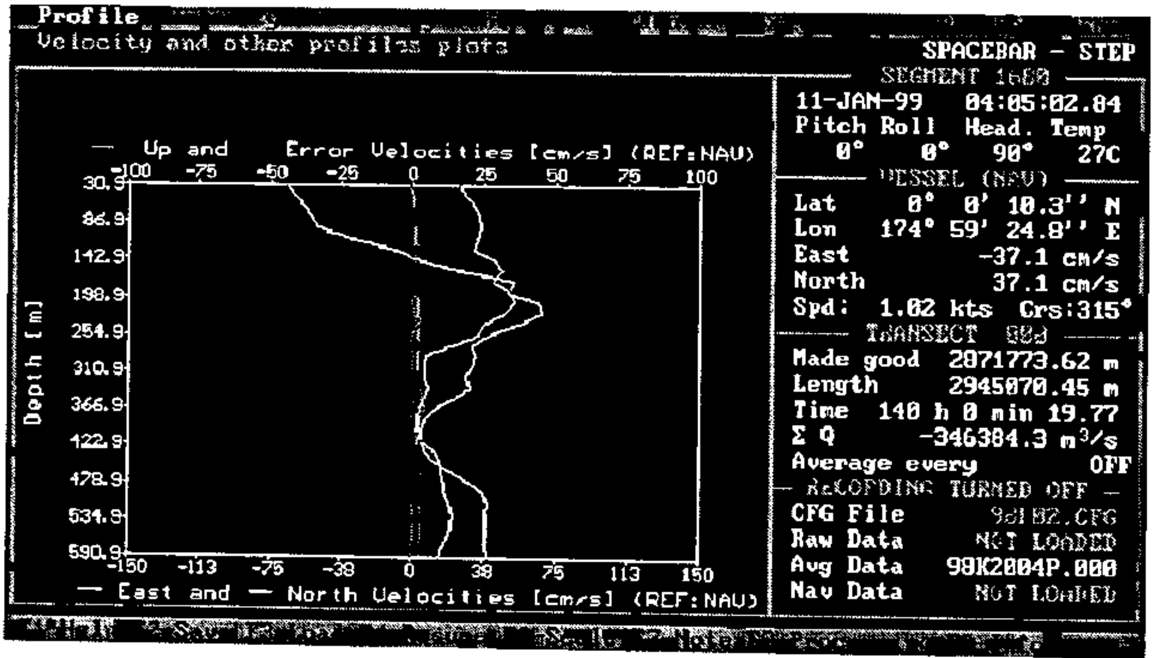


Fig.2 Zonal and meridional velocity profile and percent good near Eq. 175E

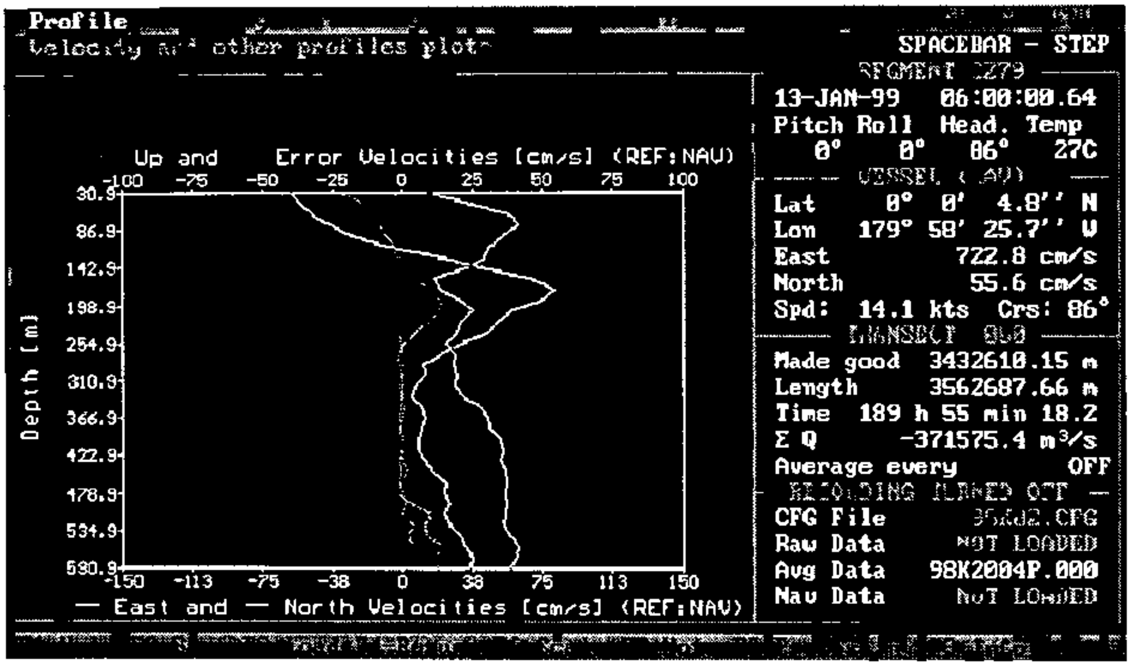


Fig.3 Zonal and meridional velocity profile and percent good near Eq. 180E

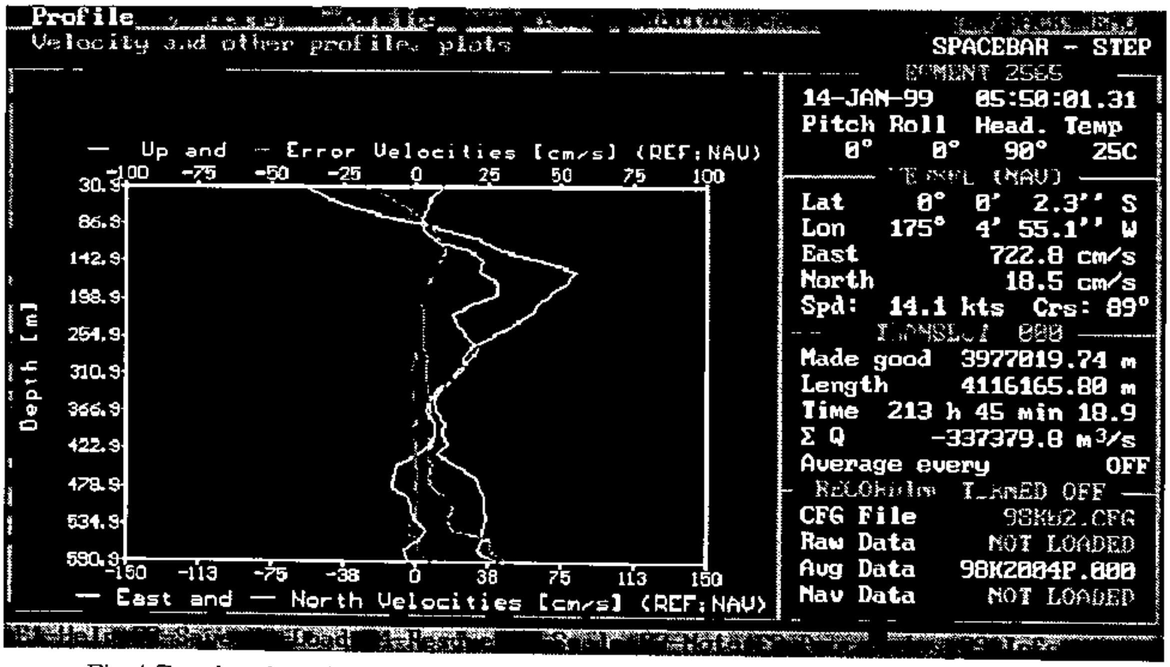


Fig.4 Zonal and meridional velocity profile and percent good near Eq. 175W

3.3 Chemical Parameters

3.3.1 Dissolved Oxygen Measurement

Takehiko Shiribiki, Fuyuki Shibata and Takahiko Inoue
Marine Works Japan Ltd.
1-1-7 Mutsuura, Kanazawa-ku, Yokohama 236 Japan

Objective

Precise determination of D.O. using the Winkler titration with potentiometric detection. Clarification of the vertical transection of D.O. concentration in the Western Equatorial Pacific.

Instruments and Methods

(a) Instruments and Apparatus

Dispenser: Eppendorf Comforpette 4800 / 1000 μ l

OPTIFIX / 2ml

Metrohm Model 725 Multi Dosimat / 20ml

Titrator: Metrohm Model 716 DMS Titrino / 10ml of titration vessel

Pt electrode / 6.0403.100 (NC)

Software: Data acquisition / Metrohm, METRODATA / 606013.000 Endpoint evalution

Methods:

Samples were collected from 30L Niskin bottles and a bucket for the surface to the volumetrically caribrated dry grass bottles, and 2-3 times of bottle volumes of sample water were overflowed during each sampling. The sampling bottles consists of the ordinary BOD flask (ca. 200ml) and grass stopper with long nipple, modified from the nipple presented in Green and Carritt (1966). The samples were fixed dissolved oxygen immediately following to measure the water temperature at the time of sampling for correction of the volume of sampling bottle. The bottles were kept at a wood box in the laboratory until titraion.

The analytical method and the preparation of reagents were fundamentally done according to the WHP Operations and Methods (Culberson, 1991). We used 0.07N thiosulfate of titrant at this cruise and volumetric apparatus except with titrator were calibrated before this cruise. We started analysis about 1 hours later after the fixation of dissolved oxygen. Titration and the end-point determination were made by 2 sets of Metrohm titrators with the automatic piston buret of 10ml and Pt electrode using whole bottle titration in the laboratory under controlled temperature. The water temperature in the laboratory was ca. 22℃ during this cruise. The end point was determined by the potentiometric method and evaluated by the second-derivative curve method with computerization.

Concentration of dissolved oxygen was calculated by equation (8) of WHP Operations and Methods (Culberson, 1991). However the amount of dissolved oxygen in the reagents was reported 0.0017ml at 25.5℃ (Murray et al., 1968), we used the value (=0.0027ml at 21℃) measured at the same laboratory in 1995 WOCE cruise in this cruise.

Dissolved oxygen concentrations were not corrected by seawater blank.

Preliminary results

(a) Comparison of each standards to CSK standard solution.

We prepared a 5 liter batch of 0.07N thiosulfate solution and two kinds of 0.0100N KIO_3 standard solution for standardization.(Lot JM981016(0.01002N), JM981017(0.01002N)) Before this cruise, we compared each standard to CSK standard solution which are prepared by Wako pure chemical industries, Ltd. The results are shown in Table 1. Normality of our standard may be different 0.2% from nominally normality.

Table 1. Comparison of each standards

KIO_3 Lot No.	Normality	Average titer(ml)	Standard deviation.	N	Ratio to DLG8365(CSK)
CSK DLG 8365	0.0100	1.386	0.001	10	
JM981016	0.01002	1.387	0.001	10	1.0005
JM981017	0.01002	1.387	0.001	10	1.0007

(b) Thiosulfate Standardization

Thiosulfate was standardized prior to the sample measurement at each station. We used two kinds of standard KIO3 solution. The averaged volume of thiosulfate for the standardization is 1.388ml (titrator #1) and 1.389ml (titrator #2), respectively and standard deviation is 0.001ml (#1) and 0.001ml (#2), respectively when used one kind of the standard. The results were showed in Fig.1.

(c) Pure water blanks

The blank results from the presence of redox species apart from oxygen in the reagents which can behave equivalently to oxygen in the analysis. The pure water blank (titration blank) were determined using distilled water (Milli-RX12, Millipore) at each stations. The average of pure water blank was -0.011±0.001ml (#1) and -0.011±0.002ml (#2), respectively. The results were showed in Fig.2.

(d) Reproducibility

In this cruise, duplicate samples were taken from same Niskin bottles at each station to estimate for precision for our analysis. We obtained 56 pairs of replicate samples and analyzed throughout this cruise. The results is shown in Fig.3. We obtained standard deviation (2 sigma) of 0.008mL/L (0.17% of D.O. maximum concentration, 4.701mL/L, in this cruise).

(e) Vertical profiles and contour plot

The vertical profiles and contour ploy of dissolved oxygen is shown in Fig.4.. The mixed layer extended to maximum 100m depth. At St.1 (4N,135E) and St.2 (5N, 140E), dissolved oxygen concentration were gradually decreased below 150m depth, because they is not along equator

References

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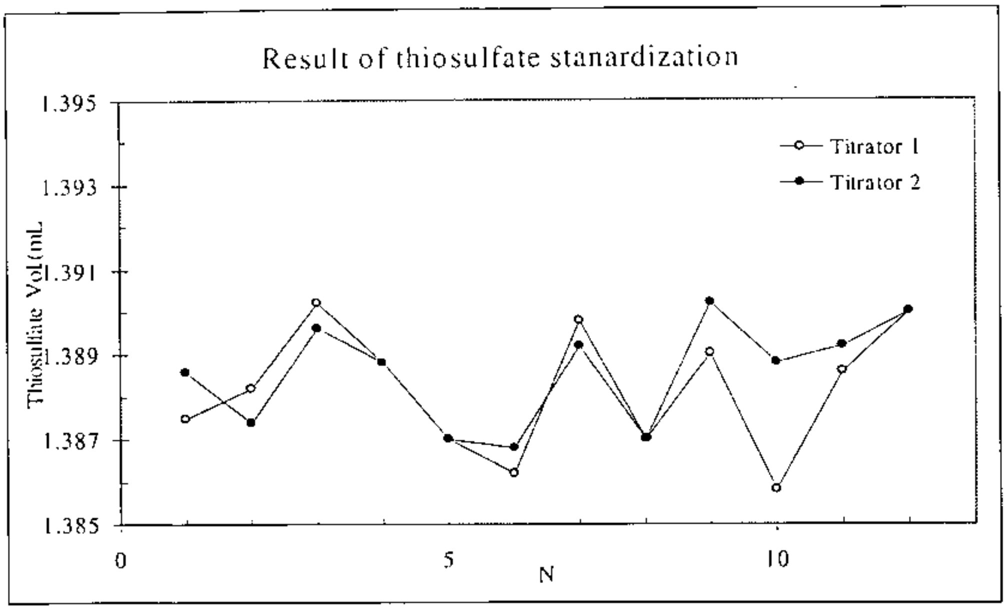
Green,E.J. and D.E.Carritt (1966) An improved iodine determination for whole-bottle titrations, Analyst, 91, 207-208

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



Filg.1 Result of Thiosulfate Standardization

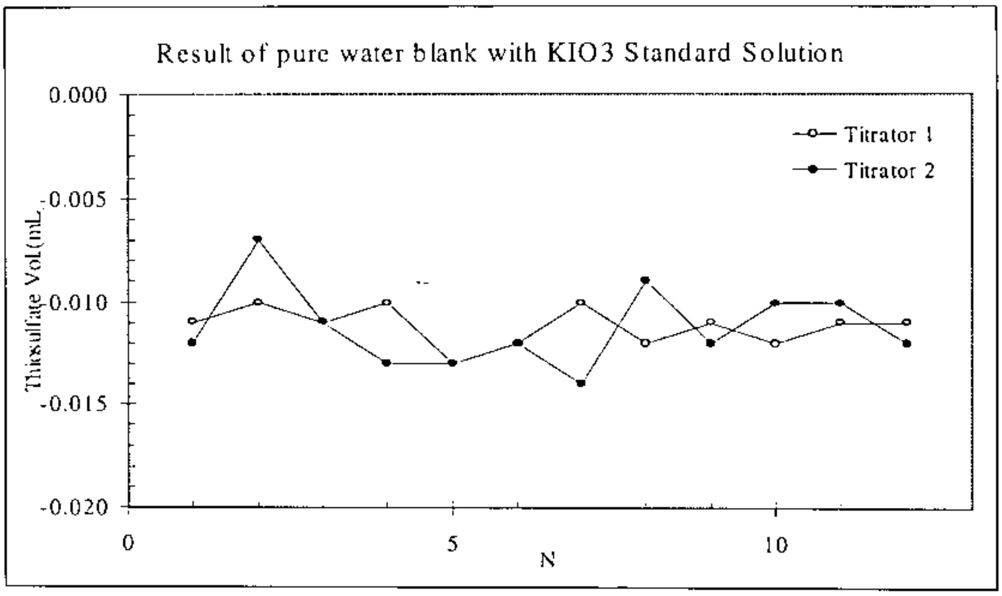


Fig.2 Result of pure water blank with KIO3 standard solution

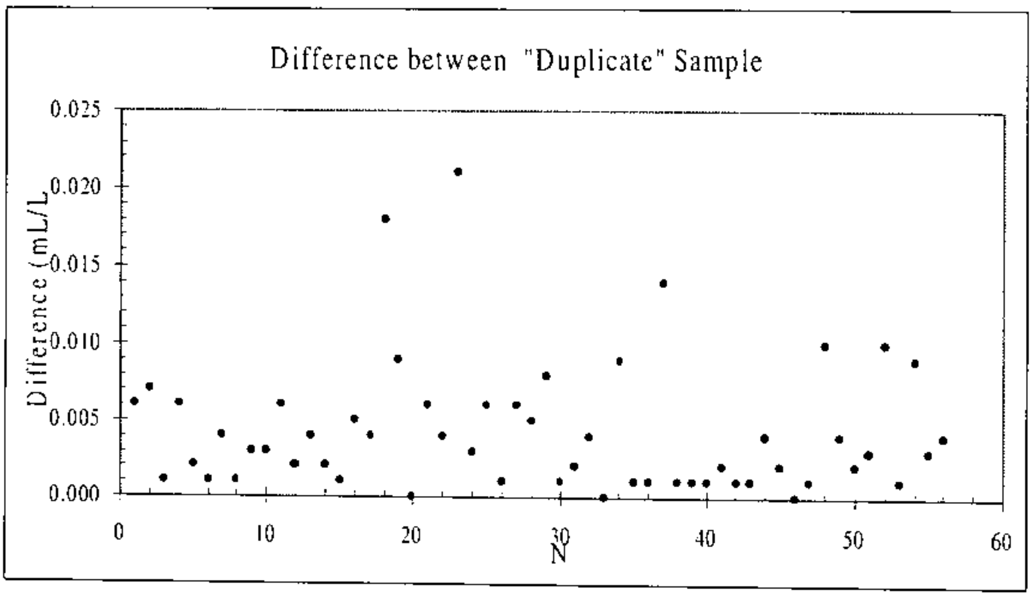


Fig.3 Difference between "Duplicate" sample

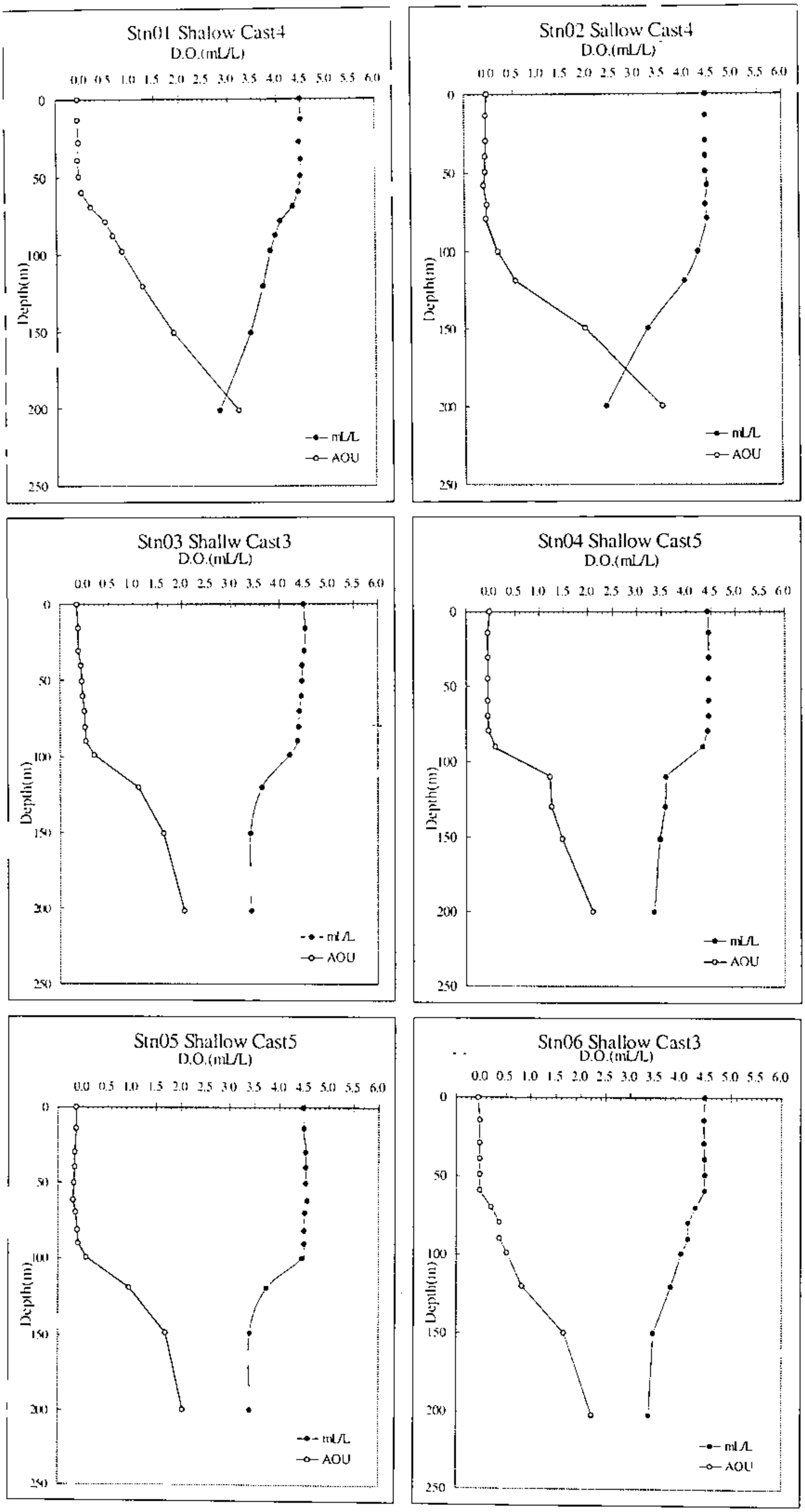


Fig.4 (1) Vertical Plofiles (Shallow Cast)

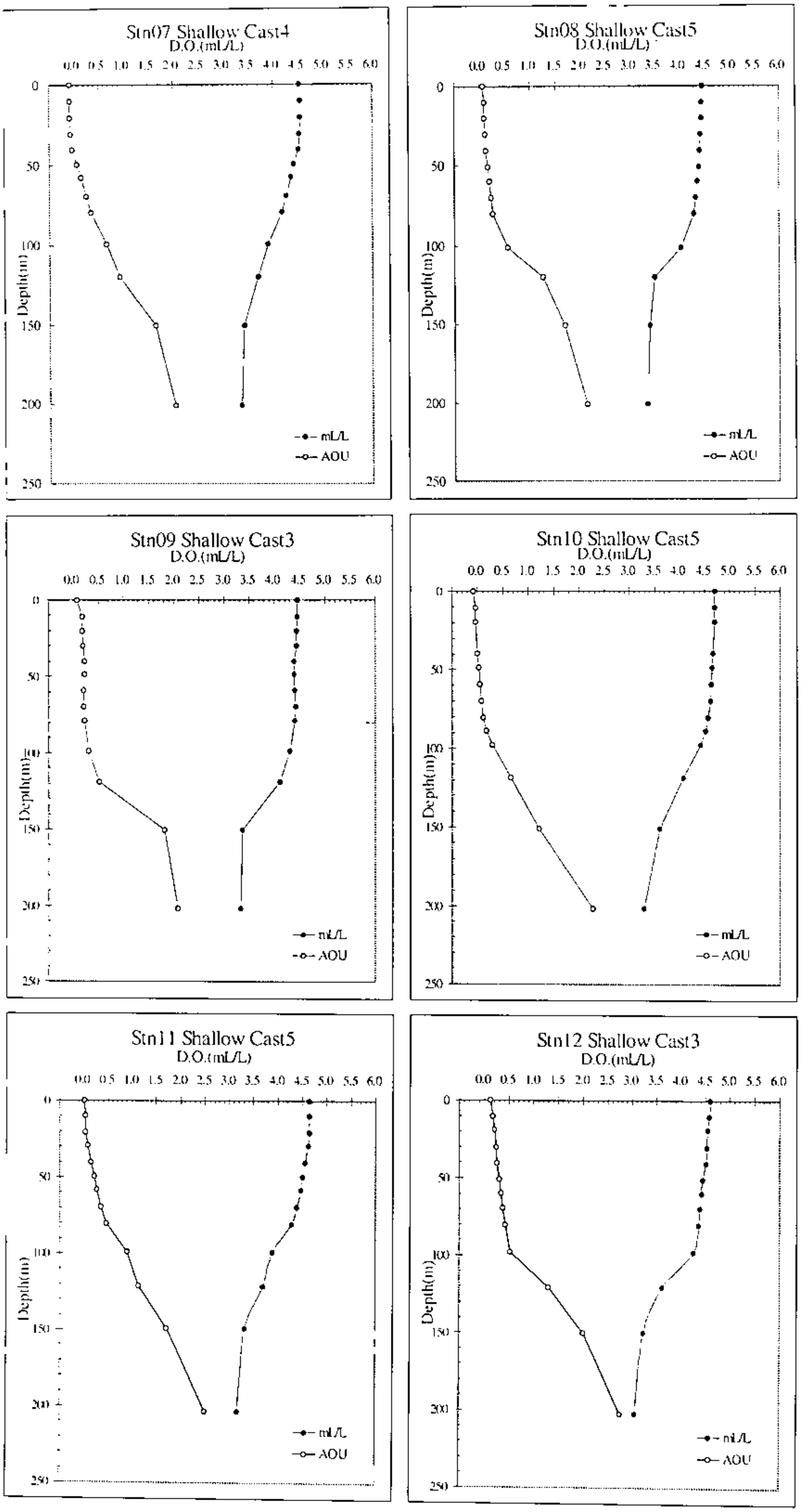


Fig.4 (2) Vertical Plofiles (Shallow Cast)

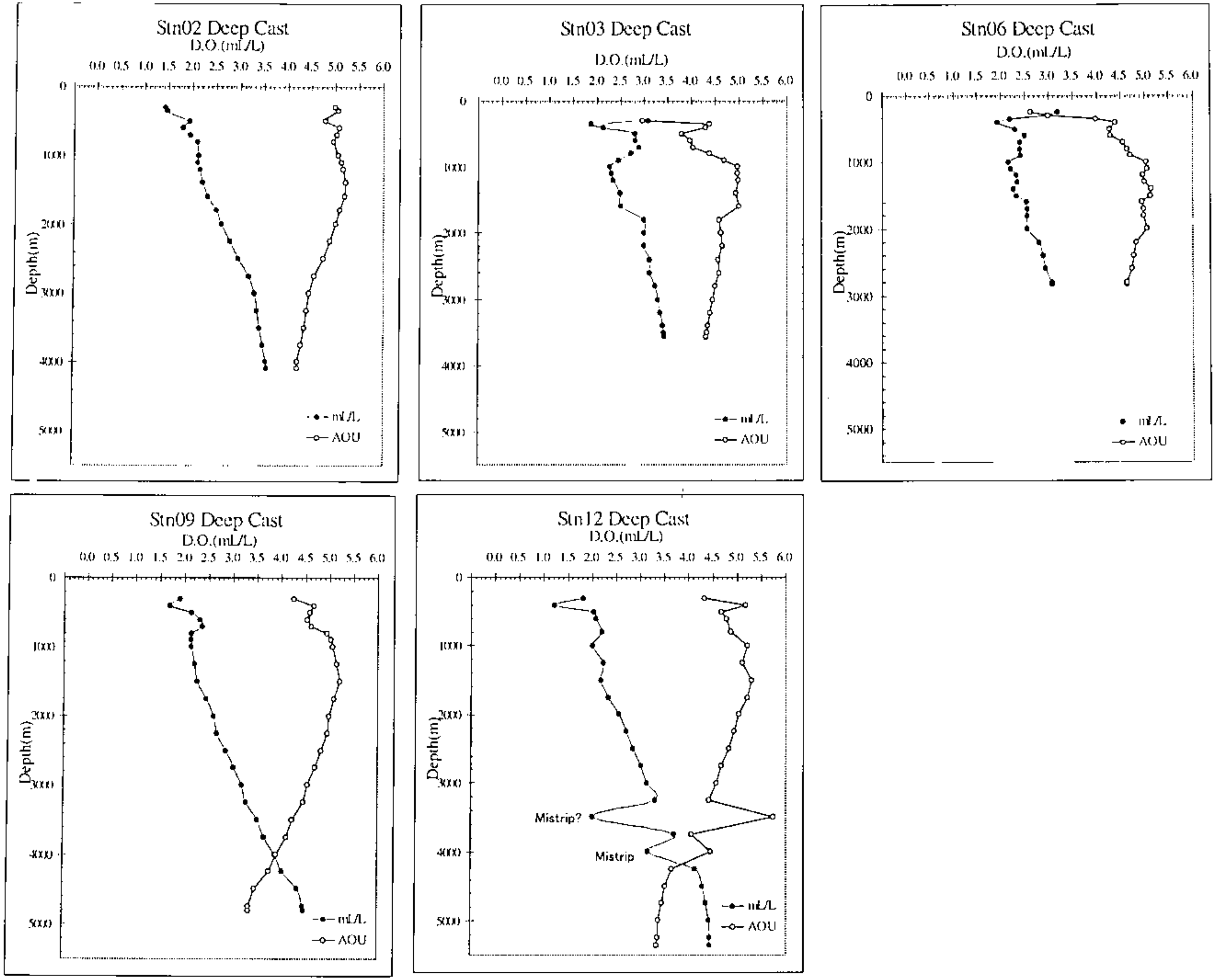


Fig.4 (3) Vertical Plofiles (Deep Cast)

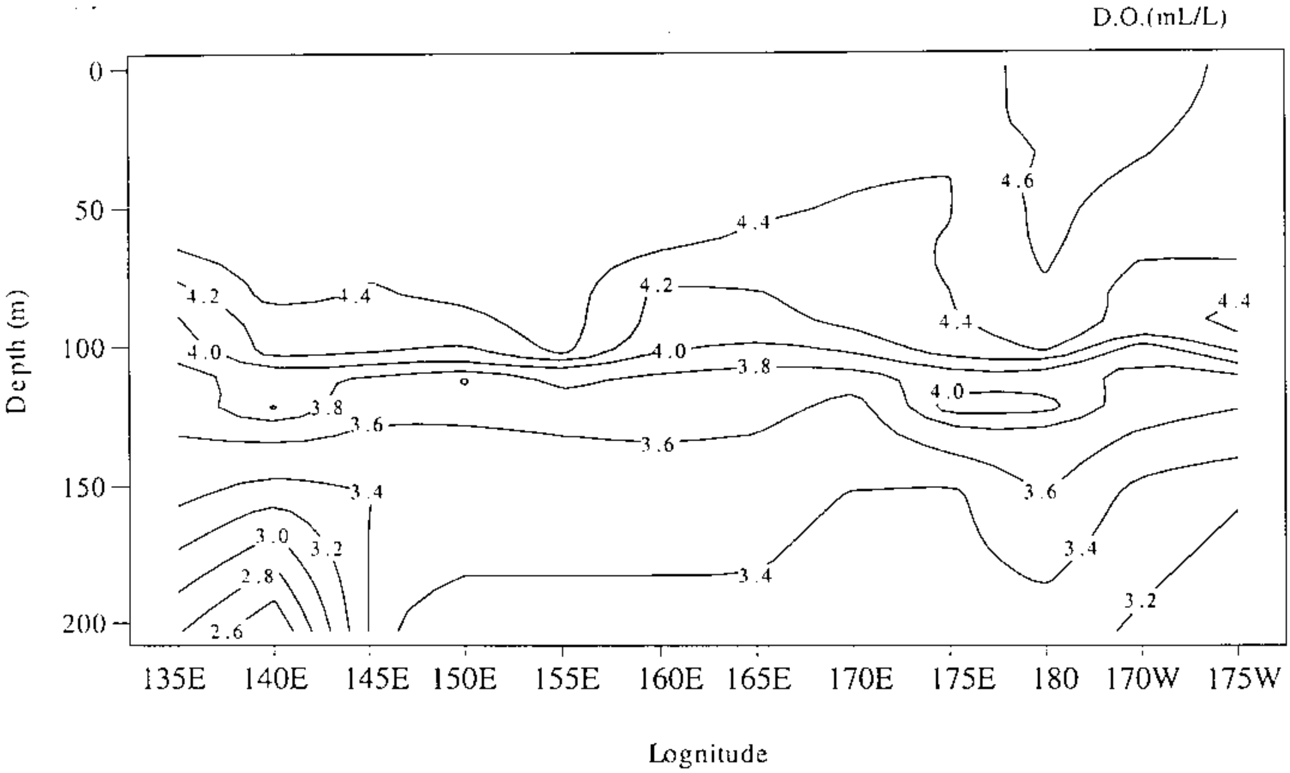


Fig.4 (4) Contour Plot

分析精度：0.004ml　算出方法：デュプリケイトの差（絶対値）の標準偏差の値

Stn.01	Sallow04
04-02.9N	135-01.2E
Depth(m)	DO(mL/L)
0.0	4.477
13.6	4.491
28.1	4.468
39.1	4.493
49.7	4.485
59.7	4.443
69.1	4.316
78.9	4.076
87.7	3.973
97.4	3.871
120.3	3.711
150.7	3.462
201.1	2.818

Stn.02	Sallow04
05-01.1N	140-02.1E
Depth(m)	DO(mL/L)
0.0	4.446
13.6	4.444
29.9	4.444
39.5	4.448
49.3	4.455
58.3	4.486
70.0	4.447
79.4	4.488
99.9	4.288
119.2	4.016
149.5	3.265
199.2	2.407

Stn.03	Sallow04
00-00.4N	145-01.2E
Depth(m)	DO(mL/L)
0.0	4.495
15.9	4.517
30.5	4.511
40.4	4.464
50.6	4.448
60.3	4.433
70.3	4.407
80.2	4.388
89.5	4.375
98.8	4.209
120.0	3.645
150.8	3.397
201.5	3.420

Stn.04	Sallow05
00-00.0S	147-53.2E
Depth(m)	DO(mL/L)
0.0	4.432
14.3	4.451
30.3	4.454
44.7	4.452
59.4	4.449
69.1	4.451
79.5	4.431
90.0	4.334
99.7	No Data
109.7	3.589
129.6	3.572
151.3	3.471
199.9	3.352

Stn.05	Sallow05
00-00.1S	153-15.8E
Depth(m)	DO(mL/L)
0.0	4.471
14.1	4.489
29.6	4.521
39.2	4.527
49.9	4.525
61.2	4.560
69.7	4.502
81.1	4.496
90.0	4.489
99.3	4.458
119.1	3.739
148.3	3.403
199.6	3.398

Stn.06	Sallow03
00-04.1N	159-59.7E
Depth(m)	DO(mL/L)
0.0	4.479
14.6	4.464
29.2	4.466
39.1	4.473
48.9	4.477
59.0	4.473
70.0	4.289
80.0	4.147
89.8	4.136
99.3	4.012
120.4	3.799
149.1	3.448
201.9	3.367

Stn.02	Deep
05-02.0N	140-05.6E
Depth(m)	DO(mL/L)
297.6	1.422
349.9	1.450
399.0	
498.2	1.933
599.2	1.795
698.7	1.937
798.5	2.095
898.0	
997.8	2.120
1097.0	2.104
1197.0	2.152
1396.6	2.200
1596.0	2.312
1794.7	2.490
1996.0	2.610
2245.4	2.775
2494.1	2.946
2743.2	3.177
2991.0	3.289
3241.9	3.352
3493.0	3.404
3742.1	3.469
3988.1	3.546
4086.3	3.558

Stn.03	Deep
00-01.7N	144-59.8E
Depth(m)	DO(mL/L)
299.3	3.086
350.1	1.874
398.7	2.130
498.0	2.802
597.9	2.798
697.9	2.891
797.3	2.711
897.6	2.456
997.0	2.267
1096.9	2.295
1196.2	2.340
1395.8	2.496
1595.3	2.511
1795.4	2.990
1995.0	2.990
2194.3	2.990
2400.0	3.117
2592.3	3.119
2792.7	3.230
2992.2	3.281
3191.6	3.336
3391.5	3.395
3490.4	3.412
3552.2	3.427

Stn.06	Deep
00-00.6N	159-59.7E
Depth(m)	DO(mL/L)
249.9	3.189
300.4	2.974
348.7	2.190
398.1	1.937
498.8	2.291
598.5	2.510
698.3	2.394
797.6	2.397
897.5	2.426
997.3	2.159
1097.0	2.213
1197.0	2.325
1296.5	2.349
1396.4	2.259
1495.8	2.332
1595.9	2.537
1695.2	2.552
1795.4	2.564
1994.9	2.553
2194.1	2.800
2394.0	2.888
2593.6	2.946
2792.8	3.078
2816.7	3.080

Stn.07	Sallow05
00-00.1N	163-36.0E
Depth(m)	DO(mL/L)
0.0	4.545
10.3	4.554
20.7	4.554
31.0	4.542
40.7	4.514
49.6	4.425
57.9	4.366
69.5	4.271
79.4	4.185
99.2	3.913
119.7	3.714
150.3	3.428
200.7	3.381

Stn.08	Sallow05
00-00.3S	168-55.9E
Depth(m)	DO(mL/L)
0.0	4.463
10.4	4.442
20.2	4.437
30.5	4.425
40.7	4.409
51.1	4.384
60.1	4.357
70.2	4.318
80.4	4.285
101.1	4.031
119.7	3.496
150.7	3.397
201.0	3.350

Stn.09	Sallow03
00-03.5N	174-54.8E
Depth(m)	DO(mL/L)
0	4.445
10.8	4.448
20.3	4.444
30.0	4.432
40.2	4.392
48.7	4.389
58.9	4.407
69.9	4.416
79.2	4.397
99.1	4.310
119.1	4.114
150.5	3.361
201.9	3.332

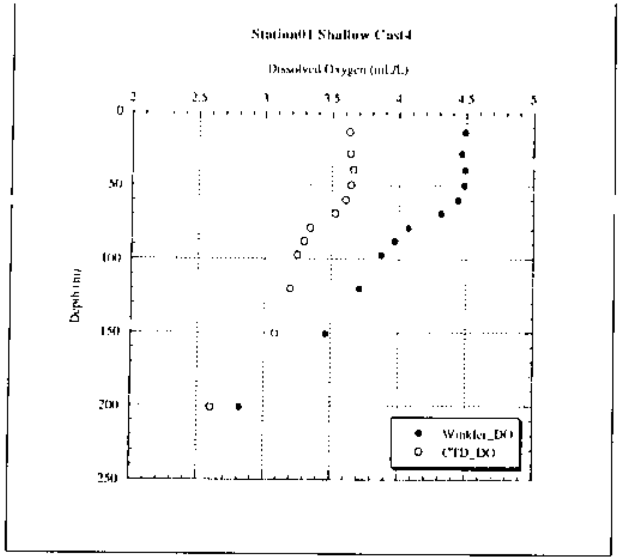
Stn.10	Sallow05
00-00.1S	178-47.8E
Depth(m)	DO(mL/L)
0.0	4.704
10.6	4.698
19.5	4.701
39.7	4.672
48.9	4.651
59.3	4.643
70.0	4.615
80.4	4.576
89.1	4.517
97.9	4.418
118.7	4.075
151.1	3.609
202.0	3.298

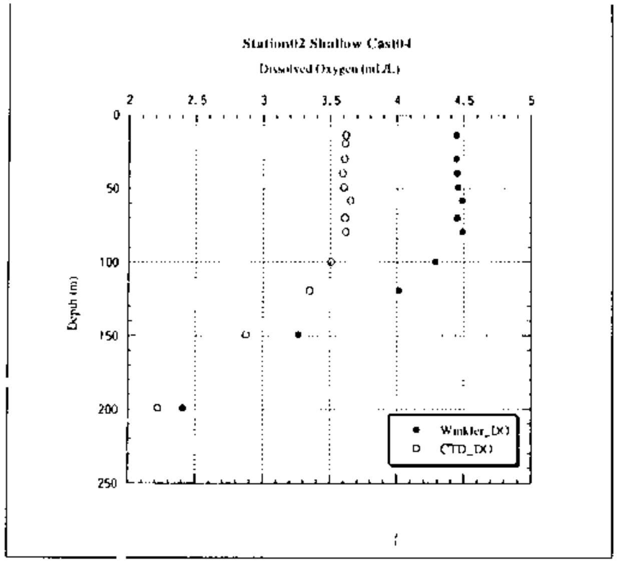
Stn.11	Sallow05
00-00.1N	176-17.4W
Depth(m)	DO(mL/L)
0.0	4.633
9.6	4.643
20.5	4.641
29.3	4.612
40.3	4.558
49.5	4.498
58.3	4.457
69.5	4.380
80.2	4.282
98.8	3.880
121.1	3.693
148.7	3.329
203.4	3.163

Stn.12	Sallow03
00-02.9S	170-11.0W
Depth(m)	DO(mL/L)
0.0	4.586
10.1	4.575
19.0	4.541
30.3	4.516
40.1	4.498
50.5	4.443
59.6	4.428
69.2	4.394
80.3	4.351
97.6	4.255
120.2	3.609
150.0	3.222
202.0	3.054

Stn.09	Deep
00-01.4N	174-57.7E
Depth(m)	DO(mL/L)
300.7	1.902
399.2	1.696
508.2	2.142
597.9	2.316
697.9	2.368
798.3	2.133
897.7	2.139
997.8	2.149
1247.4	2.213
1496.1	2.255
1745.6	2.451
1995.2	2.602
2243.9	2.681
2493.0	2.856
2742.3	3.011
2991.3	3.180
3241.1	3.274
3491.1	3.517
3739.2	3.649
3990.0	3.866
4238.0	4.036
4486.7	4.328
4737.4	4.456
4790.8	4.469

Stn.12	Deep
00-00.2N	170-05.5W
Depth(m)	DO(mL/L)
299.0	1.809
399.1	1.216
499.0	2.013
598.0	2.071
797.6	2.200
996.7	2.005
1246.5	2.235
1496.0	2.172
1745.2	2.323
1994.8	2.552
2243.7	2.711
2493.2	2.842
2743.0	3.018
2992.7	3.139
3242.5	3.306
3490.6	1.998
3740.0	3.707
3990.2	3.149
4239.6	4.138
4488.3	4.292
4738.0	4.361
4988.0	4.427
5235.8	4.432
5351.5	4.443


Station01 Shallow Cast4
Dissolved Oxygen (mL/L)
2 2.5 3 3.5 4 4.5 5
0 50 100 150 200 250
Depth (m)
Winkler_DO
CTD_DO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Dissolved Oxygen (mL/L)
2 2.5 3 3.5 4 4.5 5
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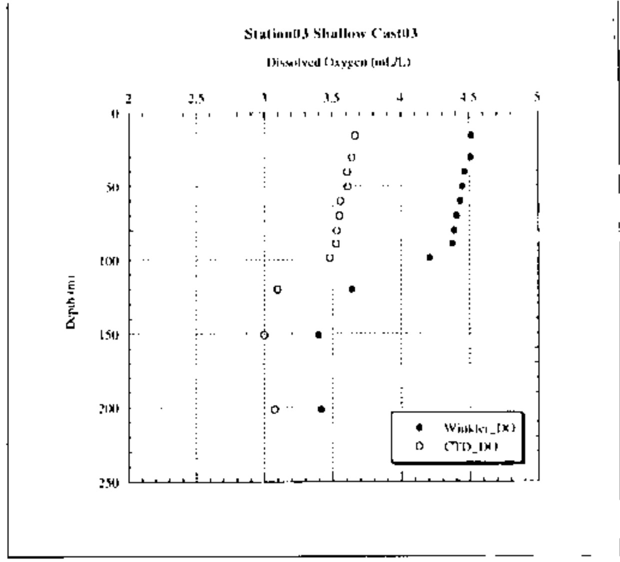
Depth (m)
Winkler_DO
CTD_DO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Dissolved Oxygen (mL/L)
2 2.5 3 3.5 4 4.5 5
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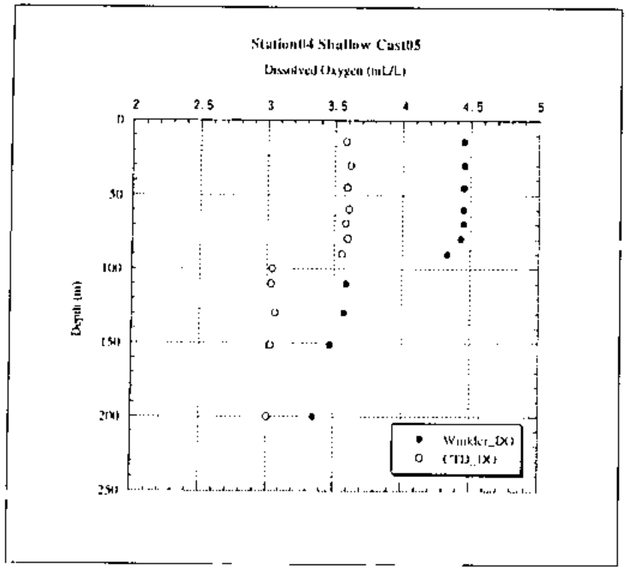
Depth (m)
Winkler_DO
CTD_DO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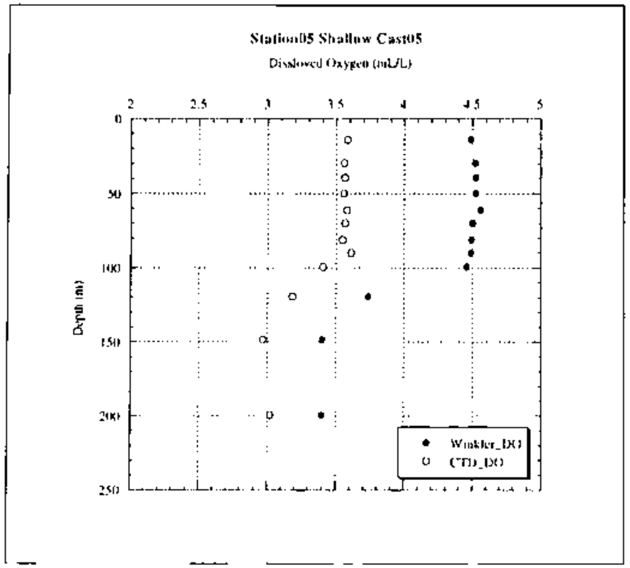
Dissolved Oxygen (mL/L)
2 2.5 3 3.5 4 4.5 5
0 50 100 150 200 250
Depth (m)
Winkler_DO
CTD_DO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Disslved Oxygen (mL/L)
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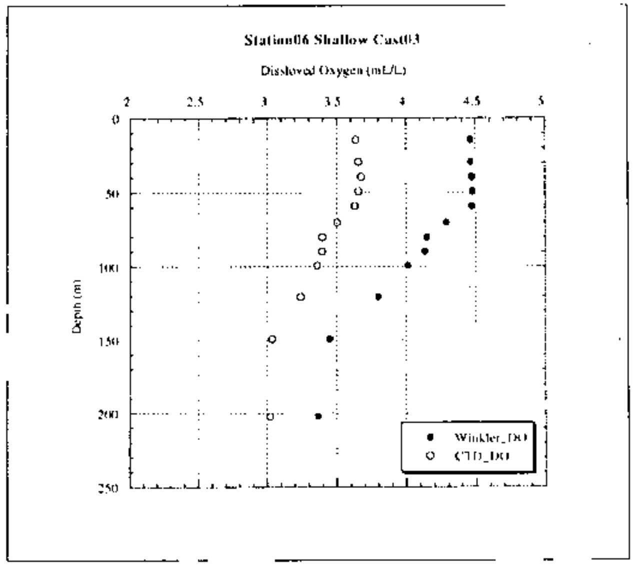
0 50 100 150 200 250
Depth (m)
Winkler_DO
CTD_DO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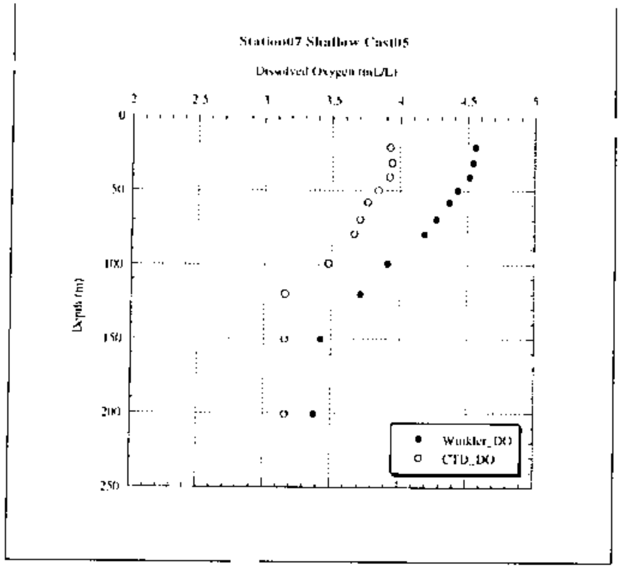
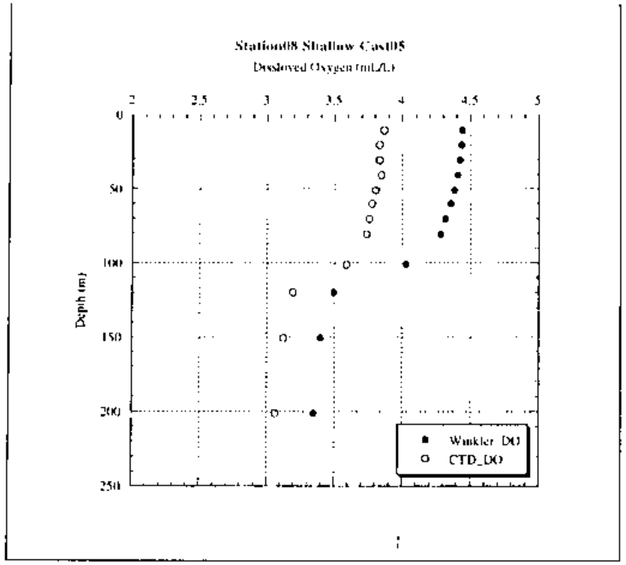
Dissloved Oxygen (mL/L)
2 2.5 3 3.5 4 4.5 5
0 50 100 150 200 250
Depth (m)
Winkler_DO
CTD_DO


Station07 Shallow Cast05
Dissolved Oxygen (mL/L)
Depth (m)
Winkler_DO
CTD_DO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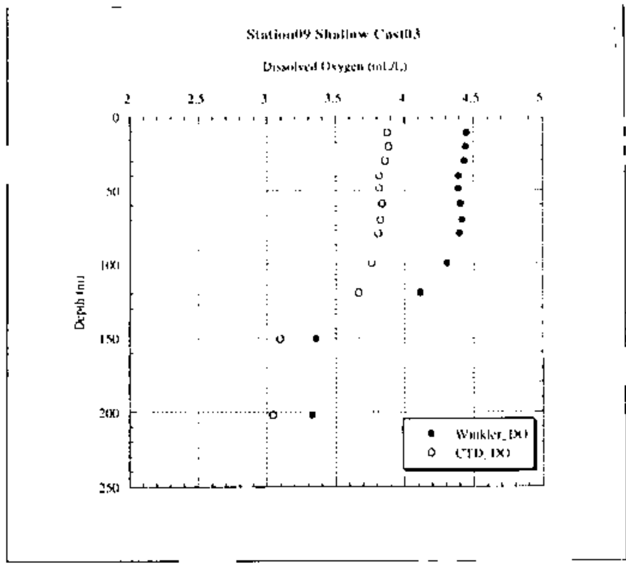
Dissolved Oxygen (mL/L)
Depth (m)
Winkler_DO
CTD_DO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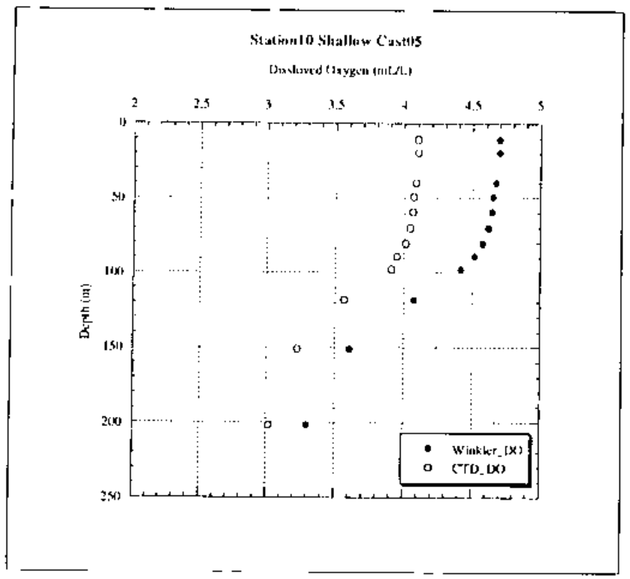
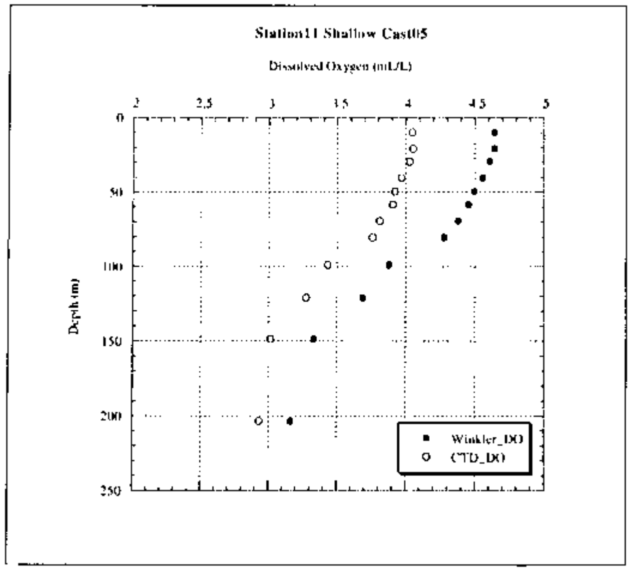
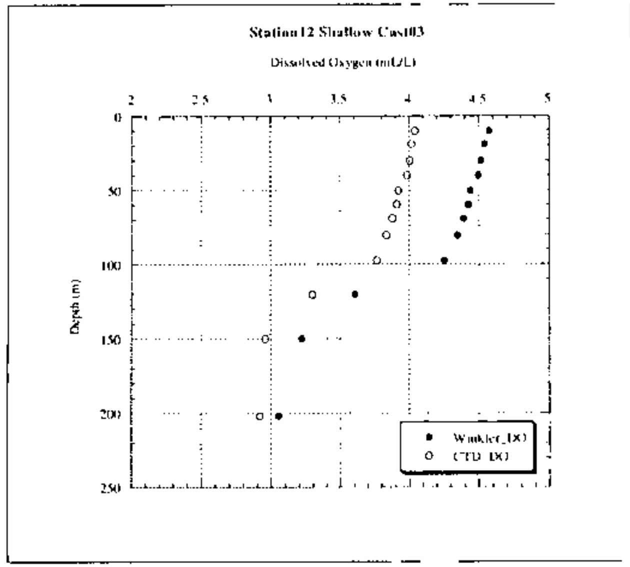
Dissolved Oxygen (mL/L)
Depth (m)
Winkler_DO
CTD_DO


Station10 Shallow Cast05
Dissolved Oxygen (mL/L)
Depth (m)
Winkler_DO
CTD_DO


Station11 Shallow Cast05
Dissolved Oxygen (mL/L)
Depth (m)
Winkler_DO
CTD_DO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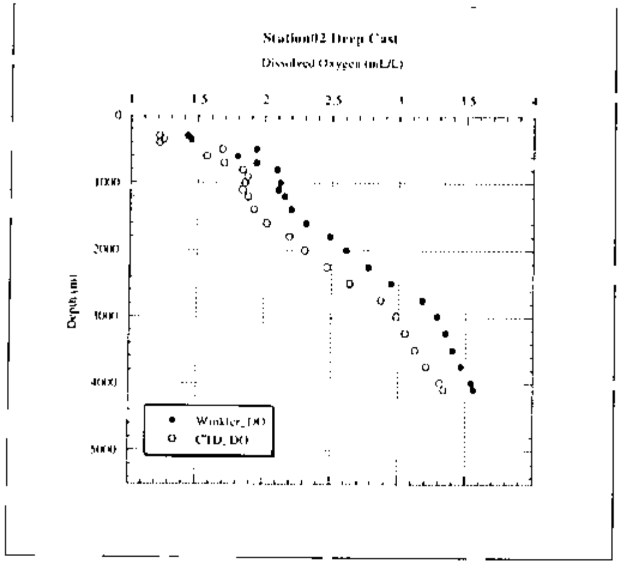
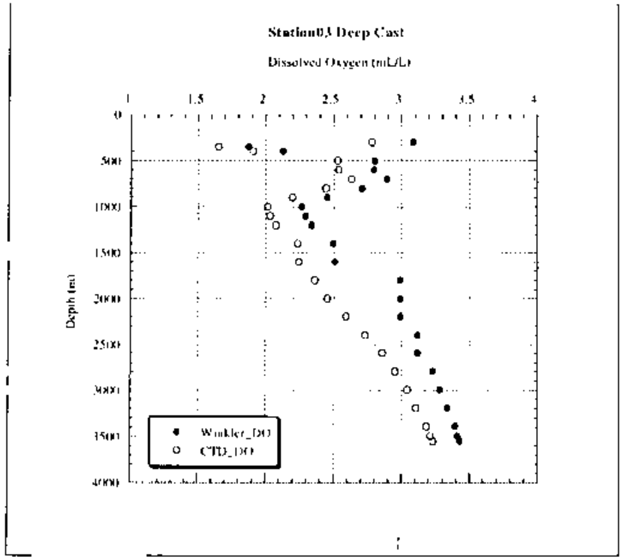
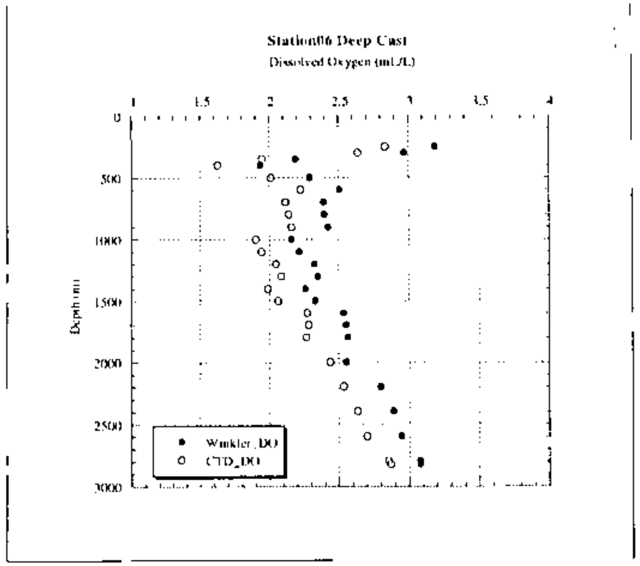
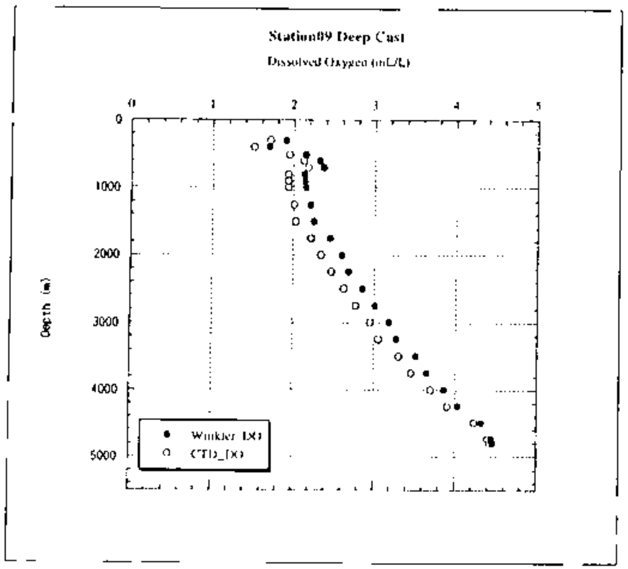
Dissolved Oxygen (mL/L)
Depth (m)
Winkler_DO
CTD_DO


Station02 Deep Cast
Dissolved Oxygen (mL/L)
Depth (m)
Winkler_DO
CTD_DO


Station03 Deep Cast
Dissolved Oxygen (mL/L)
Depth (m)
Winkler_DO
CTD_DO


Station06 Deep Cast
Dissolved Oxygen (mL/L)
Depth (m)
Winkler_DO
CTD_DO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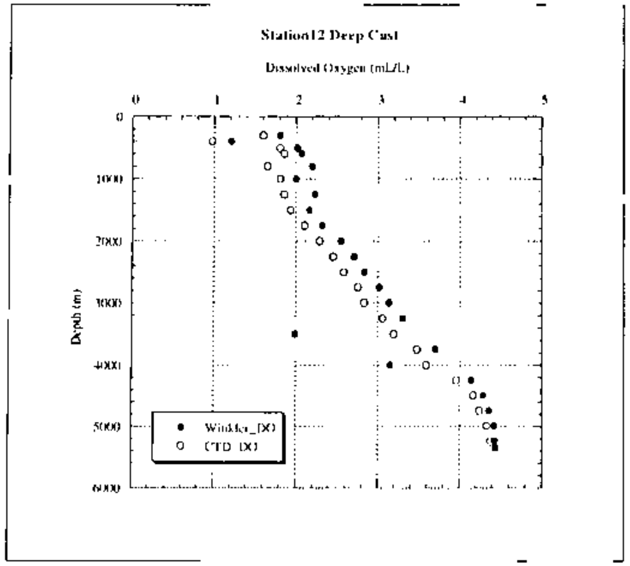
Dissolved Oxygen (mL/L)
Depth (m)
Winkler_DO
CTD_DO


Station12 Deep Cast
Dissolved Oxygen (mL/L)
Depth (m)
Winkler_DO
CTD_DO

3.3.2 Salinity Measurement

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Instruments and Methods

Seawater samples were collected from a bucket for the surface and from 30L Niskin bottles for Other layers. They were stored in 250ml Poenix brown grass bottle with screw caps. The bottles were kept at a wood box until measurement. The salinity measurements were carried out on Guildline Autosal model 8400B. The instrument was operated in the Salinity measurement room with a bath temperature of 24degC. The standardization was made with IAPSO Standard Sea water batch P131 whose conductivity is 0.99986. Sub−Standard seawater was used to check the drift and stability.

Result

The results were showed in Tablel.1. The vertical profiles of salinity were shown in Fig.1.The Measurement accuracy was ±0・0022PSU. The measured values were used to calibrate the CTDs. The salinity measured by SBE911 Plus of large CTD/RMS system were shifted by 0.0026PSU, and the salinity measured by SBE911 Plus of small CTD/RMS system were shifted by O.0105 PSU.

Table 1 Salinity Data

	Stn.1		ShallowCast4	
Depth(m)	Niskin.No.	SalBTL No.	Salinity(PSU)	CTD(PSU)
Surface	bucket	1	34.1470	
13.6	12	2	34.1515	34.1476
28.1	13	3	34.1486	34.1426
39.1	14	4	34.1750	34.1691
49.7	15	5	34.2487	34.2412
59.7	16	6	34.3864	34.3849
69.1	17	7	34.5357	34.5363
78.9	18	8	34.6232	34.6143
87.7	19	9	34.6749	34.6707
97.4	20	10	34.7230	34.7140
120.3	21	11	34.7270	34.7217
150.7	22	12	34.7135	34.7086
201.1	23	13	34.5211	34.5244

	Stn.2		ShallowCast1	
Depth(m)	Niskin.No.	SalBTL No.	Salinity(PSU)	CTD(PSU)
Surface	bucket	14	34.4131	
151.5	1	15	34.7649	34.7648
120.2	2	16	34.8089	34.8084
99.9	3	17	34.8500	34.8304
90.0	4	18	34.8363	34.8283
79.1	5	19	34.8281	34.8199
70.2	6	20	34.8027	34.7948
59.9	7	21	34.7517	34.7270
50.3	8	22	34.6931	34.6350
39.7	9	23	34.5972	34.5684
30.9	10	24	34.5096	34.4675
19.9	11	25	34.4404	34.4246
10.2	12	26	34.4198	34.4010

	Stn.2		DeepCast	
Depth(m)	Niskin.No.	SalBTL No.	Salinity(PSU)	CTD(PSU)
4086.3	1	27	34.6865	34.6876
3988.1	2	28	34.6853	34.6870
3742.1	3	29	34.6825	34.6837
3493.0	4	30	34.6787	34.6799
3241.9	5	31	34.6761	34.6768
2991.0	6	32	34.6776	34.6738
2743.2	7	33	34.6669	34.6686
2494.1	8	34	34.6572	34.6581
2245.4	9	35	34.6484	34.6487
1996.0	10	36	34.6369	34.6375
1794.7	11	37	34.6232	34.6241
1596.0	12	38	34.6076	34.6077
1396.6	13	39	34.5866	34.5870
1197.0	14	40	34.5687	34.5691
1097.0	15	41	34.5592	34.5588
997.8	16	42	34.5520	34.5521
898.0	17		NoData	34.5420
798.5	18	44	34.5389	34.5390
698.7	19	45	34.5381	34.5379
599.2	20	46	34.5424	34.5424
498.2	21	47	34.5653	34.5660
399.0	22		NoData	34.5977
349.9	23	49	34.6057	34.6061
297.6	24	50	34.5881	34.5861

	Stn.2		ShallowCast4	
Depth(m)	Niskin.No.	SalBTL No.	Salinity(PSU)	CTD(PSU)
Surface	bucket	51	34.4282	
13.6	1	52	34.4177	34.4172
29.9	2	53	34.4338	34.4321
39.5	3	54	34.4659	34.4518
49.3	4	55	34.5146	34.5129
58.3	5	56	34.6874	34.6845
70.0	6	57	34.7671	34.7590
79.4	7	58	34.8079	34.8030
19.4	8		NoData	34.4156
99.9	9	59	34.8370	34.8303
119.2	10	60	34.8275	34.8193
149.5	11	61	34.7325	34.7329
199.2	12	62	34.5660	34.5705

	Stn.3		ShallowCast1	
Depth(m)	Niskin.No.	SalBTL No.	Salinity(PSU)	CTD(PSU)
Surface	bucket	63	34.2392	
150.0	1	64	35.4393	35.4238
120.0	2	65	35.2158	35.2100
99.4	3	66	34.8272	34.7266
90.6	4	67	34.6115	34.6082
79.9	5	68	34.5350	34.5329
70.1	6	69	34.4338	34.4321
59.8	7	70	34.3972	34.3929
50.2	8	71	34.3828	34.3753
40.1	9	72	34.3642	34.3582
30.7	10	73	34.3162	34.3121
20.0	11	74	34.2913	34.2744
10.2	12	75	34.2321	34.2165

	Stn.3		DeepCast	
Depth(m)	Niskin.No.	SalBTL No.	Salinity(PSU)	CTD(PSU)
3552.2	1	76	34.6799	34.6811
3490.4	2	77	34.6796	34.6806
3391.5	3	78	34.6789	34.6795
3191.6	4	79	34.6767	34.6763
2992.2	5	80	34.6716	34.6730
2792.7	6	81	34.6683	34.6690
2592.3	7	82	34.6641	34.6646
2400.0	8	83	34.6633	34.6571
2194.3	9	84	34.6547	34.6475
1995.0	10	85	34.6557	34.6360
1795.4	11	86	34.6574	34.6278
1595.3	12	87	34.6095	34.6098
1395.8	13	88	34.5903	34.5901
1196.2	14	89	34.5728	34.5731
1096.9	15	90	34.5641	34.5634
997.0	16	91	34.5577	34.5581
897.6	17	92	34.5453	34.5453
797.3	18	93	34.5313	34.5308
697.9	19	94	34.5301	34.5300
597.9	20	95	34.5580	34.5585
498.0	21	96	34.6084	34.6118
398.7	22	97	34.6835	34.6838
350.1	23	98	34.7600	34.7614
299.3	24	99	34.8586	34.8635

	Stn.3		ShallowCast3	
Depth(m)	Niskin.No.	SalBTL No.	Salinity(PSU)	CTD(PSU)
Surface	bucket	113	34.2948	
15.9	1	100	34.2815	34.2816
30.5	2	101	34.2978	34.2990
40.4	3	102	34.3657	34.3626
50.6	4	103	34.3844	34.3814
60.3	5	104	34.3856	34.3825
70.3	6	105	34.4049	34.4060
80.2	7	106	34.4677	34.4624
89.5	8	107	34.5299	34.5260
98.8	9	108	34.7362	34.6876
120.0	10	109	35.1860	35.2199
150.8	11	110	35.4889	35.4981
201.5	12	111	35.3203	35.3221

	Stn.4		ShallowCast5	
Depth(m)	Niskin.No.	SalBTL No.	Salinity(PSU)	CTD(PSU)
Surface	bucket	126	34.2377	
14.3	1	114	34.2248	34.2199
30.3	2	115	34.2209	34.2171
44.7	3	116	34.2550	34.2540
59.4	4	117	34.4322	34.4265
69.1	5	118	34.4223	34.4191
79.5	6	119	34.4242	34.4188
90.0	7	120	34.6209	34.6241
99.7	8	121	35.1275	35.1155
109.7	9	122	35.0686	35.0926
129.6	10	123	35.1754	35.1731
151.3	11	124	35.2929	35.3234
199.9	12	125	35.1406	35.1440

	Stn.5		ShallowCast5	
Depth(m)	Niskin.No.	SalBTL No.	Salinity(PSU)	CTD(PSU)
Surface	bucket	127	34.4421	
14.1	1	128	34.4233	34.4189
29.6	2	129	34.4230	34.4183
39.2	3	130	34.4283	34.4207
49.9	4	131	34.6124	34.6066
61.2	5	132	34.7788	34.7728
69.7	6	133	34.8262	34.8209
81.1	7	134	34.9349	34.9269
90.0	8	135	34.9798	34.9718
99.3	9	136	35.1575	35.1425
119.1	10	137	35.4772	35.4264
148.3	11	138	35.3881	35.3790
199.6	12	139	35.2458	35.2780

	Stn.6		ShallowCast1	
Depth(m)	Niskin.No.	SalBTL No.	Salinity(PSU)	CTD(PSU)
Surface	bucket	140	35.0659	
150.8	1	141	34.9931	35.0144
119.2	2	142	35.0776	35.0556
100.4	3	143	35.0691	35.0704
90.6	4	144	35.0848	35.0896
80.1	5	145	35.1179	35.1243
70.3	6	146	35.1004	35.0738
59.9	7	147	35.0518	35.0465
50.6	8	148	35.0502	35.0454
40.1	9	149	35.0513	35.0466
30.5	10	150	35.0509	35.0465
20.2	11	151	35.0525	35.0471
10.3	12	152	35.0555	35.0508

	Stn.6		DeepCast	
Depth(m)	Niskin.No.	SalBTL No.	Salinity(PSU)	CTD(PSU)
2816.7	1	153	34.6670	34.6672
2792.8	2	154	34.6671	34.6671
2593.6	3	155	34.6599	34.6608
2394.0	4	156	34.6567	34.6567
2194.1	5	157	34.6472	34.6469
1994.9	6	158	34.6338	34.6371
1795.4	7	159	34.6232	34.6230
1695.2	8	160	34.6200	34.6186
1595.9	9	161	34.6084	34.6089
1495.8	10	162	34.5997	34.5995
1396.4	11	163	34.5909	34.5882
1296.5	12	164	34.5791	34.5793
1197.0	13	165	34.5707	34.5682
1097.0	14	166	34.5632	34.5628
997.3	15	167	34.5545	34.5544
897.5	16	168	34.5402	34.5407
797.6	17	169	34.5358	34.5346
698.3	18	170	34.5384	34.5382
598.5	19	171	34.5559	34.5556
498.8	20	172	34.6183	34.6216
398.1	21	173	34.7262	34.7297
348.7	22	174	34.7953	34.7964
300.4	23	175	34.8367	34.8369
249.9	24	176	34.9573	34.9641

	Stn.6		ShallowCast3	
Depth(m)	Niskin.No.	SalBTL No.	Salinity(PSU)	CTD(PSU)
Surface	bucket	177	35.0969	
14.6	1	178	35.0640	35.0616
29.2	2	179	35.0640	35.0609
39.1	3	180	35.0632	35.0603
48.9	4	181	35.0636	35.0602
59.0	5	182	35.0697	35.0659
70.0	6	183	35.1232	35.1195
80.0	7	184	35.0957	35.0914
89.8	8	185	35.0848	35.0807
99.3	9	186	35.0543	35.0528
120.4	10	187	35.0642	35.0566
149.1	11	188	35.0270	35.0220
201.9	12	189	35.1371	35.1574

Depth(m)	Stn.7 Niskin.No.	SalBTL No.	ShallowCast5 Salinity(PSU)	CTD(PSU)
Surface	bucket	190	35.1448	
200.7	1	191	35.2409	35.2445
150.3	5	192	35.1803	35.1788
119.7	7	193	35.1363	35.0943
99.2	9	194	35.1071	35.1011
79.4	11	195	35.1102	35.1028
69.5	13	196	35.1115	35.1087
57.9	14	197	35.1167	35.1120
49.6	16	198	35.1200	35.1183
40.7	18	199	35.1240	35.1186
31.0	20	200	35.1228	35.1196
20.7	22	201	35.1236	35.1205
10.3	24	202	35.1242	35.1218

Depth(m)	Stn.8 Niskin.No.	SalBTL No.	ShallowCast5 Salinity(PSU)	CTD(PSU)
Surface	bucket	1	35.2489	
10.4	1	2	35.2016	35.1973
20.2	2	3	35.1991	35.1970
30.5	3	4	35.1991	35.1956
40.7	4	5	35.1973	35.1930
51.1	5	6	35.1984	35.1920
60.1	6	7	35.1960	35.1901
70.2	7	8	35.1905	35.1881
80.4	8	9	35.1908	35.1846
101.1	9	10	35.1237	35.1294
119.7	10	11	35.0668	35.0774
150.7	11	12	35.3413	35.3495
201.0	12	13	35.2053	35.2106

Depth(m)	Stn.9 Niskin.No.	SalBTL No.	ShallowCast1 Salinity(PSU)	CTD(PSU)
Surface	bucket	14	35.2087	
151.3	1	15	35.4406	35.4476
120.2	2	16	35.3521	35.3463
99.5	3	17	35.3334	35.3206
90.3	4	18	35.3211	35.3143
80.8	5	19	35.3184	35.3137
70.7	6	20	35.3226	·35.3210
60.0	7	21	35.3264	35.3237
49.3	8	22	35.3234	35.3121
40.1	9	23	35.2920	35.2597
30.0	10	24	35.2460	35.2006
20.2	11	25	35.2031	35.1926
10.4	12	26	35.1976	35.1877

Depth(m)	Stn.9 Niskin.No.	SalBTL No.	DeepCast Salinity(PSU)	CTD(PSU)
4790.8	1	27	34.7070	34.7077
4737.4	2	28	34.7051	34.7076
4486.7	3	29	34.7037	34.7051
4238.0	4	30	34.6980	34.6991
3990.0	5	31	34.6937	34.6955
3739.2	6	32	34.6874	34.6893
3491.1	7	33	34.6838	34.6851
3241.1	8	34	34.6759	34.6774
2991.3	9	35	34.6724	34.6739
2742.3	10	36	34.6669	34.6672
2493.0	11	37	34.6602	34.6606
2243.9	12	38	34.6598	34.6506
1995.2	13	39	34.6330	34.6338
1745.6	14	40	34.6211	34.6215
1496.1	15	41	34.6030	34.6035
1247.4	16	42	34.5958	34.5785
997.8	17	43	34.5545	34.5550
897.7	18	44	34.5499	34.5502
798.3	19	45	34.5418	34.5424
697.9	20	46	34.5371	34.5361
597.9	21	47	34.5504	34.5507
508.2	22	48	34.5980	34.5818
399.2	23	49	34.7056	34.7137
300.7	24	50	34.8061	34.8063

Depth(m)	Stn.9 Niskin.No.	SalBTL No.	ShallowCast3 Salinity(PSU)	CTD(PSU)
Surface	bucket	51	35.1439	
10.8	1	52	35.1687	35.1676
20.3	2	53	35.1694	35.1670
30.0	3	54	35.1683	35.1665
40.2	4	55	35.1814	35.1799
48.7	5	56	35.2151	35.2121
58.9	6	57	35.2305	35.2282
69.9	7	58	35.2820	35.2801
79.2	8	59	35.2950	35.2922
99.1	9	60	35.3198	35.3179
119.1	10	61	35.3747	35.3612
150.5	11	62	35.4182	35.4339
201.9	12	63	35.2687	35.2716

Depth(m)	Stn.10 Niskin.No.	SalBTL No.	ShallowCast5 Salinity(PSU)	CTD(PSU)
Surface	bucket	64	35.0846	
10.6	1	65	35.0872	35.0854
19.5	2	66	35.0891	35.0871
39.7	3	67	35.1849	35.1855
48.9	4	68	35.2258	35.2237
59.3	5	69	35.2325	35.2293
70.0	6	70	35.2311	35.2294
80.4	7	71	35.2315	35.2299
89.1	8	72	35.2237	35.2211
97.9	9	73	35.2220	35.2161
118.7	10	74	35.2799	35.2777
151.1	11	75	35.4441	35.3705
202.0	12	76	35.0710	35.0741

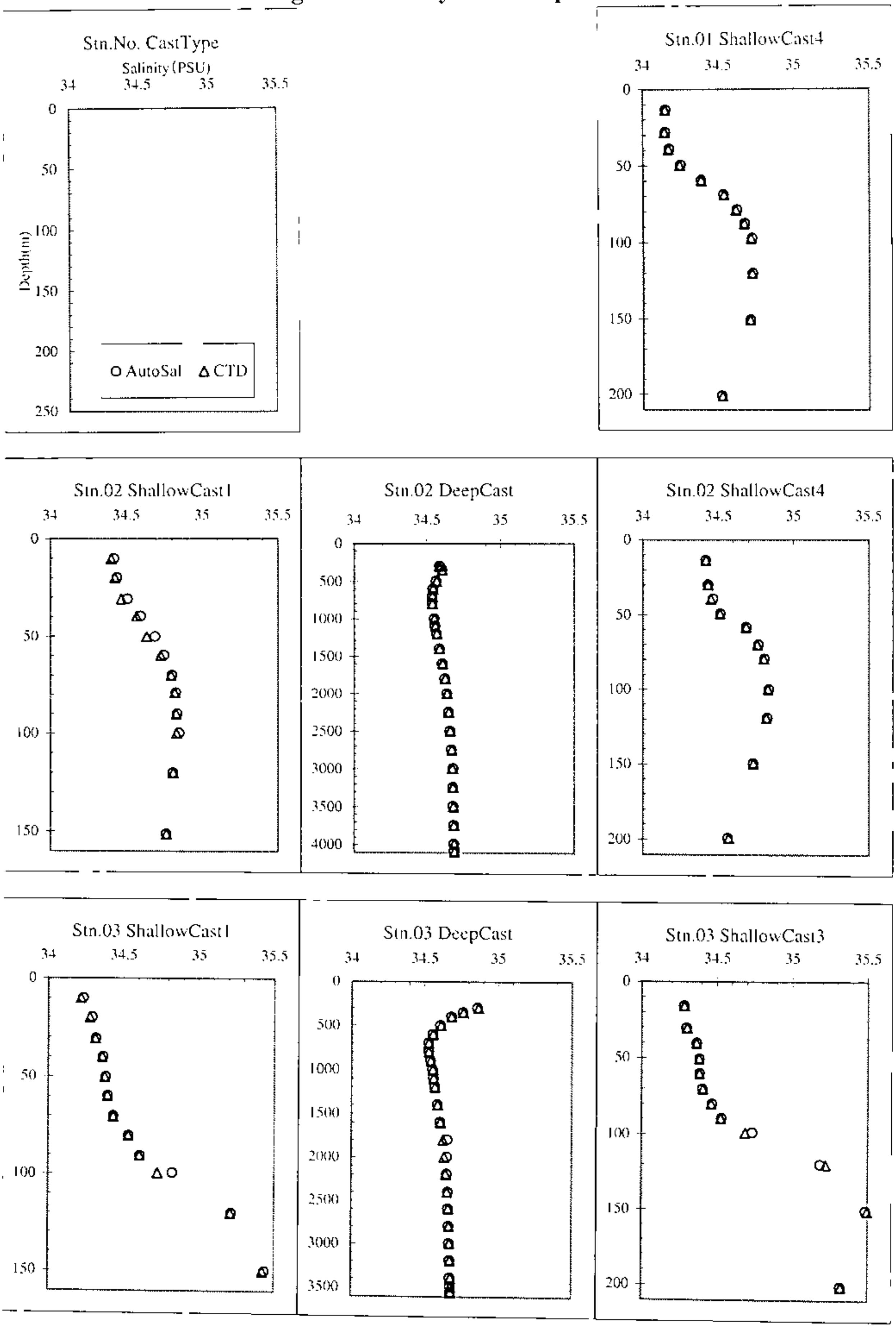
	Stn.11		ShallowCast5	
Depth(m)	Niskin.No.	SalBTL No.	Salinity(PSU)	CTD(PSU)
Surface	bucket	77	35.0781	
9.6	1	78	35.0596	35.0578
20.5	2	79	35.0640	35.0589
29.3	3	80	35.0806	35.0790
40.3	4	81	35.1206	35.1192
49.5	5	82	35.1650	35.1657
58.3	6	83	35.1947	35.1936
69.5	15	84	35.2553	35.2542
80.2	8	85	35.2729	35.2703
98.8	9	86	35.3533	35.3467
121.1	10	87	35.4845	35.4837
148.7	11	88	35.3912	35.3879
203.4	12	89	35.0095	34.9891

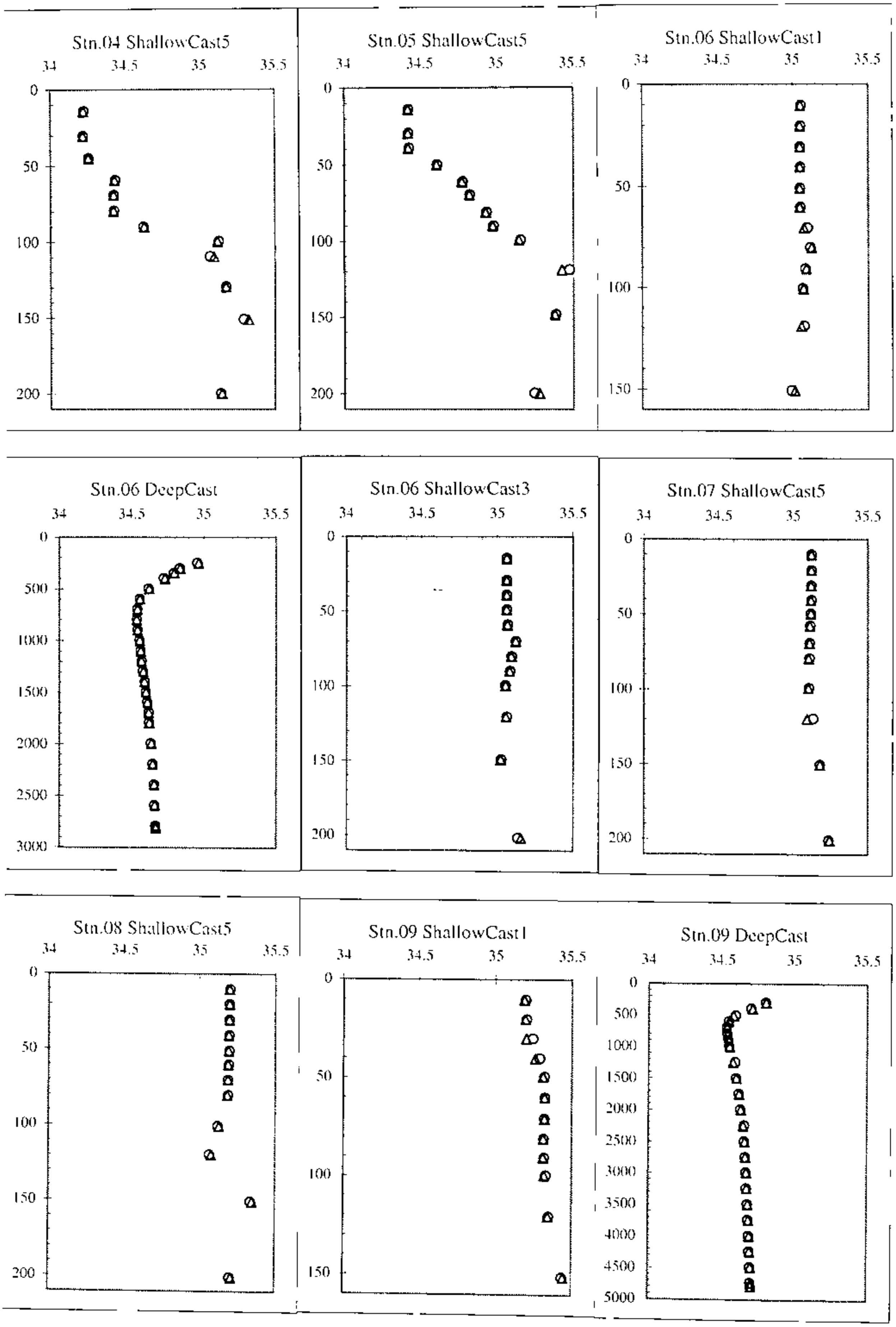
	Stn.12		ShallowCast1	
Depth(m)	Niskin.No.	SalBTL No.	Salinity(PSU)	CTD(PSU)
Surface	bucket	90	35.1767	
151.5	1	91	35.4459	35.4666
121.6	2	92	35.0027	34.9945
100.2	3	93	35.1522	35.1469
89.9	4	94	35.1488	35.1452
80.2	5	95	35.1519	35.1484
69.5	6	96	35.1544	35.1506
60.1	7	97	35.1585	35.1533
49.2	8	98	35.1579	35.1536
39.9	9	99	35.1584	35.1539
30.4	10	100	35.1596	35.1541
20.1	11	101	35.1598	35.1559
10.1	12	102	35.1666	35.1582

	Stn.12		DeepCast	
Depth(m)	Niskin.No.	SalBTL No.	Salinity(PSU)	CTD(PSU)
5351.5	1	103	34.7061	34.7063
5235.8	2	104	34.7054	34.7063
4988.0	3	105	34.7052	34.7063
4738.0	4	106	34.7052	34.7057
4488.3	5	107	34.7036	34.7043
4239.6	6	108	34.6991	34.7008
3990.2	7	109	34.6771	34.6941
3740.0	8	110	34.6903	34.6908
3490.6	9	111	34.7396	34.6820
3242.5	10	112	34.6765	34.6779
2992.7	11	113	34.6729	34.6729
2743.0	12	114	34.6685	34.6685
2493.2	13	115	34.6609	34.6602
2243.7	14	116	34.6542	34.6537
1994.8	15	117	34.6395	34.6392
1745.2	16	118	34.6450	34.6235
1496.0	17	119	34.6062	34.6055
1246.5	18	120	34.6249	34.5803
996.7	19	121	34.5635	34.5570
797.6	20	122	34.6438	34.5471
598.0	21	123	34.5555	34.5549
499.0	22	124	34.5900	34.5907
399.1	23	125	34.6743	34.6801
299.0	24	126	34.8196	34.8193

	Stn.12		ShallowCast3	
Depth(m)	Niskin.No.	SalBTL No.	Salinity(PSU)	CTD(PSU)
Surface	bucket	130	35.1695	
10.1	1	131	35.1617	35.1609
19.0	3	132	35.1617	35.1609
30.3	4	133	35.1625	35.1616
40.1	5	134	35.1673	35.1620
50.5	7	135	35.1638	35.1632
59.6	8	136	35.1650	35.1641
69.2	9	137	35.1663	35.1650
80.3	11	138	35.1691	35.1678
97.6	12	139	35.1710	35.1698
120.2	13	140	35.1053	35.0961
150.0	15	141	35.3874	35.4163
202.0	16	142	34.8608	34.8644

Figure1 Salinity vertical profile

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0 50 100 150 200
Stn.05 ShallowCast5
34 34.5 35 35.5
0 50 100 150 200
Stn.06 ShallowCast1
34 34.5 35 35.5
0 50 100 150
Stn.06 DeepCast
34 34.5 35 35.5
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Stn.06 ShallowCast3
34 34.5 35 35.5
0 50 100 150 200
Stn.07 ShallowCast5
34 34.5 35 35.5
0 50 100 150 200
Stn.08 ShallowCast5
34 34.5 35 35.5
0 50 100 150 200
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34 34.5 35 35.5
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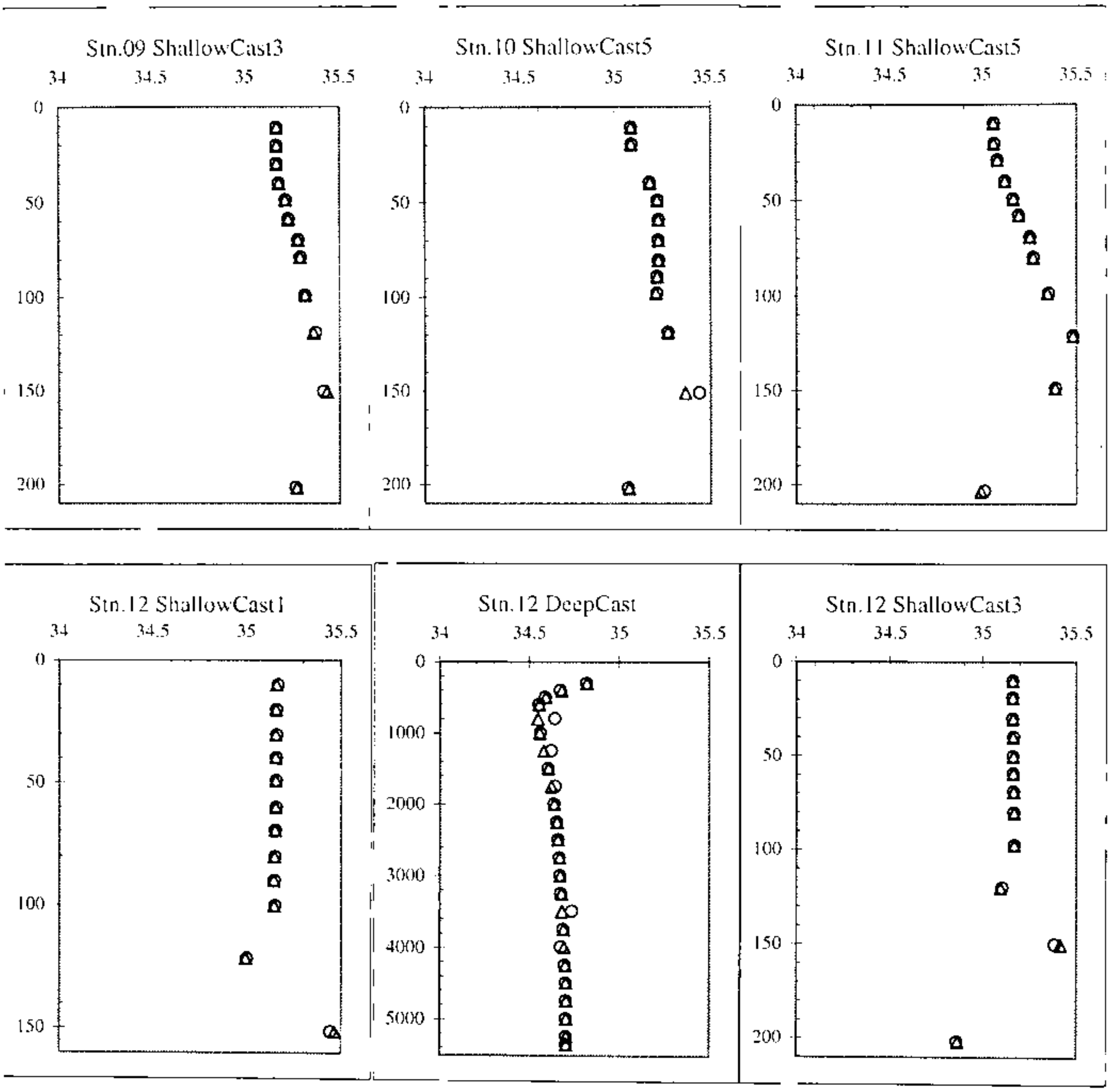
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Stn.10 ShallowCast5
Stn.11 ShallowCast5
Stn.12 ShallowCast1
Stn.12 DeepCast
Stn.12 ShallowCast3
34
34.5
35
35.5
0
50
100
150
200
1000
2000
3000
4000
5000

3.3.3 Nutrients Analysis

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Objectives

The vertical and horizontal distributions of nutrients are one of the important factors on the study of primary production, ocean circulation and water mass structure. During this cruise, the objectives of nutrients (NO_3, NO_2, SiO_2, PO_4 and NH_3) analysis were to obtain the important and basic information on these study.

Instruments and Methods

The nutrients analysis were performed on Bran + Luebbe continuous flow analytical system Model TRAACS 800 (4 channels types and 2 channels type). The manifolds are shown in Fig.1, 2 and 3. The TRAACS 800s were located at twice laboratories in the R/V MIRAI. The monitoring of laboratory's temperature and humidity were done at intervals of five minutes at one laboratory for this cruise. The temperature and humidity maintained between 13.5 - 25.7 degree C (average 22.3 degree C) and 17 - 91 % (average 45.7 %), respectively. The analytical methods were as follows:

A. by the TRAACS 800 of 4 channels types;

Nitrate (ch.1): Nitrate in seawater was reduced to nitrite by reduction tube (Cd - Cu tube), and the nitrite produced was determined by the nitrite method described to next, but the flow cell used in nitrate analysis was 3 cm length type. Nitrite initially present in the samples, was corrected by nitrite analytical data after this measurement.

Nitrite (ch.2): Nitrite was determined by diazotizing with sulfanilamide, by coupling with N-1-naphthyl- ethylenediamine (NED) to form a colored azo compound and by being measured the absorbance of 550 nm using 5 cm length flow cell, in the system.

Silicate (ch.3): Silicate was determined by complexing with molybdate, by reducing with ascorbic acid to form a colored complex and by being measured the absorbance of 630 nm using 3 cm length flow cell, in the system.

Phosphate (ch.4): Phosphate was determined by complexing with molybdate, by reducing with ascorbic acid to form a colored complex and by being measured the absorbance of 880 nm using 5 cm length flow cell, in the system.

B. by the TRAACS 800 of 2 channels types;

Ammonia (ch.1): Ammonia in seawater was determined by couplying with phenol and sodium hypochlorite to form a colored indophenol blue and by being measured the absorbance of 630 nm using 3 cm length flow cell in the system.

Sampling Procedures

Samples were drawn into polypropylene 100 ml small mouth bottles from Niskin bottle or bucket with a silicon tube. These were rinsed twice before filling. The samples were analyzed as soon as possible.

As analyzing by the TRAACS 800, glassy 7 ml sample cups were used. Before this cruise, the glass sample cup had been washed with a detergent solution (hydrochloric acid solution), had been rinsed by fresh water, had been rinsed by deionized water, had kept in packings container deionized water. These were rinsed twice with sample before being made to analyze.

Calibration of volumetric utensil

The calibration of all volumetric flasks and micropipettes used for the cruise had been checked before this cruise.

Nutrient standards

According to Gordon et al., who reported "an suggested protocol for continuous flow automated analysis of seawater nutrients" in 1992, standards of nitrate, nitrite and phosphate were prepared. Nutrients primary standards (stock solution) were prepared from salts (KNO_3, $NaNO_2$ and KH_2PO_4), that dried on oven at 110 degree C and cooled over silica gel in desiccator before weighing, respectively. The precision of the weighing was ca. 0.1 %. Concentration of nutrients in the stock solutions was 40,000 uM for nitrate, 4,000 uM for nitrite and 2,500 uM for phosphate, respectively.

Silicate primary standard (stock solution) was prepared by an ampoule of J.T.Baker Chemical Co. LTD, was containing one gram of SiO_2 in one ampoule. Concentration of silicate in the stock solution was 33,286.5 uM.

Ammonia primary standard (stock solution) was prepared from ammonium sulfate ($(NH_4)_2SO_4$), that dried on oven at 110 degree C and cooled over silica gel in desiccator before weighing. The precision of the weighing was ca. 0.1 %. Concentration of ammonia in the stock solutions was 4,000 uM for ammonium.

These stock solutions were diluted to 400 uM for nitrate, 8 uM for nitrite, 1664.33 uM for silicate, 30 uM for phosphate and 16 uM for ammonia by all together as measuring samples of deep casting, the diluted standard solution was named to B standard. The B standard was diluted to six types with low nutrients seawater (LNSW). This standard diluted from the B standard, was named to C working standards. The C working standards have the six types of difference nutrients concentration as follows: nitrate 48, 40, 32, 16, 8 and 0 uM; nitrite 0.96, 0.80, 0.64, 0.32, 0.16 and 0.00 uM; 199.72, 166.43, 133.15, 66.57, 33.29 and 0.00 uM; phosphate 3.6, 3.0, 2.4, 1.2, 0.6 and 0.00 uM; ammonia 1.92, 1.60, 1.28, 0.64, 0.32 and 0.00 uM (These values are all about, because of some correction have been done after preparing it.).

These stock solutions were diluted to 320 uM for nitrate, 16 uM for nitrite, 332.87 uM for silicate, 20 uM for phosphate and 32 uM for ammonia by all together as measuring samples of shallow casting, the diluted standard solution was named to E standard. The E standard was diluted to six types with LNSW. This standard diluted from the E standard, was named to F working standards. The F working standards have the six types of difference nutrients concentration as follows: nitrate 19.2, 16.0, 12.8, 6.4,3.2 and 0 uM; nitrite 0.96, 0.80, 0.64, 0.32, 0.16 and 0.00 uM; 19.97, 16.64, 13.32, 6.66, 3.33 and 0.00 uM; phosphate 1.2, 1.0, 0.8, 0.4, 0.2 and 0.00 uM; ammonia 1.92, 1.60, 1.28, 0.64, 0.32 and 0.00 uM (These values are all about, because of some correction have been done after preparing it.).

The check of standard

After stock solutions were prepared, we separated the stock to two bottles each standard. One bottle was used to prepare for B standards during the cruise. The other was stocking as reference standard. The comparison measurement was done for checking of stock standard on twice in the cruise. The result of comparison is shown in Table 1.

Low nutrient seawater

Surface seawater was collected at point of 00 - 00 N and 165 - 00 W on Feb. 6, 1998 as low nutrients seawater (LNSW). The collected seawater was stocked in the 20 L polyethylene container for several month, filtered with 0.45 um pore size membrane filter (Millipore HA), was restored in the 20 L container. The concentration of nutrients was determined in each batch of container. The results are shown in Table 2.

The comparison between working standard and CSK standard

The comparison between working standard solution and CSK standard were carried out twice during the cruise on board. It had difference matrix between working standard solution (LNSW base) and CSK standard (NaCl 3.05 % base), but it had been done to measure as values against the LNSW base. The results are shown in Table 3.

Precision check on each analysis

On each analysis, the maximum chlorophyll of sample and the most deep of sample in the sampling cast were analyzed six times by repeating to get the precision, respectively. The results of the repeat analysis are summarized in the percent of the concentration level in Table 4.

Preliminary results

Vertical profiles of nutrients

Vertical profiles of nutrients each casting are shown in Fig.4. The data are used in Fig.4, are not the formal data of this cruise, they are the preliminary data.

Vertical distribution of nutrients

Vertical distribution of nutrients (SiO_2, NO_3, PO_4, NO_2 and NH_3) under equator are shown in Fig.5. The data are used in Fig.5, are not the formal data of this cruise, they are the preliminary data.

Table 1. The result of comparing between the stock standard for preparing the working standard (stock A) and the stock standard for the reference (stock B). The concentration ratio between stock A and stock B calculated from the following formula: R = (MW/MR)/(CW/CR), R; concentration ratio, MW; measured working STD, MR; measured reference STD, CW; calculated working STD, CR; calculated reference STD.

Date	Nitrate (ratio)	Nitrite (ratio)	Silicate (ratio)	Phosphate (ratio)	Ammonium (ratio)	Type *)
Dec. 31, '98	0.9916	0.9875	0.9995	0.9885	−	High
Dec. 31, '98	1.0147	0.9961	0.9829	0.9064	−	Low
Dec. 31, '98	1.0083	0.9868	0.9815	0.9689	−	Low
Jan. 19, '99	1.0035	0.9792	1.0028	1.0016	−	High

*) The Type stands for the concentration as being done measurement: The ‘High’ is the highest concentration in working standard solution for the sample of deep casting, the ‘Low’ is the highest concentration in working standard solution for the sample of shallow casting.

Table 2. The results of measuring nutrients in low nutrients seawater (LNSW).

Batch No.	Nitrate (μM)	Nitrite (μM)	Silicate (μM)	Phosphate (μM)	Ammonium (μM)
98Feb.01	0.000	0.000	1.421	0.153	0.000
98Feb.02	0.000	0.000	1.299	0.160	0.000
98Feb.03	0.000	0.000	1.306	0.150	0.000
98Feb.04	0.000	0.000	1.325	0.154	0.000
98Feb.05	0.000	0.000	1.310	0.149	0.000
98Feb.06	0.000	0.000	1.364	0.170	0.000
98Feb.07	0.000	0.000	1.272	0.156	0.000
98Feb.08	0.000	0.000	1.283	0.121	0.000
98Feb.09	0.000	0.000	1.310	0.171	0.000
98Feb.10	0.000	0.000	1.306	0.040	0.000
97Oct.01	0.000	0.000	1.916	0.000	0.000
97Oct.02	0.000	0.000	1.955	0.012	0.000
97Oct.03	0.000	0.000	1.905	0.006	0.000

Table 3. The results of measuring the CSK standard on the working standard. The 'Anal. Style' stands for working standards that were made used to measure of CSK samples: The 'HR' is working standard for sample of deep casting, the 'LR' is working standard for sample of shallow casting.

Date	Anal. Style	Sample	NO3 (μM)	Nox (μM)	NO2 (μM)	SiO2 (μM)	PO4 (μM)
Dec. 31,'98	HR	CSK-SiO2-0uM	0.107	0.130	0.024	-1.049	-0.022
		CSK-SiO2-50uM	0.112	0.130	0.018	48.747	-0.005
		CSK-SiO2-100uM	0.096	0.108	0.012	99.268	-0.035
		CSK-PO4-0.00uM	0.056	0.623	0.566	21.239	-0.031
		CSK-PO4-2.00uM	0.148	0.275	0.127	26.921	1.743
		CSK-PO4-3.00uM	0.113	0.289	0.176	27.038	2.816
		CSK-NO3-0uM	0.091	0.109	0.018	27.970	-0.050
		CSK-NO3-40uM	39.175	39.187	0.013	20.365	-0.053
		CSK-NO2-0.00uM	0.016	0.116	0.100	18.181	-0.032
		CSK-NO2-0.50uM	0.055	0.601	0.546	12.649	0.011
		CSK-NO2-1.00uM	-0.047	1.079	1.127	24.502	0.025
Dec. 31,'98	LR	CSK-SiO2-0uM	0.075	0.095	0.020	-1.458	0.025
		CSK-SiO2-10uM	0.086	0.106	0.020	8.236	0.011
		CSK-NO3-0uM	9.690	10.289	0.599	11.200	0.763
		CSK-NO3-10uM	-0.084	0.020	0.104	19.145	0.025
		CSK-NO2-0.00uM	-0.072	0.023	0.094	18.981	-0.061
		CSK-NO2-0.50uM	0.017	0.565	0.548	15.487	-0.032
		CSK-PO4-0.00uM	0.064	0.118	0.054	22.114	0.038
		CSK-PO4-1.00uM	0.086	0.343	0.257	18.644	0.956
Dec. 31,'98	LR	CSK-SiO2-0uM	0.077	0.116	0.038	-1.296	-0.034
		CSK-SiO2-10uM	0.045	0.074	0.029	8.466	0.009
		CSK-NO3-0uM	-0.003	0.039	0.042	22.384	-0.077
		CSK-NO3-10uM	10.411	10.448	0.036	22.358	-0.022
		CSK-PO4-0.00uM	0.023	0.066	0.043	22.352	-0.068
		CSK-PO4-1.00uM	0.070	0.330	0.259	18.754	1.020
		CSK-NO2-0.00uM	-0.077	0.022	0.099	17.386	-0.038
		CSK-NO2-0.50uM	-0.007	0.544	0.551	12.272	-0.077
Jan. 14,'99	LR	CSK-NO2-0.00uM	-0.094	-0.106	-0.012	19.494	-0.097
		CSK-NO2-0.50uM	-0.116	0.437	0.553	16.921	-0.005
		CSK-NO3-0uM	-0.168	-0.119	0.049	23.768	0.007
		CSK-NO3-10uM	10.512	10.547	0.035	23.773	-0.012
		CSK-SiO2-0uM	-0.079	-0.046	0.033	0.310	0.035
		CSK-SiO2-10uM	-0.080	-0.049	0.031	10.561	0.091
		CSK-PO4-0.00uM	-0.079	0.030	0.109	16.651	0.110
		CSK-PO4-1.00uM	0.182	0.256	0.075	18.679	1.007

Table 3. Continue

Jan. 14,'99	HR	CSK-SiO2-0uM	0.045	0.052	0.007	-0.015	0.028
		CSK-SiO2-10uM	0.053	0.059	0.007	9.798	0.033
		CSK-SiO2-50uM	0.015	0.023	0.008	50.140	0.042
		CSK-SiO2-100uM	0.016	0.023	0.007	100.290	0.056
		CSK-PO4-0.00uM	-0.008	0.346	0.353	26.406	0.028
		CSK-PO4-2.00uM	0.010	0.155	0.144	39.319	1.822
		CSK-PO4-3.00uM	-0.009	0.155	0.163	25.429	2.882
		CSK-NO2-0.00uM	-0.067	0.015	0.083	18.987	0.049
		CSK-NO2-0.50uM	-0.046	0.478	0.523	16.166	-0.005
		CSK-NO3-0uM	-0.029	0.001	0.030	24.969	0.003
		CSK-NO3-10uM	9.790	9.804	0.015	42.471	0.000
		CSK-NO3-40uM	39.795	39.807	0.012	21.317	0.026
Jan. 14,'99	HR	CSK-NO2-1.00uM	—	—	1.079	—	—

Table 4. The results of repeat analysis for checking the precision each station. In Sample No., the 'SC' stands for shallow casting, the 'DC' stands for deep casting and the final figure (such as –23) stands for the sampling bottle No.

Sample No.	Items	Nox	NO2	SiO2	PO4	NH3
St.1-SC4-23	Average (uM)	20.964	-0.003	25.566	1.551	—
	STD (uM)	0.053	0.005	0.087	0.023	—
	RSD (%)	0.254	155.426	0.339	1.453	—
	n	8	8	8	8	—
St.1-SC3-22	Average (uM)	10.345	0.013	7.986	0.758	—
	STD (uM)	0.017	0.007	0.075	0.009	—
	RSD (%)	0.168	52.844	0.939	1.180	—
	n	8	8	8	8	—
St.2-SC1-03	Average (uM)	0.728	0.333	0.322	0.236	0.003
	STD (uM)	0.007	0.007	0.063	0.007	0.045
	RSD (%)	0.994	2.067	19.629	3.145	1348.447
	n	8	8	8	8	8
St.2-SC1-01	Average (uM)	6.975	0.046	4.154	0.599	—
	STD (uM)	0.017	0.005	0.066	0.008	—
	RSD (%)	0.247	10.192	1.587	1.259	—
	n	8	8	8	8	—
St.2-DC-01	Average (uM)	36.162	0.000	143.567	2.524	—
	STD (uM)	0.263	0.002	0.959	0.023	—
	RSD (%)	0.727	-888.511	0.668	0.895	—
	n	8	8	8	8	—
St.2-SC3-6	Average (uM)	—	—	—	—	0.091
	STD (uM)	—	—	—	—	0.097
	RSD (%)	—	—	—	—	105.814
	n	—	—	—	—	8

Table 4. Continue.

Sample No.	Items	Nox	NO2	SiO2	PO4	NH3
St.2-SC3-7	Average (uM)	—	—	—	—	-0.434
	STD (uM)	—	—	—	—	0.930
	RSD (%)	—	—	—	—	214.325
	n	—	—	—	—	8
St.2-SC4-10	Average (uM)	1.142	0.412	0.450	0.245	—
	STD (uM)	0.015	0.005	0.040	0.011	—
	RSD (%)	1.336	1.243	8.832	4.369	—
	n	8	8	8	8	—
St.2-SC4-11	Average (uM)	10.714	0.030	7.409	0.833	—
	STD (uM)	0.027	0.004	0.049	0.005	—
	RSD (%)	0.255	13.609	0.667	0.550	—
	n	8	8	8	8	—
St.2-SC4-12	Average (uM)	21.880	0.004	21.862	1.635	—
	STD (uM)	0.068	0.004	0.271	0.024	—
	RSD (%)	0.309	87.891	1.239	1.484	—
	n	10	10	10	10	—
St.3-SC1-04	Average (uM)	0.242	0.228	1.849	0.142	—
	STD (uM)	0.003	0.006	0.043	0.006	—
	RSD (%)	1.349	2.480	2.329	4.504	—
	n	8	8	8	8	—
St.3-SC1-01	Average (uM)	7.153	0.021	3.279	0.647	—
	STD (uM)	0.027	0.004	0.037	0.011	—
	RSD (%)	0.371	21.541	1.140	1.676	—
	n	8	8	8	8	—
St.3-SC1-09	Average (uM)	—	—	—	—	0.417
	STD (uM)	—	—	—	—	0.099
	RSD (%)	—	—	—	—	23.702
	n	—	—	—	—	8
St.3-SC3-09	Average (uM)	0.805	0.304	1.746	0.241	0.384
	STD (uM)	0.015	0.003	0.061	0.133	0.032
	RSD (%)	1.875	0.911	3.510	55.290	8.363
	n	8	8	8	8	8
St.3-SC3-12	Average (uM)	13.104	0.009	6.853	1.023	—
	STD (uM)	0.049	0.006	0.047	0.017	—
	RSD (%)	0.371	66.910	0.682	1.661	—
	n	8	8	8	8	—
St.3-DC-01	Average (uM)	37.309	0.007	146.141	2.623	—
	STD (uM)	0.100	0.006	0.569	0.010	—
	RSD (%)	0.269	78.443	0.389	0.379	—
	n	8	8	8	8	—
St.4-SC6-07	Average (uM)	0.369	0.172	1.746	0.174	—
	STD (uM)	0.011	0.002	0.064	0.010	—
	RSD (%)	2.915	0.926	3.669	6.031	—
	n	8	8	8	8	—

Table 4. Continue.

Sample No.	Items	Nox	NO2	SiO2	PO4	NH3
St.4-SC6-09	Average (uM)	—	—	—	—	0.315
	STD (uM)	—	—	—	—	0.054
	RSD (%)	—	—	—	—	17.315
	n	—	—	—	—	8
St.4-SC6-12	Average (uM)	13.479	0.015	10.074	1.083	—
	STD (uM)	0.020	0.005	0.075	0.009	—
	RSD (%)	0.150	33.088	0.743	0.875	—
	n	8	8	8	8	—
St.5-SC5-09	Average (uM)	1.747	0.291	1.718	0.340	—
	STD (uM)	0.008	0.002	0.051	0.004	—
	RSD (%)	0.459	0.682	2.988	1.316	—
	n	8	8	8	8	—
St.5-SC5-12	Average (uM)	12.992	0.000	7.857	1.026	0.356
	STD (uM)	0.020	0.000	0.075	0.006	0.066
	RSD (%)	0.157	237.547	0.957	0.629	18.423
	n	8	8	8	8	8
St.6-SC1-01	Average (uM)	9.822	0.016	7.986	0.832	—
	STD (uM)	0.025	0.002	0.117	0.014	—
	RSD (%)	0.251	12.860	1.463	1.740	—
	n	8	8	8	8	—
St.6-SC1-02	Average (uM)	—	—	—	—	0.468
	STD (uM)	—	—	—	—	0.059
	RSD (%)	—	—	—	—	12.624
	n	—	—	—	—	8
St.6-SC1-03	Average (uM)	—	—	—	—	0.354
	STD (uM)	—	—	—	—	0.075
	RSD (%)	—	—	—	—	21.293
	n	—	—	—	—	8
St.6-SC1-05	Average (uM)	1.287	0.431	1.502	0.319	—
	STD (uM)	0.004	0.007	0.051	0.004	—
	RSD (%)	0.335	1.701	3.426	1.234	—
	n	8	8	8	8	—
St.6-DC-01	Average (uM)	37.877	0.005	146.109	2.696	—
	STD (uM)	0.092	0.007	0.732	0.007	—
	RSD (%)	0.242	141.053	0.501	0.252	—
	n	8	8	8	8	—
St.6-SC3-06	Average (uM)	—	—	—	—	0.372
	STD (uM)	—	—	—	—	0.061
	RSD (%)	—	—	—	—	16.277
	n	—	—	—	—	8
St.6-SC3-07	Average (uM)	1.580	0.482	1.619	0.327	0.365
	STD (uM)	0.014	0.003	0.043	0.003	0.087
	RSD (%)	0.915	0.560	2.649	0.946	23.899
	n	8	8	8	8	8

Table 4. Continue.

Sample No.	Items	Nox	NO2	SiO2	PO4	NH3
St.6-SC3-12	Average (uM)	14.440	-0.009	10.725	1.136	—
	STD (uM)	0.026	0.003	0.198	0.006	—
	RSD (%)	0.181	-36.183	1.843	0.564	—
	n	8	8	8	8	—
St.7-SC5-01	Average (uM)	12.153	-0.001	7.576	0.975	—
	STD (uM)	0.031	0.002	0.199	0.007	—
	RSD (%)	0.254	-216.793	2.627	0.721	—
	n	8	8	8	8	—
St.7-SC5-11	Average (uM)	2.170	0.461	1.799	0.340	—
	STD (uM)	0.011	0.001	0.031	0.008	—
	RSD (%)	0.515	0.318	1.744	2.267	—
	n	8	8	8	8	—
St.7-SC5-14	Average (uM)	—	—	—	—	0.257
	STD (uM)	—	—	—	—	0.046
	RSD (%)	—	—	—	—	17.892
	n	—	—	—	—	7
St.7-SC5-18	Average (uM)	—	—	—	—	0.234
	STD (uM)	—	—	—	—	0.061
	RSD (%)	—	—	—	—	26.175
	n	—	—	—	—	8
St.8-SC5-09	Average (uM)	3.714	0.270	2.274	0.431	0.549
	STD (uM)	0.007	0.002	0.043	0.004	0.073
	RSD (%)	0.201	0.809	1.904	1.030	13.239
	n	8	8	8	8	6
St.8-SC5-12	Average (uM)	13.329	0.002	9.400	1.048	—
	STD (uM)	0.019	0.002	0.090	0.005	—
	RSD (%)	0.146	128.864	0.962	0.488	—
	n	8	8	8	8	—
St.9-SC1-01	Average (uM)	7.567	0.025	3.490	0.809	—
	STD (uM)	0.020	0.005	0.083	0.009	—
	RSD (%)	0.271	18.372	2.370	1.121	—
	n	8	8	8	8	—
St.9-SC1-02	Average (uM)	4.138	0.368	2.145	0.611	—
	STD (uM)	0.022	0.007	0.034	0.006	—
	RSD (%)	0.533	1.961	1.576	1.038	—
	n	8	8	8	8	—
St.9-SC1-12	Average (uM)	—	—	—	—	0.399
	STD (uM)	—	—	—	—	0.051
	RSD (%)	—	—	—	—	12.823
	n	—	—	—	—	5
St.9-DC-01	Average (uM)	33.375	-0.009	123.399	2.648	—
	STD (uM)	0.069	0.003	0.519	0.541	—
	RSD (%)	0.206	-36.632	0.421	20.448	—
	n	8	8	8	8	—

Table 4. Continue.

Sample No.	Items	Nox	NO2	SiO2	PO4	NH3
St.9-SC3-10	Average (uM)	4.374	0.366	2.011	0.620	—
	STD (uM)	0.009	0.003	0.014	0.010	—
	RSD (%)	0.196	0.879	0.711	1.665	—
	n	8	8	8	8	—
St.9-SC3-12	Average (uM)	12.664	0.009	7.988	1.140	0.669
	STD (uM)	0.051	0.003	0.033	0.009	0.234
	RSD (%)	0.399	36.473	0.413	0.797	35.012
	n	8	8	8	8	6
St.10-SC5-09	Average (uM)	5.361	0.495	2.965	0.629	—
	STD (uM)	0.017	0.002	0.043	0.007	—
	RSD (%)	0.325	0.438	1.453	1.088	—
	n	8	8	8	8	—
St.10-SC5-12	Average (uM)	15.062	0.015	12.523	1.231	—
	STD (uM)	0.027	0.002	0.048	0.004	—
	RSD (%)	0.181	15.457	0.382	0.349	—
	n	8	8	8	8	—
St.11-SC5-08	Average (uM)	6.530	0.592	3.029	0.643	—
	STD (uM)	0.020	0.006	0.011	0.004	—
	RSD (%)	0.304	1.083	0.371	0.615	—
	n	8	8	8	8	—
St.11-SC5-12	Average (uM)	16.417	0.021	14.137	1.235	—
	STD (uM)	0.038	0.003	0.046	0.005	—
	RSD (%)	0.234	15.127	0.327	0.406	—
	n	8	8	8	8	—
St.12-SC1-03	Average (uM)	6.996	0.718	3.574	0.637	—
	STD (uM)	0.011	0.004	0.024	0.004	—
	RSD (%)	0.159	0.557	0.668	0.648	—
	n	8	8	8	8	—
St.12-SC1-01	Average (uM)	10.563	0.085	5.303	0.865	—
	STD (uM)	0.019	0.005	0.030	0.006	—
	RSD (%)	0.183	6.136	0.573	0.718	—
	n	8	8	8	8	—
St.12-DC-01	Average (uM)	33.489	-0.007	128.284	2.347	—
	STD (uM)	0.071	0.004	1.426	0.007	—
	RSD (%)	0.211	-56.175	1.112	0.305	—
	n	8	8	8	8	—
St.12-SC3-12	Average (uM)	6.845	0.722	—	0.633	—
	STD (uM)	0.010	0.004	—	0.004	—
	RSD (%)	0.147	0.555	—	0.613	—
	n	8	8	—	8	—
St.12-SC3-15	Average (uM)	—	—	6.851	—	—
	STD (uM)	—	—	0.043	—	—
	RSD (%)	—	—	0.630	—	—
	n	—	—	8	—	—

Table 4. Continue.

Sample No.	Items	Nox	NO2	SiO2	PO4	NH3
St.12-SC3-13	Average (uM)	–	–	4.984	–	–
	STD (uM)	–	–	0.148	–	–
	RSD (%)	–	–	2.966	–	–
	n	–	–	4	–	–

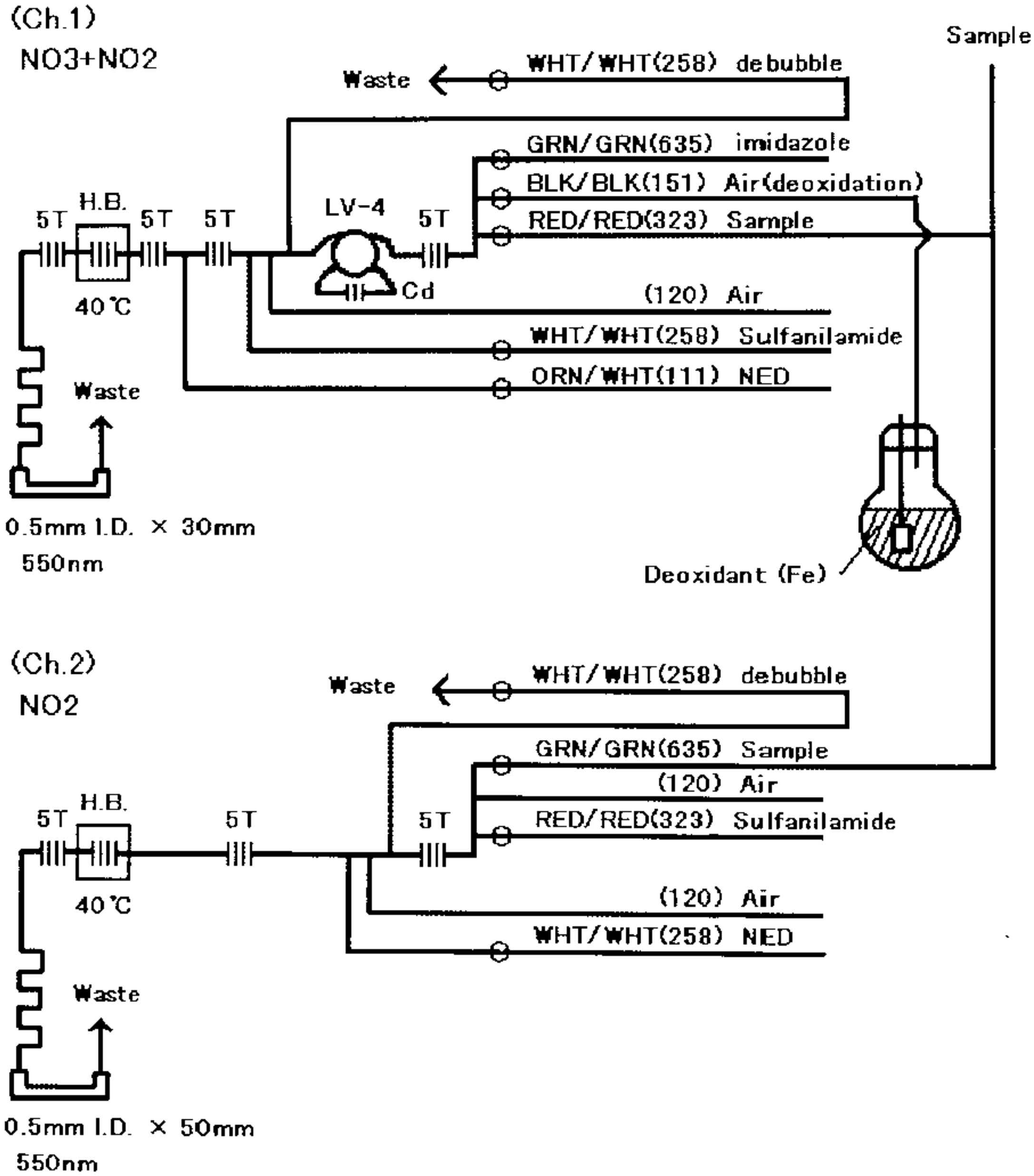


Fig.1 Flow diagram of NO3+NO2 and NO2 analysis.

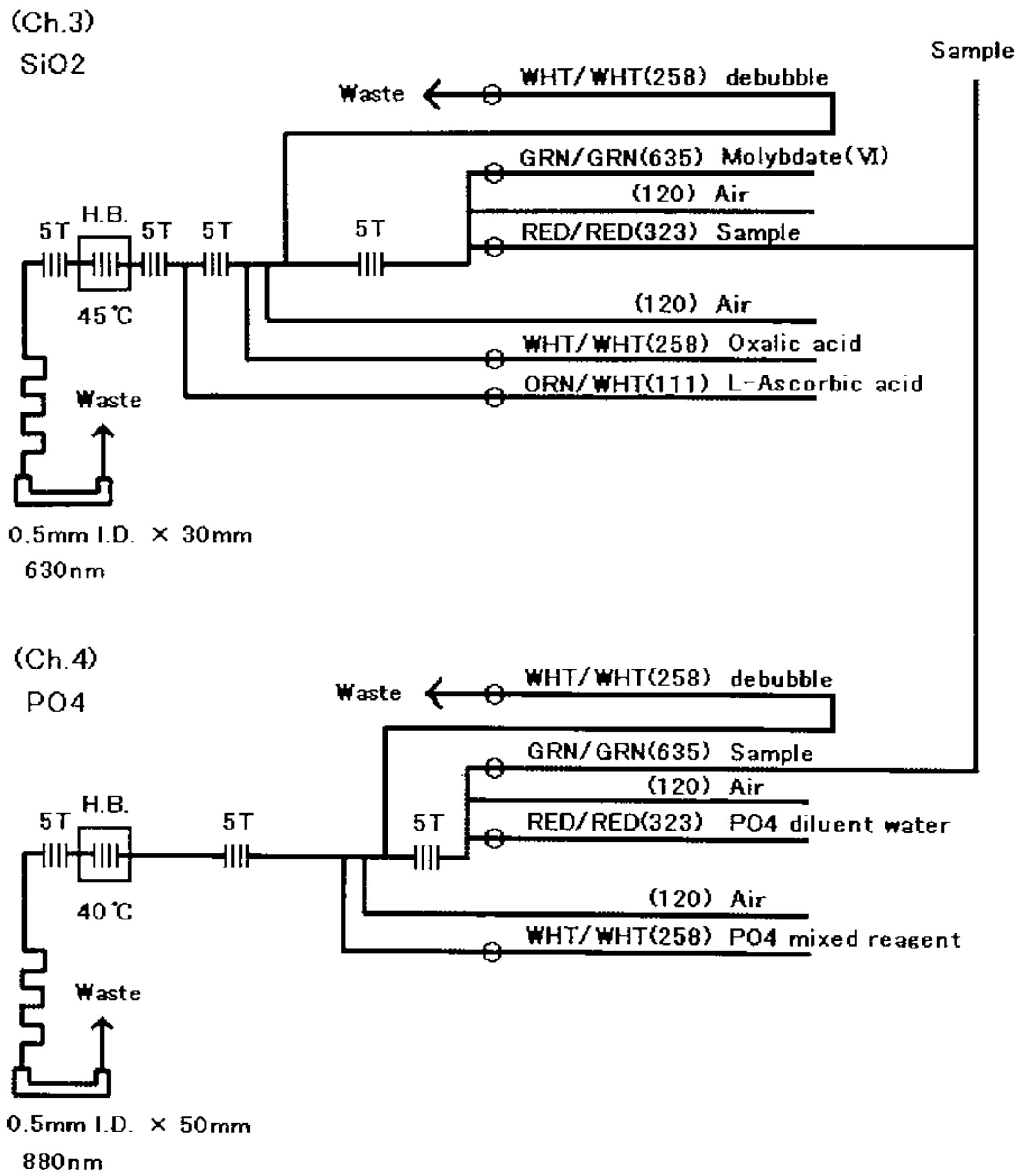


Fig.2 Flow diagram of SiO2 and PO4 analysis.

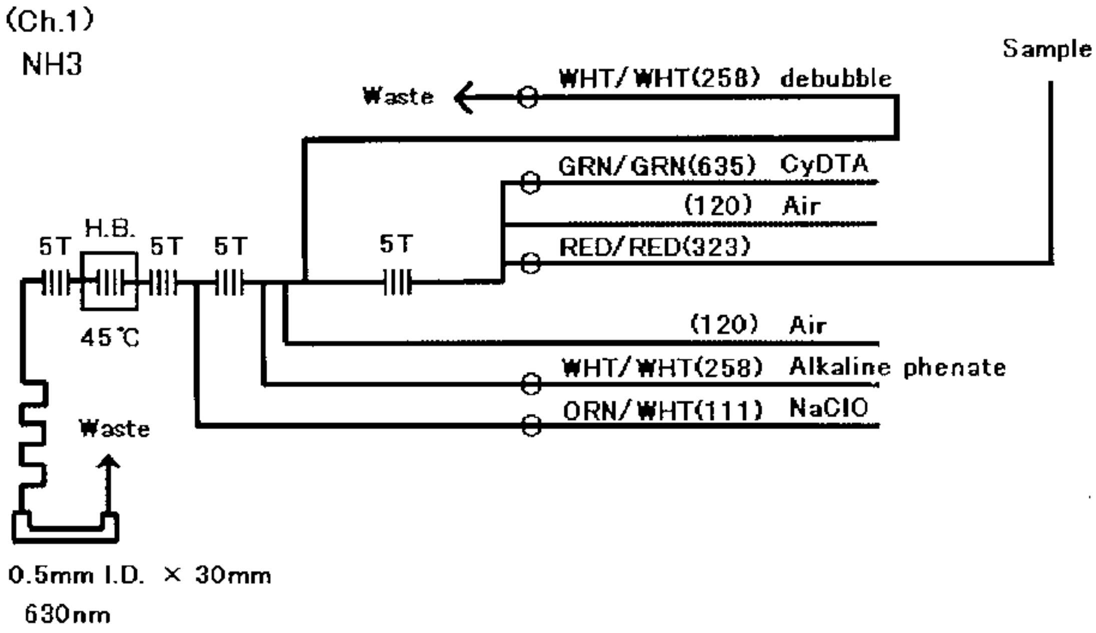
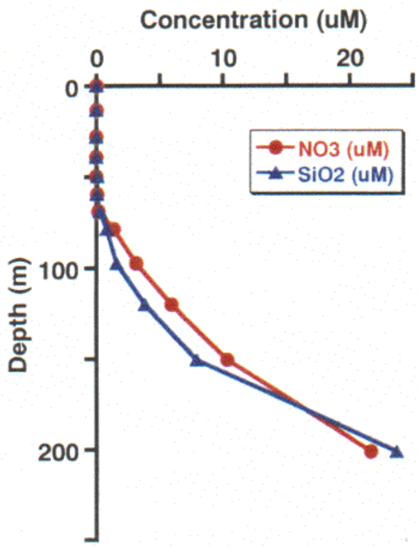
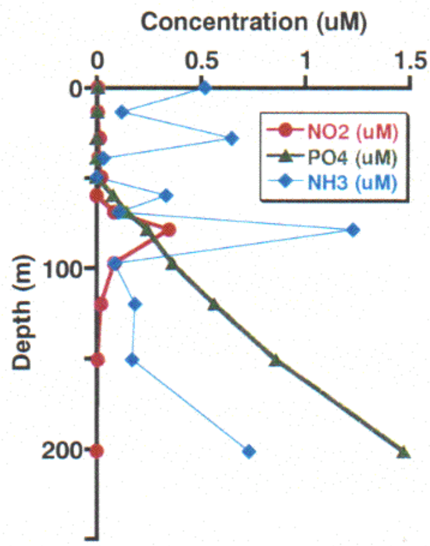


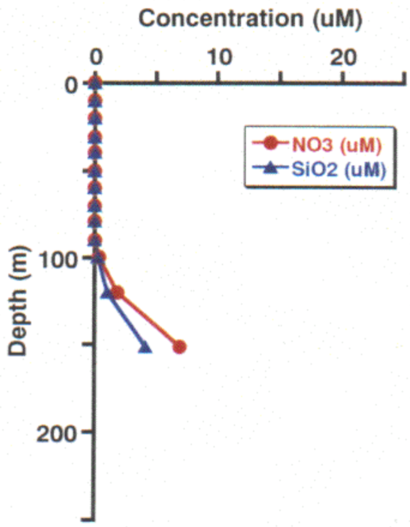
Fig.3 Flow diagram of NH3 analysis.



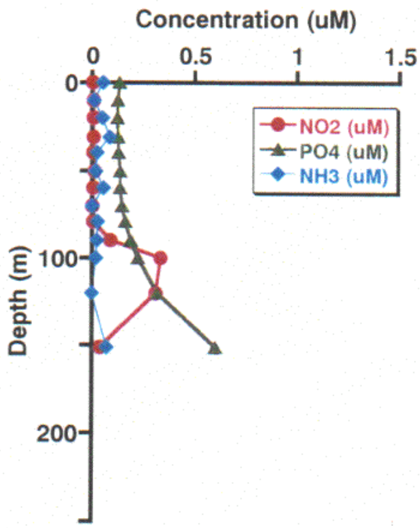
Vertical profile of NO3 and SiO2 conc. on St.1-SC4.



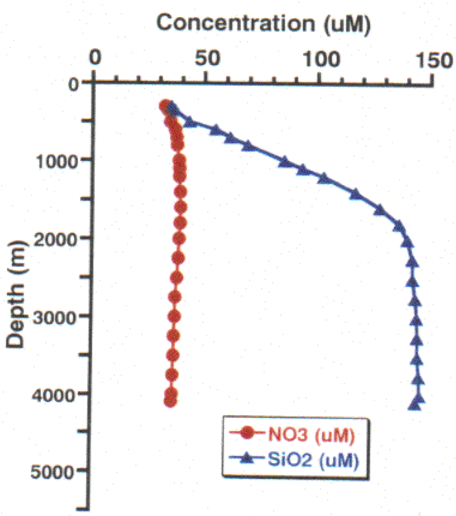
Vertical profile of NO2, PO4 and NH3 conc. on St.1-SC4.



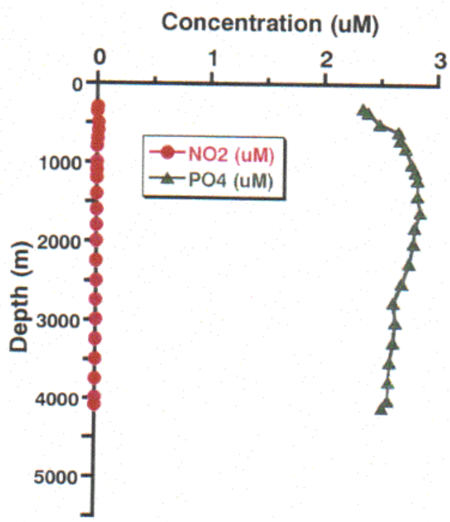
Vertical profile of NO3 and SiO2 conc. on St.2-SC1.



Vertical profile of NO2, PO4 and NH3 conc. on St.2-SC1.

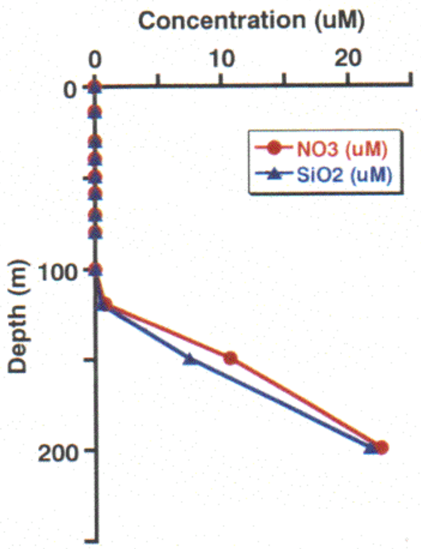


Vertical profile of NO3 and SiO2 conc. on St.2-DC.

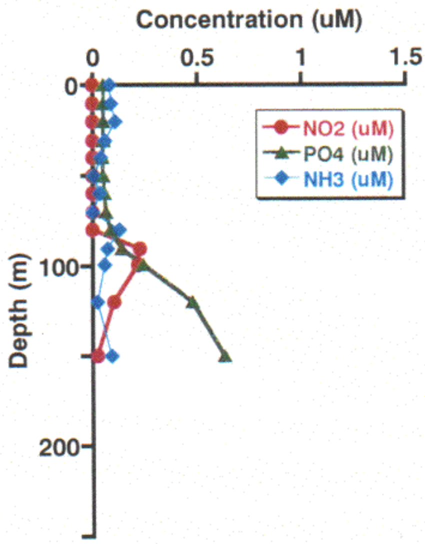


Vertical profile of NO2 and PO4 conc. on St.2-DC.

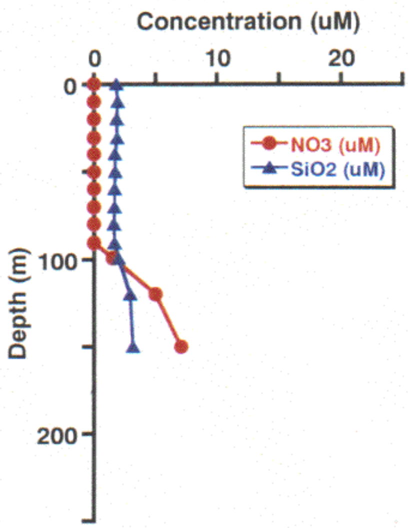
Fig.4 Vertical profiles of nutrients each casting in MR98K02.



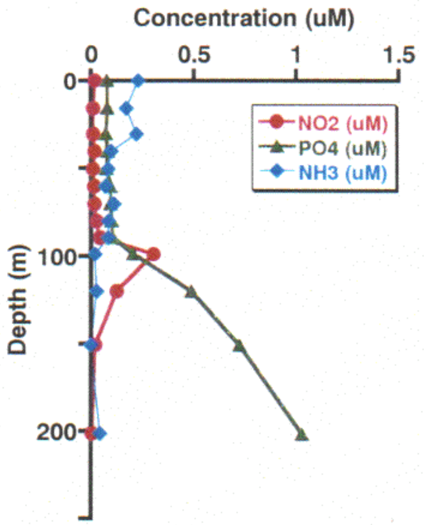
Vertical profile of NO3 and SiO2 conc. on St.2-SC3.



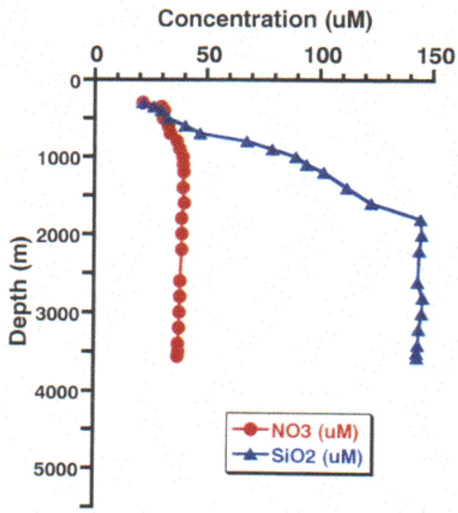
Vertical profile of NO2, PO4 and NH3 conc. on St.3-SC1.



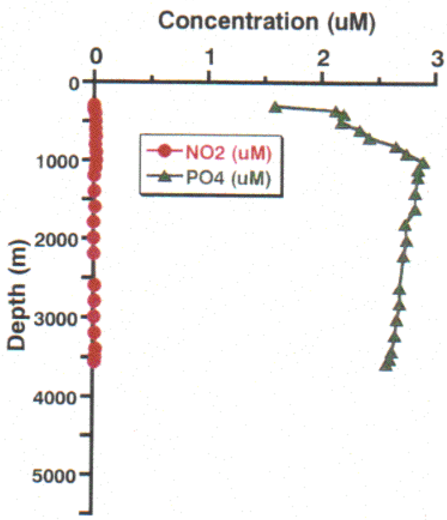
Vertical profile of NO3 and SiO2 conc. on St.3-SC1.



Vertical profile of NO2, PO4 and NH3 conc. on St.3-SC3.

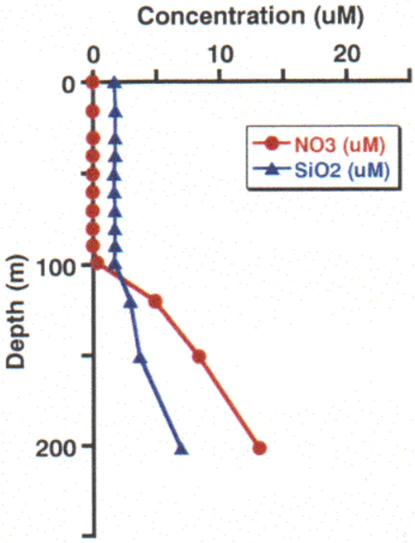


Vertical profile of NO3 and SiO2 conc. on St.3-DC.

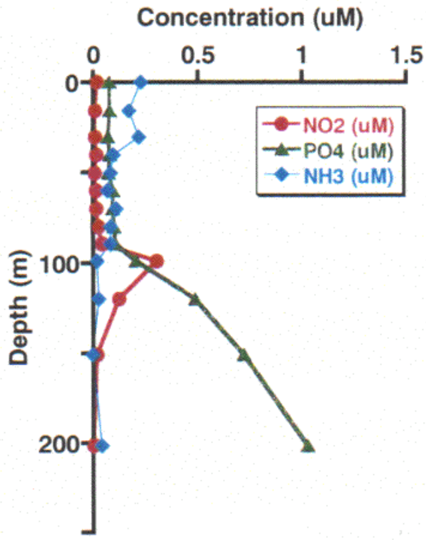


Vertical profile of NO2 and PO4 conc. on St.3-DC.

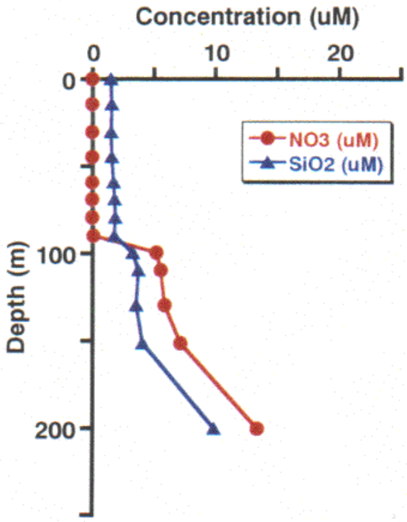
Fig.4 Continue.



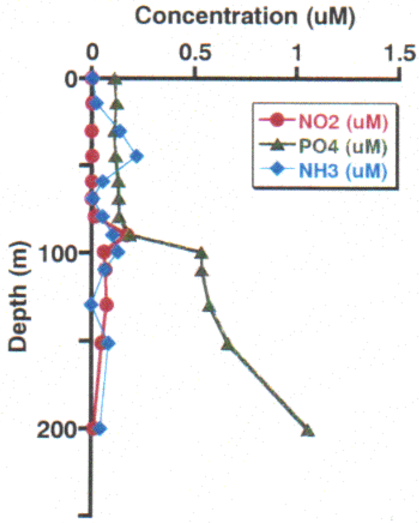
Vertical profile of NO3 and SiO2 conc. on St.3-SC3.



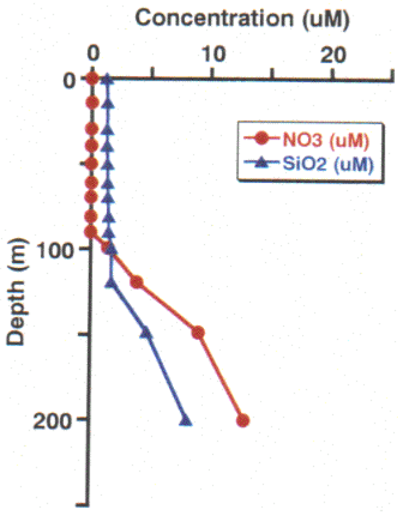
Vertical profile of NO2, PO4 and NH3 conc. on St.3-SC3.



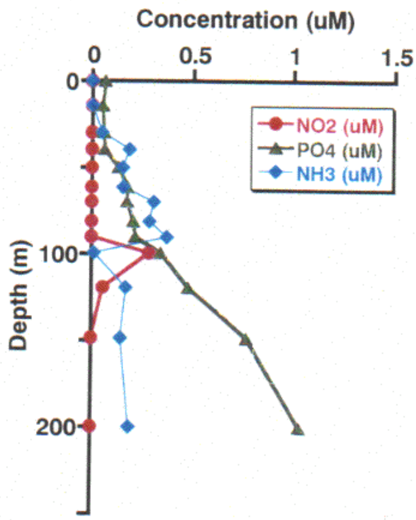
Vertical profile of NO3 and SiO2 conc. on St.4-SC6.



Vertical profile of NO2, PO4 and NH3 conc. on St.4-SC6.

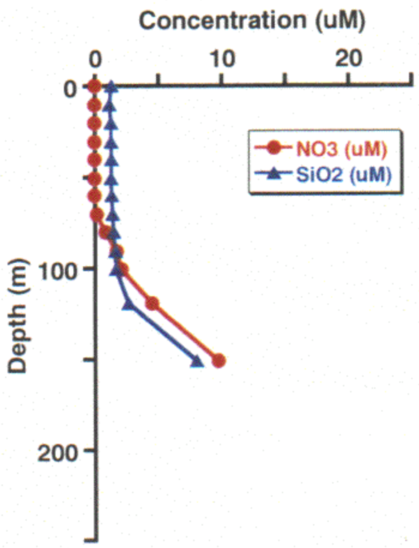


Vertical profile of NO3 and SiO2 conc. on St.5-SC5.

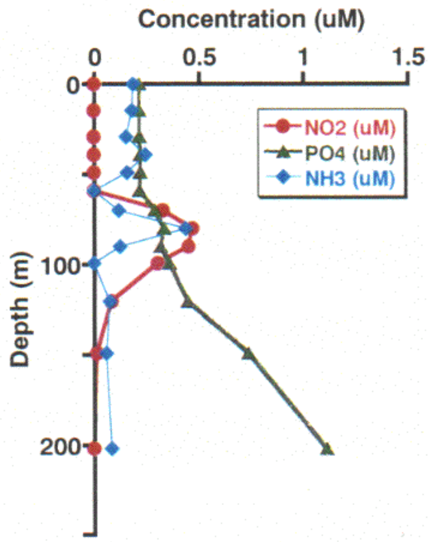


Vertical profile of NO2, PO4 and NH3 conc. on St.5-SC5.

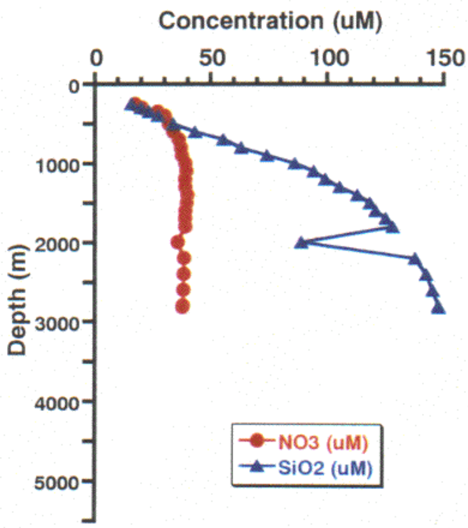
Fig.4 Continue.



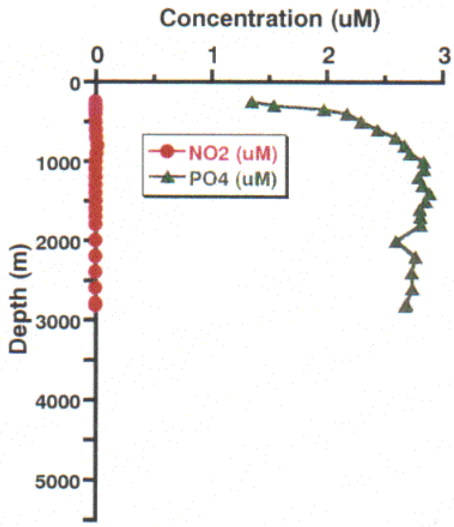
Vertical profile of NO3 and SiO2 conc. on St.6-SC1.



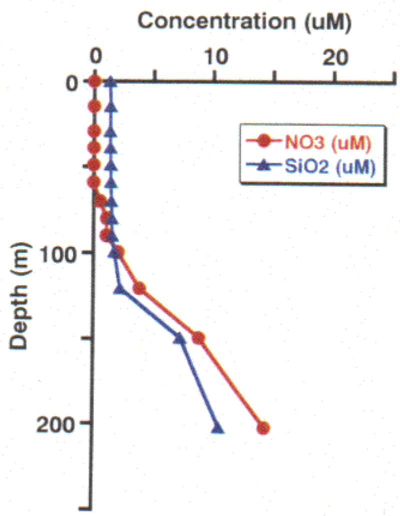
Vertical profile of NO2, PO4 and NH3 conc. on St.6-SC3.



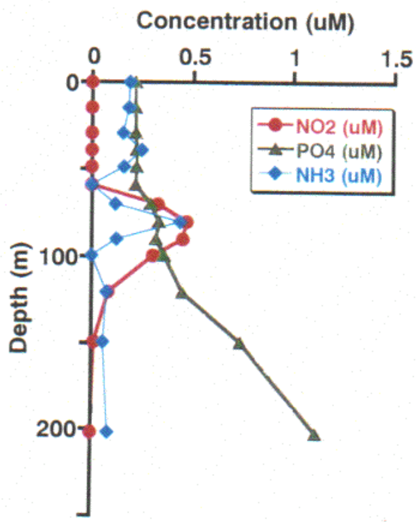
Vertical profile of NO3 and SiO2 conc. on St.6-DC.



Vertical profile of NO2 and PO4 conc. on St.6-DC.

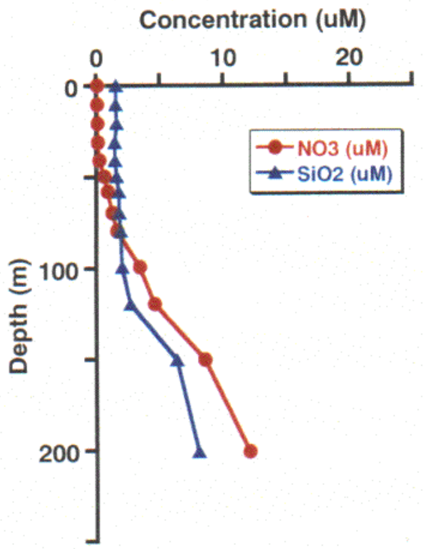


Vertical profile of NO3 and SiO2 conc. on St.6-SC3.

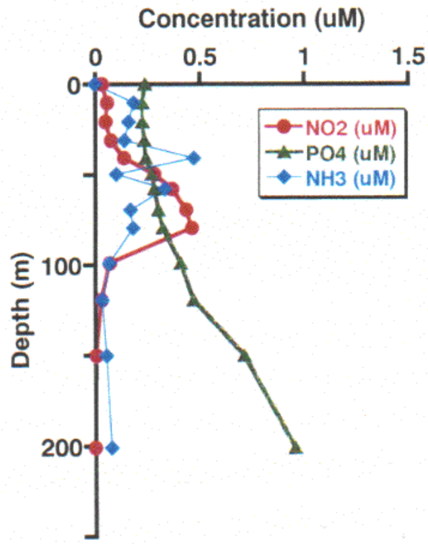


Vertical profile of NO2, PO4 and NH3 conc. on St.6-SC3.

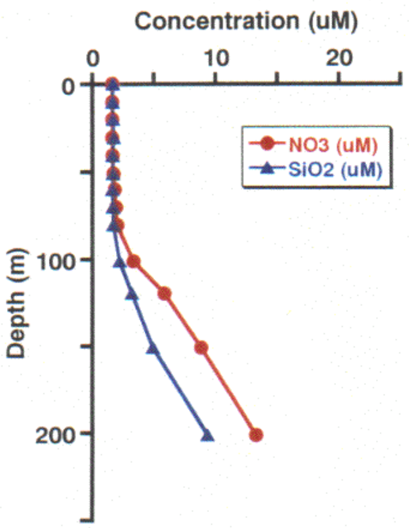
Fig.4 Continue.



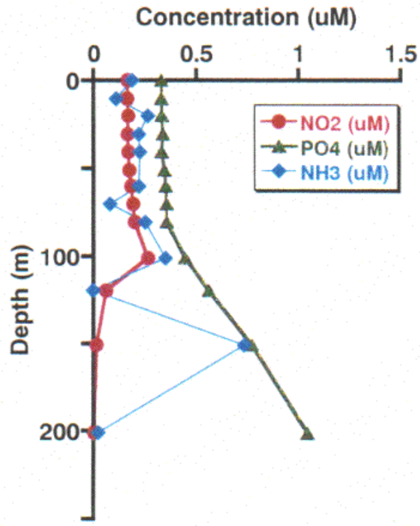
Vertical profile of NO3 and SiO2 conc. on St.7-SC5.



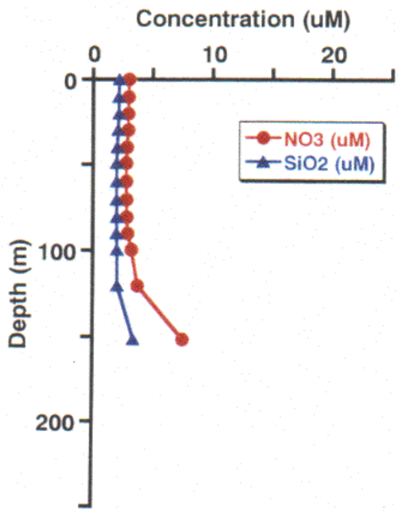
Vertical profile of NO2, PO4 and NH3 conc. on St.7-SC5.



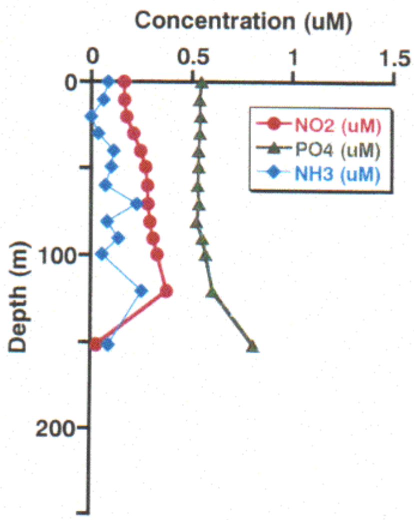
Vertical profile of NO3 and SiO2 conc. on St.8-SC5.



Vertical profile of NO2, PO4 and NH3 conc. on St.8-SC5.

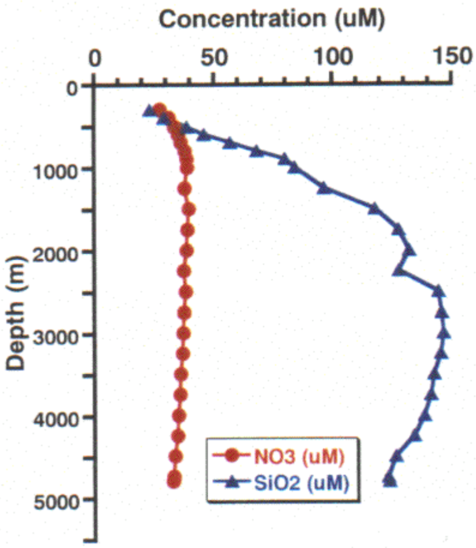


Vertical profile of NO3 and SiO2 conc. on St.9-SC1.

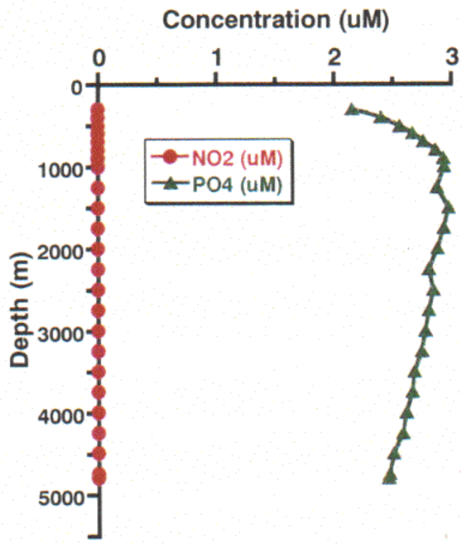


Vertical profile of NO2, PO4 and NH3 conc. on St.9-SC1.

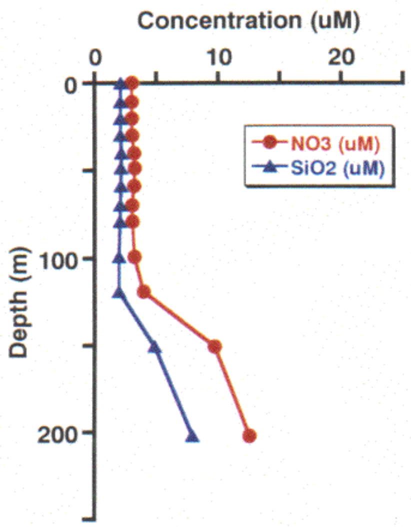
Fig.4 Continue.



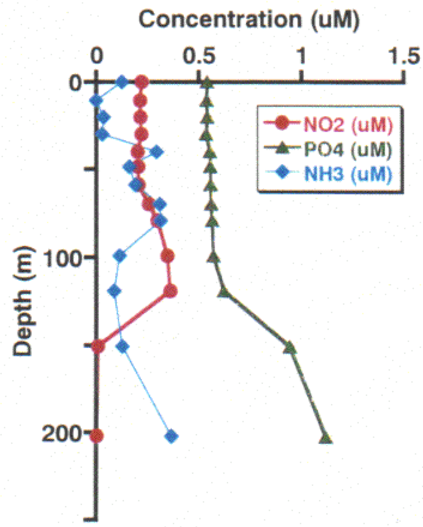
Vertical profile of NO3 and SiO2 conc. on St.9-DC.



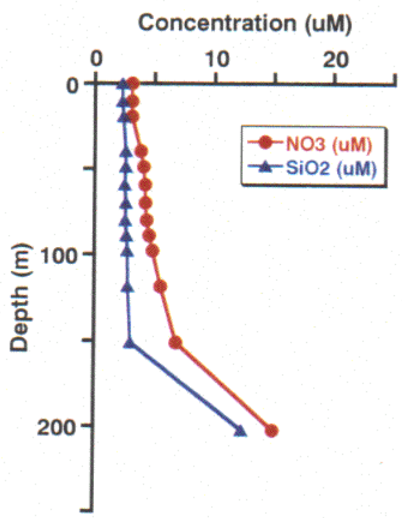
Vertical profile of NO2 and PO4 conc. on St.9-DC.



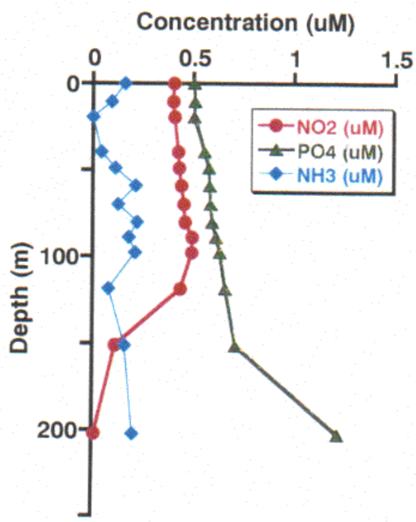
Vertical profile of NO3 and SiO2 conc. on St.9-SC3.



Vertical profile of NO2, PO4 and NH3 conc. on St.9-SC3.

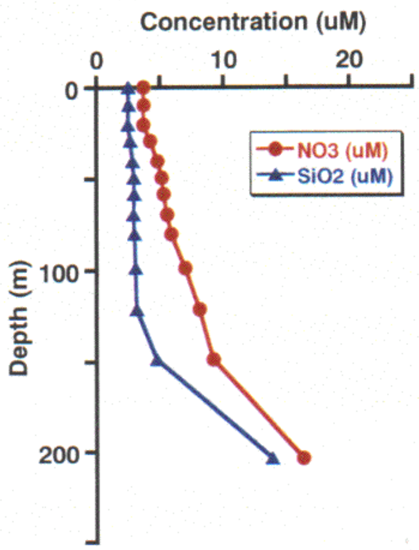


Vertical profile of NO3 and SiO2 conc. on St.10-SC5.

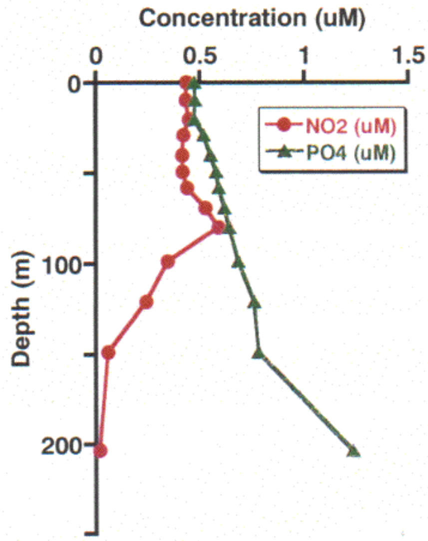


Vertical profile of NO2, PO4 and NH3 conc. on St.10-SC5.

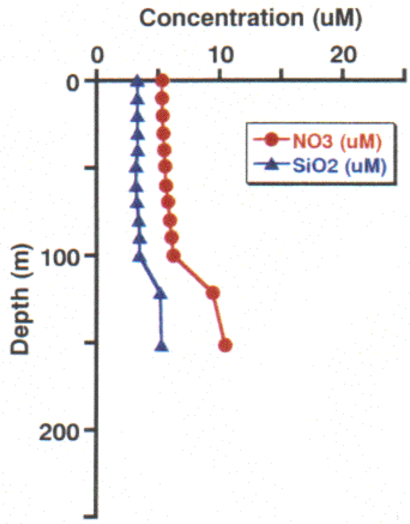
Fig.4 Continue.



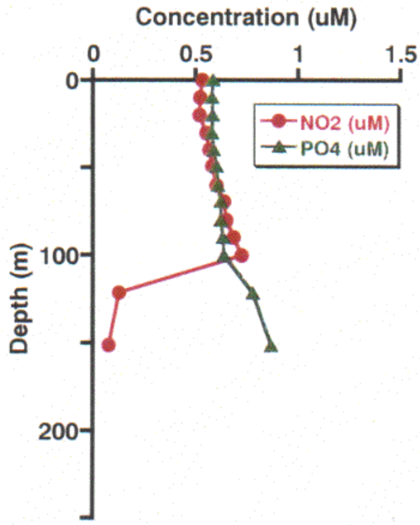
Vertical profile of NO3 and SiO2 conc. on St.11-SC5.



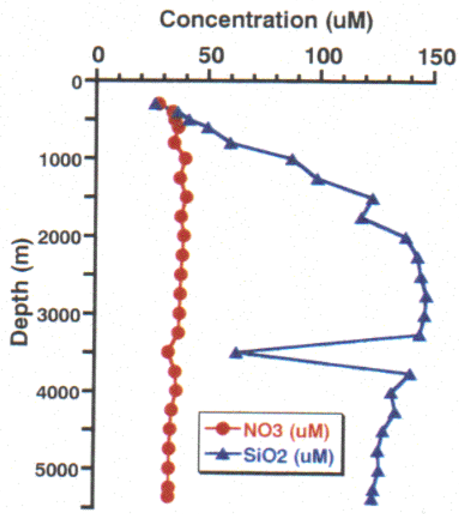
Vertical profile of NO2 and PO4 conc. on St.11-SC5.



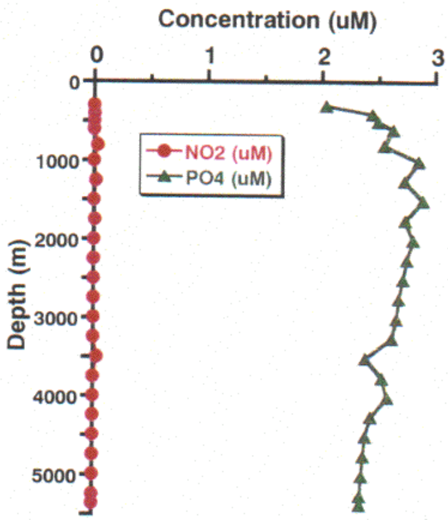
Vertical profile of NO3 and SiO2 conc. on St.12-SC1.



Vertical profile of NO2 and PO4 conc. on St.12-SC1.

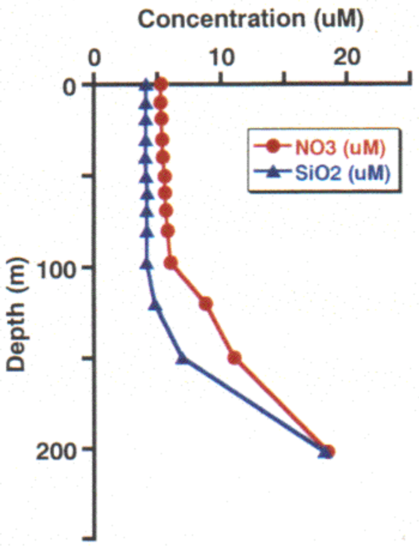


Vertical profile of NO3 and SiO2 conc. on St.12-DC.

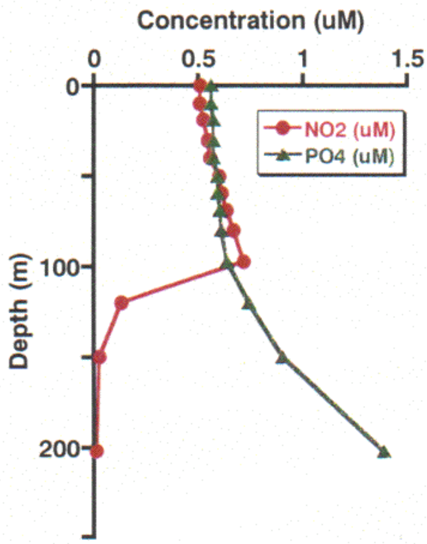


Vertical profile of NO2 and PO4 conc. on St.12-DC.

Fig.4 Continue.

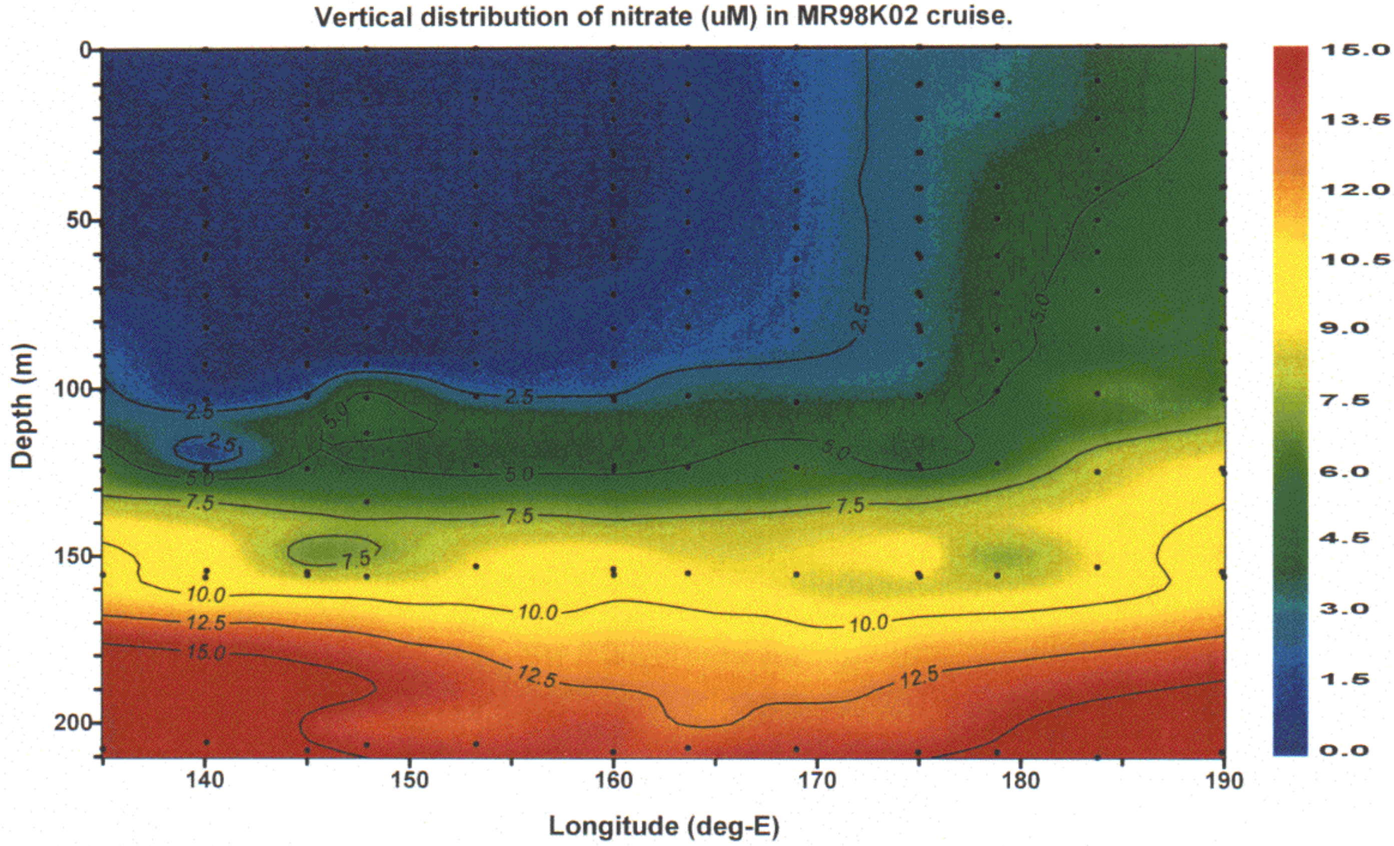


Vertical profile of NO3 and SiO2 conc. on St.12-SC3.



Vertical profile of NO2 and PO4 conc. on St.12-SC3.

Fig.4 Continue.



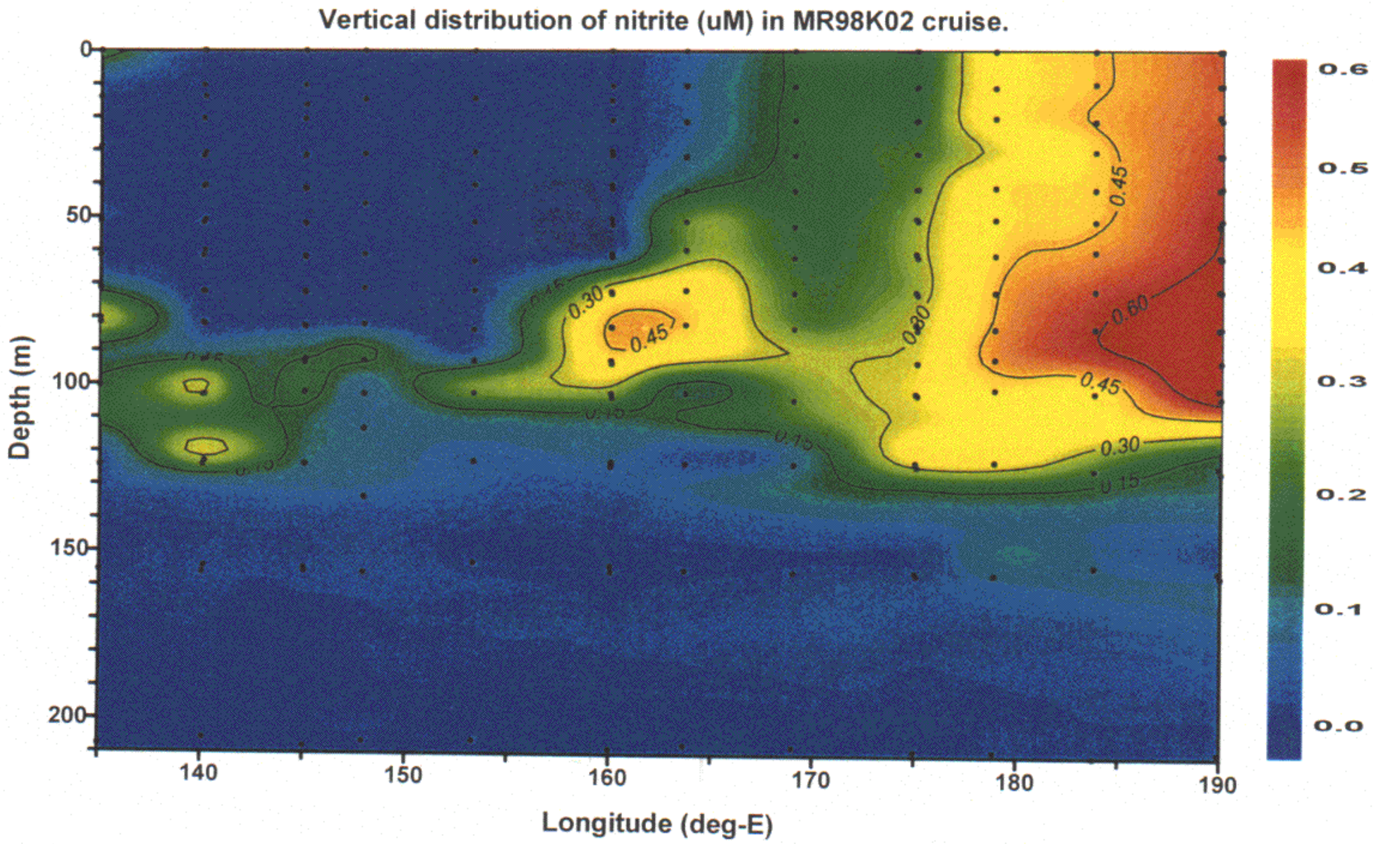
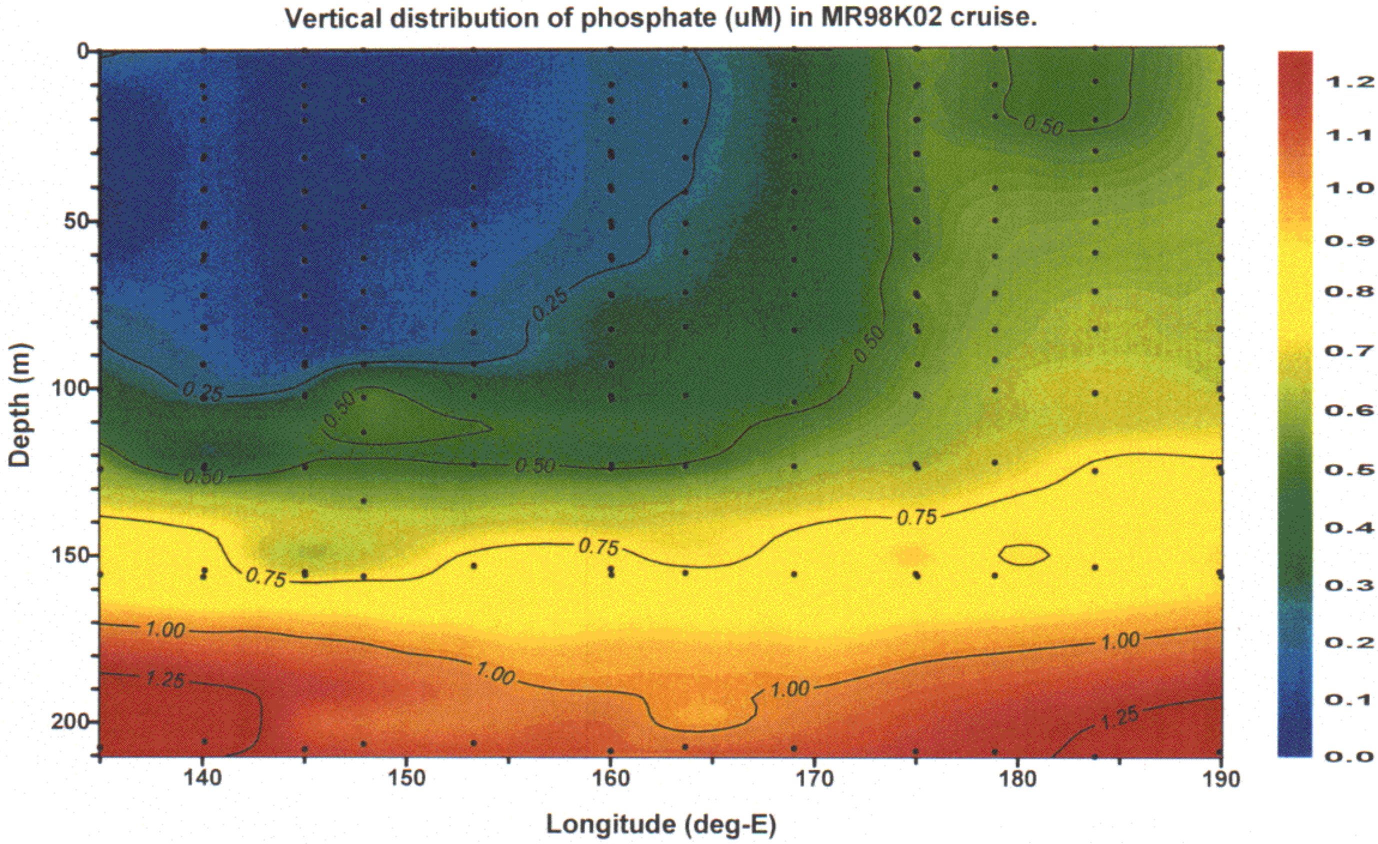


Fig.5 Vertical distribution of nutrients on equator in MR98K02.



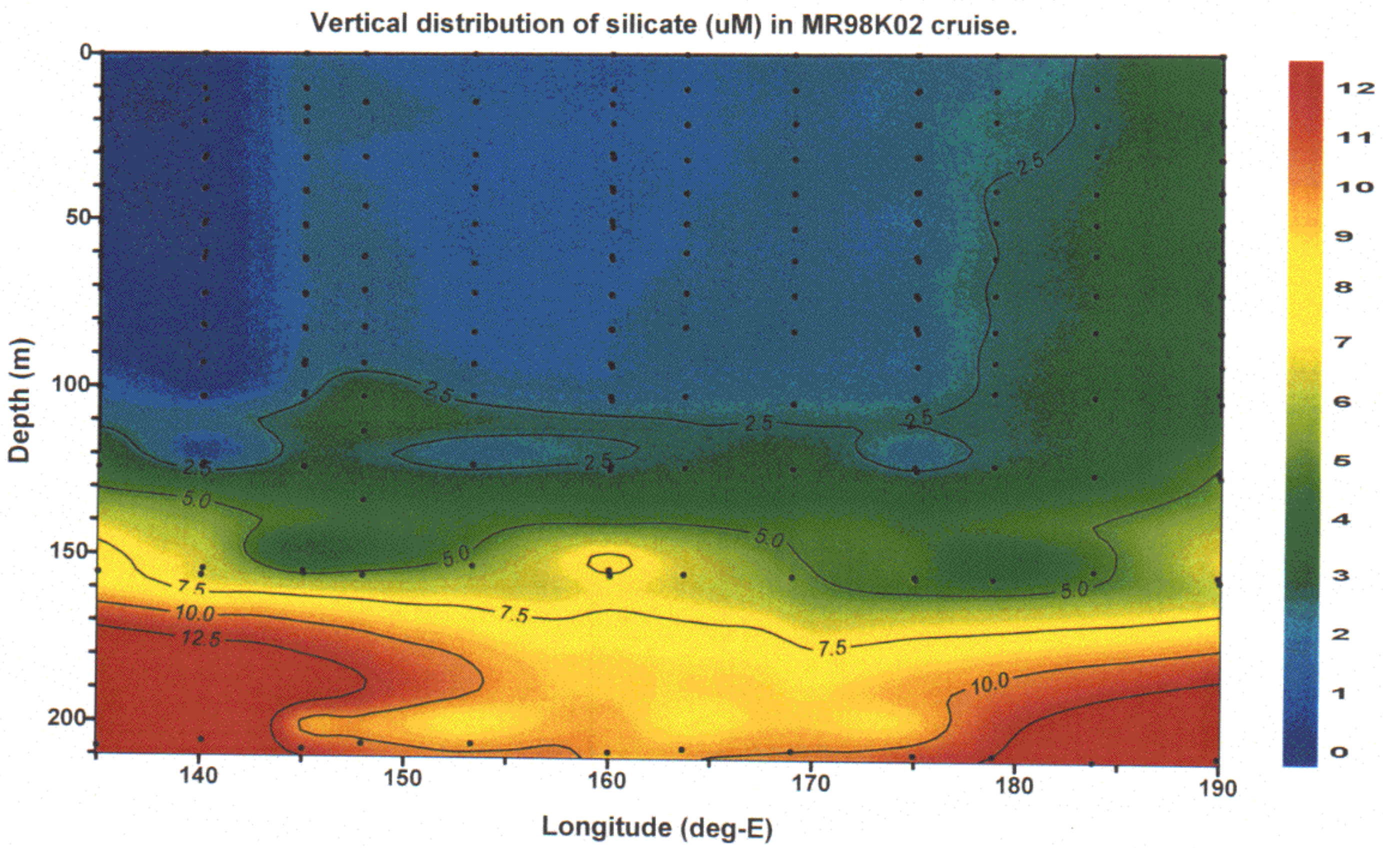


Fig.5 Continue.

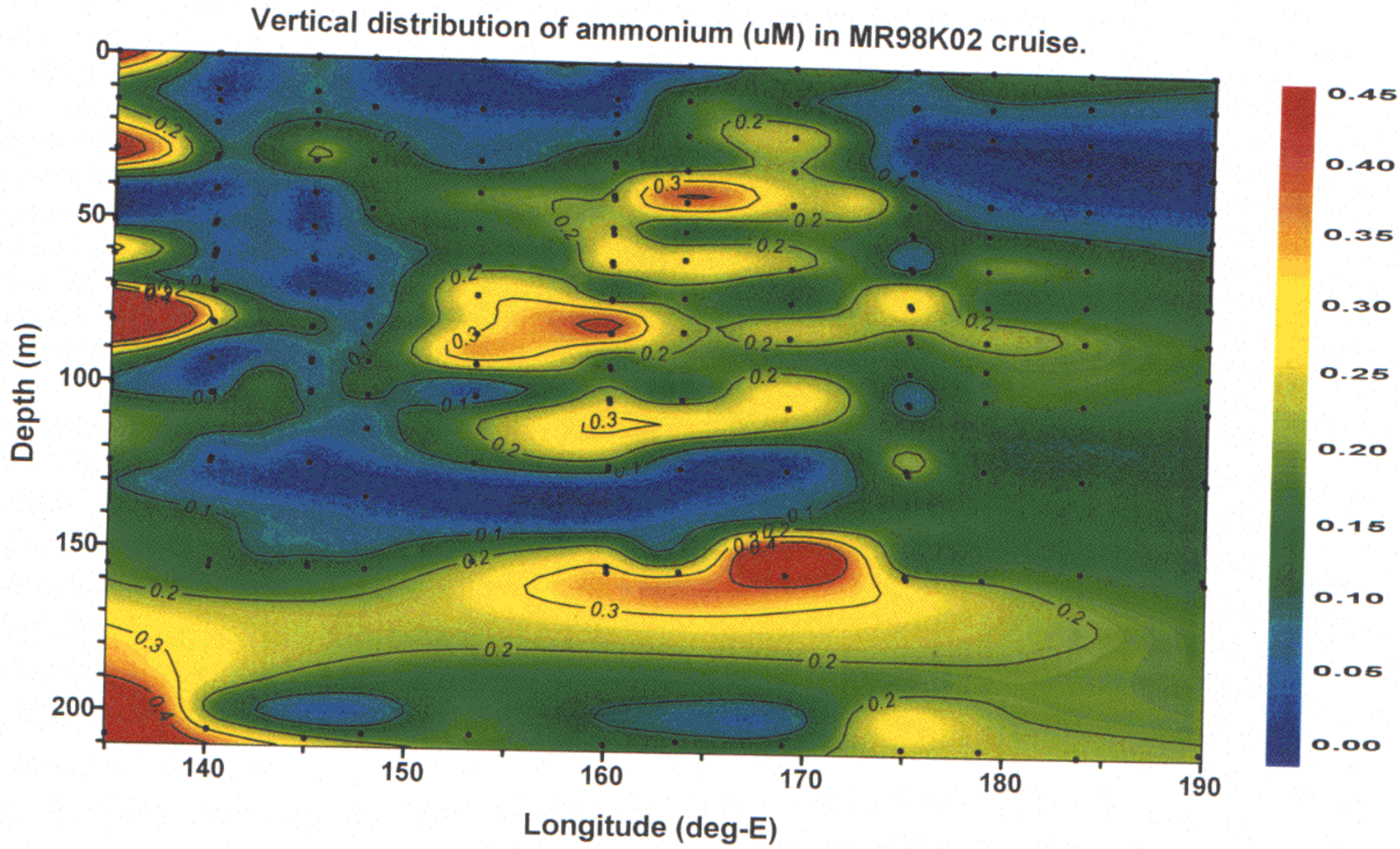


Fig.5 Continue.

3.4 Pigment Analysis

3.4.1 Pigment analysis of phytoplanktons in the equatorial Pacific Ocean by fluorescence spectroscopy (SHIMADZU and TURNER fluorophotometer)

Yasuhiro SUZUKI (MWJ, Kinki University), Takayoshi SEIKE (MWJ, Hiroshima University),Takayuki KUJI (MWJ, Tokai University), Takashi NISHIMURA (MWJ, Kinki University)and Kazu Matsumoto (JAMSTEC)

MWJ: Marine Works Japan Ltd.

Object

The first purpose of this study is to estimate the distributions of chlorophyll-a in the equatorial Pacific Ocean. Pigment analysis of phytoplankton is carried out with three analytical procedures by fluorometric determination (traditional acidification for two types of fluorometer and Welschmeyer non-acidification methods). The main object of the present work is to understand the characteristics of chlorophylls with three fluorometric methods and analytical ability for chlorophylls with three procedures by Shimadzu and Turner design fluorophotometer.

Method

Sampling area of this study was the equatorial Pacific Ocean. Seawater samples were collected at twelve sampling sites and the depth of surface to 200 meters (13 depths). The samples were collected with Niskin bottles, except for the surface water, which was taken by bucket. The samples (sample volume of 1 L for Shimadzu fluorophotometer and 0.5 L for Turner fluorophotometer) were filtered through Nucrepore filters (pore size: 0.4 µm; diameter: 47 mm) in the dark room. The chlorophylls on the filters were immediately extracted in N, N-dimethylformamide (6 ml) and then, the samples were stored at –30 ℃ until the analysis of chlorophylls.

Shimadzu RF-5300PC spectrofluorophotometer was used for the determination of chlorophyll-a. Fluorescence measurements were performed at room temperature (25±2 ℃) later than 1 hour after the samples were taken out of the freezer. Concentration of chlorophyll-a was measured by two analytical methods - without adding the acid and adding the 1 M hydrochloric acid. The determination of the acidification method was performed at 1.5 minutes later after adding the acid. Then, we attempted to measure the chlorophyll-b by fluorometric determination. Analytical conditions as follows; chlorophyll-a for excitation wavelength of 433 nm and emission wavelength of 668 nm; chlorophyll-b for excitation wavelength of 461 nm and emission wavelength of 654 nm.

Traditional acidification and Welschmeyer non-acidification methods were examined for the determinations of chlorophyll-a with Turner model 10-AU-005 fluorophotometer. Analytical conditions of two methods indicate in Table 1.

Table 1 Analytical conditions of Traditional acidification and Welschmeyer non-acidification methods for chlorophylls with Turner fluorophotometer.

	Traditional method	Welschmeyer method
Excitation filter /nm	5-60 (340-500)	436
Emission filter /nm	2-64 (>665)	680
Optical kit	10-037R	10-040R
Lamp	Daylight White F4T5D	Blue F4T5, B2/BP (F4T4, 5B2 equiv.)

Result

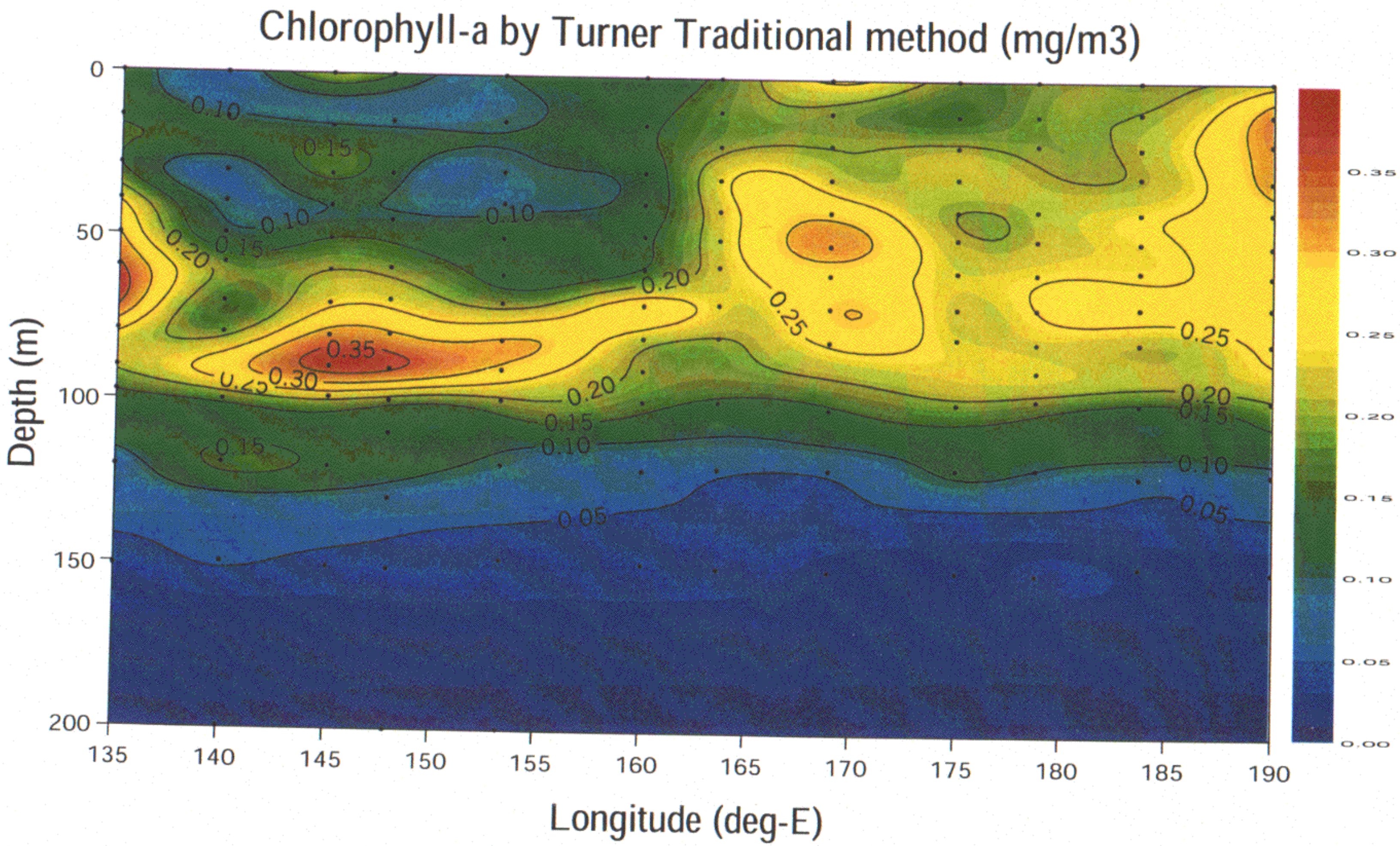
Vertical profiles of chlorophyll-a at the shallow cast (the water depth of surface to 200 meters) show Fig. 1, 2 and 3. Each study site (latitude and longitude) and number of the cast indicates in the figures. The figures indicate the measurement results in each water column by Shimadzu fluorophotometer and Turner fluorophotometer.

The vertical profiles of chlorophyll–a in the twelve sampling sites, which obtained by the determination of Shimadzu fluorophotometer, could be categorized in three types. The first type was a profile pattern in stations (Sts.) 1, 2, 4, 5, 6, 8 and 11. These vertical profiles were clearly shown a maximum of chlorophyll–a concentration in each water column. However, maximum of chlorophyll–a was varied from the water depth of 50 to 120 meters and from concentration of 0.3 to 0.5 mg·m^{-3}. Especially, it was observed at 100 to 120 meters in St. 2. The second type was observed in St. 3. These profiles were clearly different from ones of the first type. Concentration maxima were found at the surface and 80 meters in this water column. The levels of chlorophyll–a concentration were 0.3 mg·m^{-3} at the surface and 0.4 mg·m^{-3} at 80 meters, respectively. The last type, chlorophyll–a maximum was not clearly found in the profiles of Sts. 7, 9, 10 and 12. Although the concentration decreased as the depth deepened around 100 meters, the concentrations in the vertical profiles were not significantly varied from the water depth of surface to 100 meters. In the water depth range, the mean concentration of chlorophyll–a was approximately 0.3 mg·m^{-3}.

On the other hand, the results of the vertical profile patterns obtained by Turner fluorophotometer were good agreement with ones shown by Shimadzu fluorophotometer. However, concentrations of chlorophyll–a maximum were different with two fluorophotometers. In twelve sites, no significant change of the analytical values was observed between traditional acidification and Welschmeyer non-acidification methods by Turner fluorophotometer.

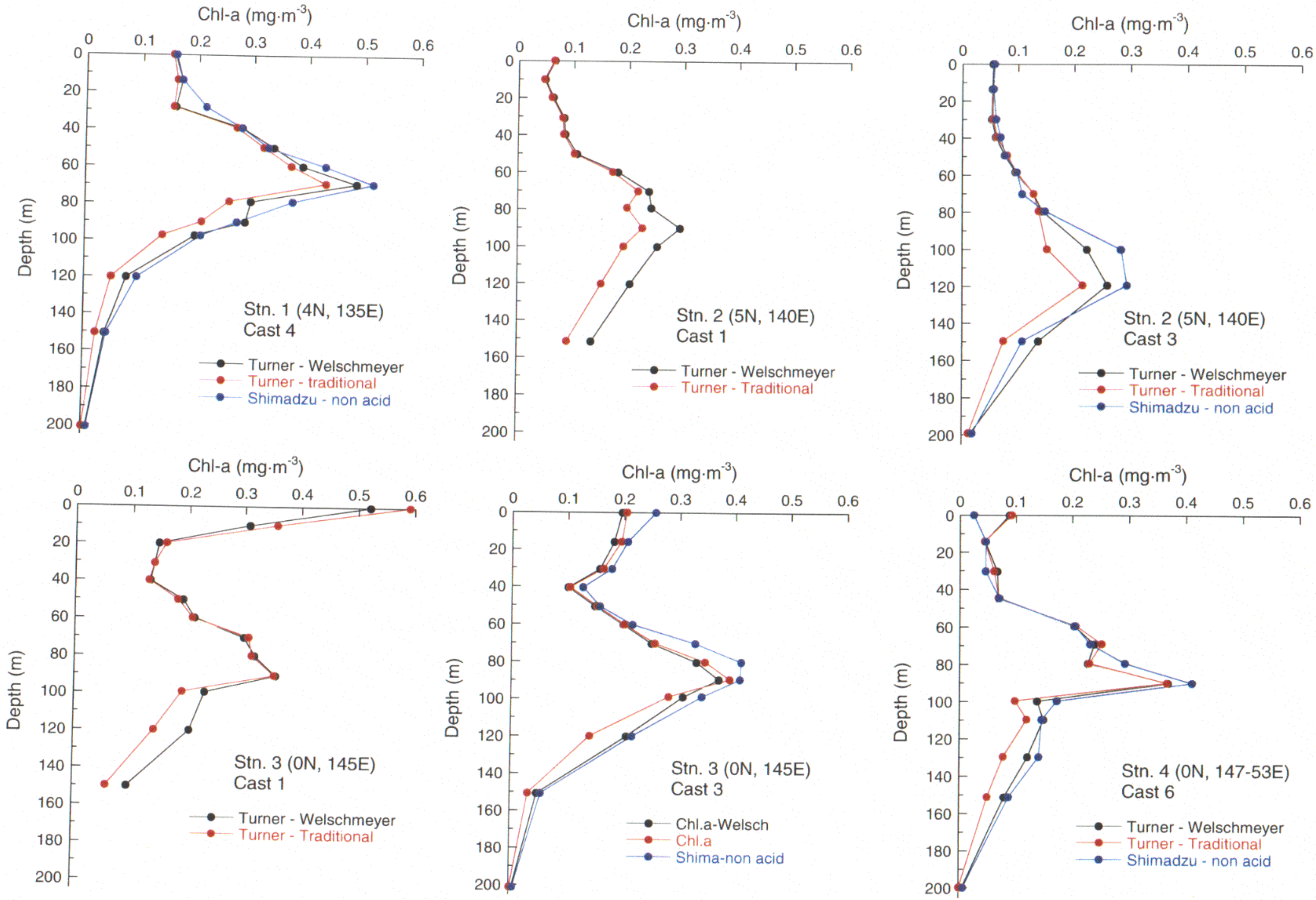
The sampling sites in Sts. 2, 3, 6, 9 and 12 had two casts in the same water column. There were duplicate profiles of chlorophyll–a by Turner fluorophotometer. There was not a significantly different variation between the duplicate profiles in the results with traditional acidification and Welschmeyer non-acidification methods. However, in the duplicate profiles, concentrations of chlorophyll –a were a little changed by two analytical methods.

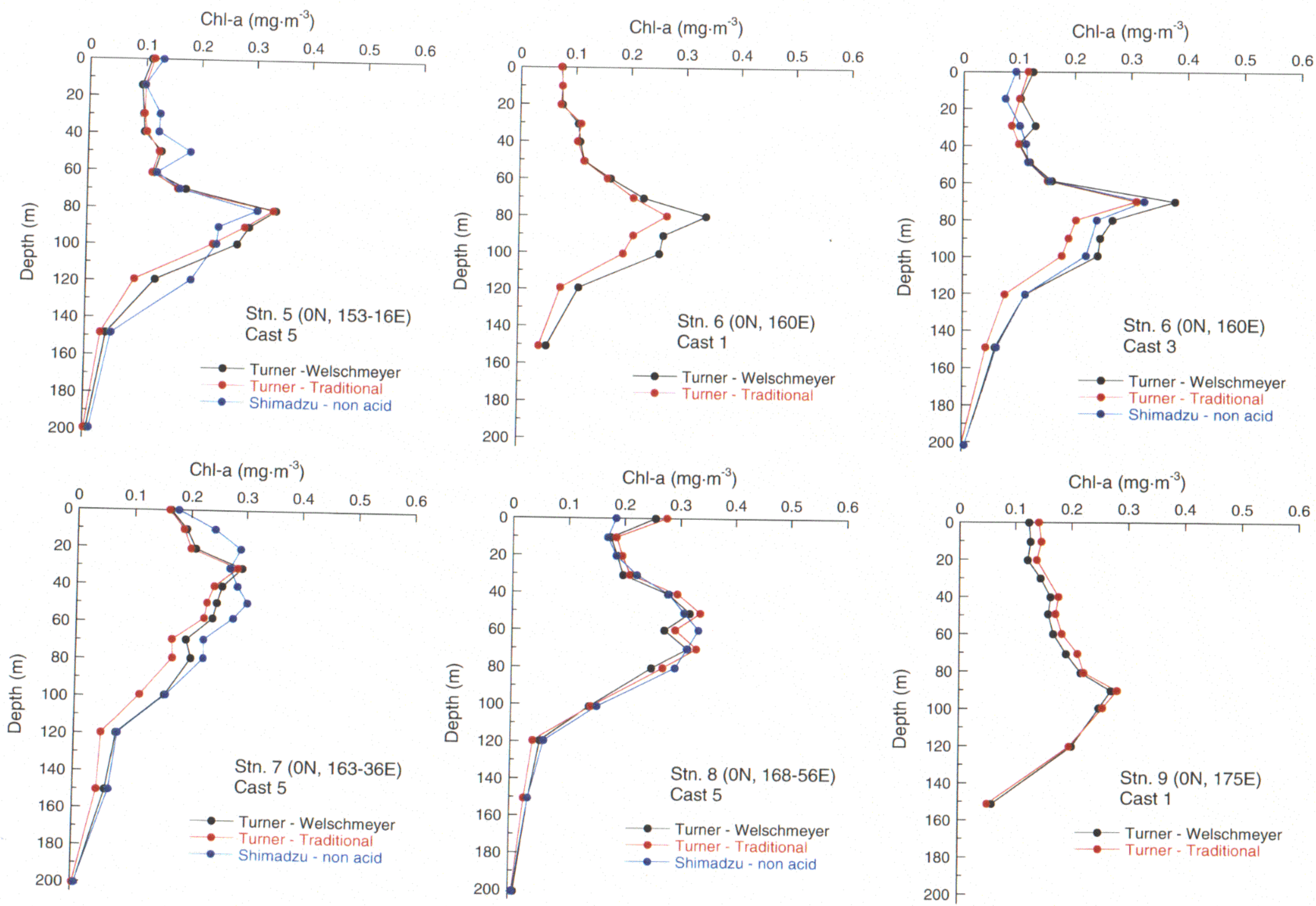
This report presented by Y. Suzuki for the results by the Shimadzu fluorophotometer and by T. Seike for the results by Turner fluorophotometer.



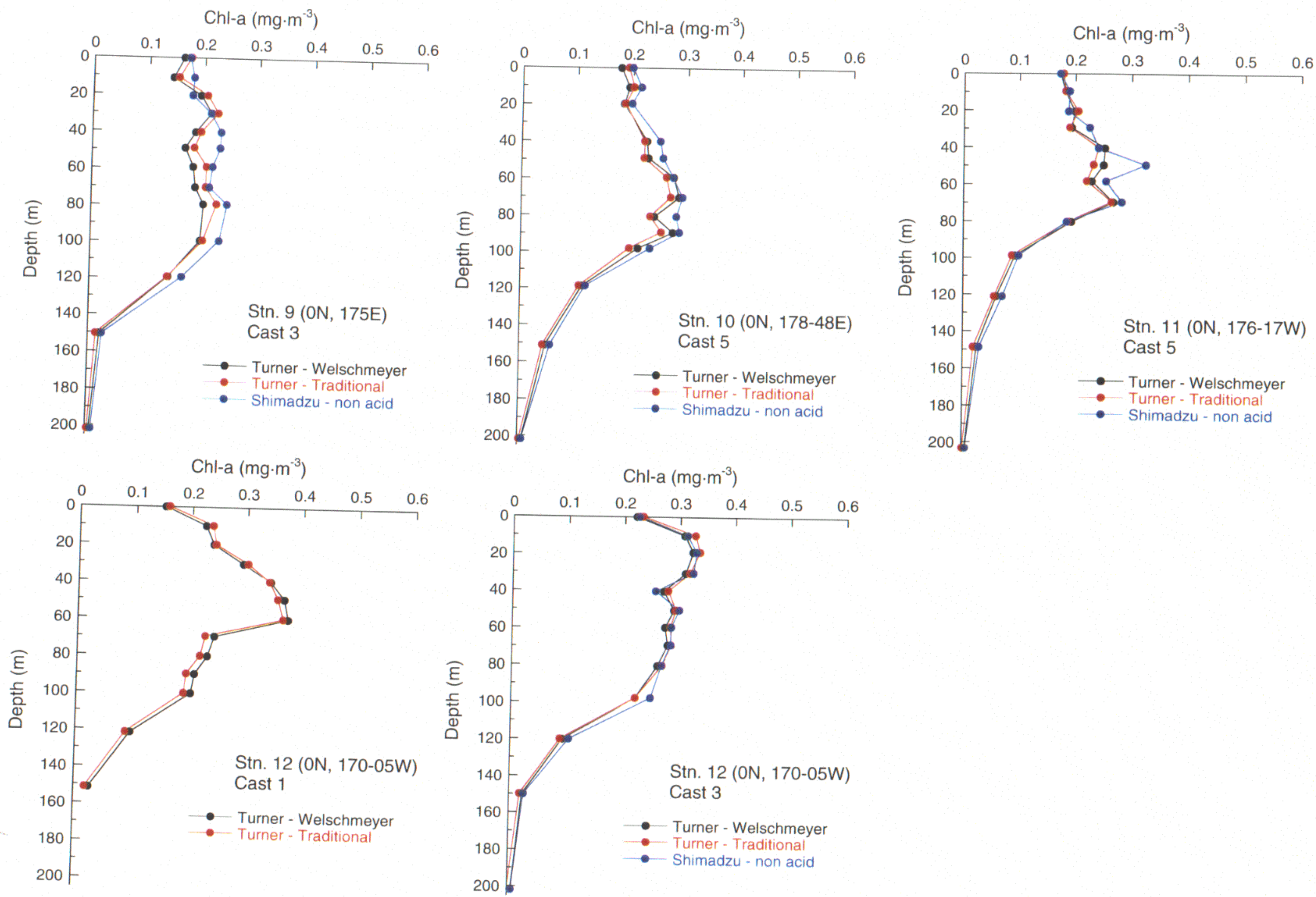
Chlorophyll-a by Turner Traditional method (mg/m3)
Depth (m)
Longitude (deg-E)
0
50
100
150
200
135
140
145
150
155
160
165
170
175
180
185
190
0.10
0.15
0.20
0.25
0.30
0.35
0.05
0.00

Figure 4


Chl-a (mg·m-3)
Depth (m)
Stn. 1 (4N, 135E)
Cast 4
Turner - Welschmeyer
Turner - traditional
Shimadzu - non acid
Chl-a (mg·m-3)
Depth (m)
Stn. 2 (5N, 140E)
Cast 1
Turner - Welschmeyer
Turner - Traditional
Chl-a (mg·m-3)
Depth (m)
Stn. 2 (5N, 140E)
Cast 3
Turner - Welschmeyer
Turner - Traditional
Shimadzu - non acid
Chl-a (mg·m-3)
Depth (m)
Stn. 3 (0N, 145E)
Cast 1
Turner - Welschmeyer
Turner - Traditional
Chl-a (mg·m-3)
Depth (m)
Stn. 3 (0N, 145E)
Cast 3
Chl.a-Welsch
Chl.a
Shima-non acid
Chl-a (mg·m-3)
Depth (m)
Stn. 4 (0N, 147-53E)
Cast 6
Turner - Welschmeyer
Turner - Traditional
Shimadzu - non acid



Chl-a (mg·m-3)
Depth (m)
Stn. 5 (0N, 153-16E)
Cast 5
Turner -Welschmeyer
Turner - Traditional
Shimadzu - non acid
Stn. 6 (0N, 160E)
Cast 1
Turner - Welschmeyer
Turner - Traditional
Stn. 6 (0N, 160E)
Cast 3
Turner - Welschmeyer
Turner - Traditional
Shimadzu - non acid
Stn. 7 (0N, 163-36E)
Cast 5
Turner - Welschmeyer
Turner - Traditional
Shimadzu - non acid
Stn. 8 (0N, 168-56E)
Cast 5
Turner - Welschmeyer
Turner - Traditional
Shimadzu - non acid
Stn. 9 (0N, 175E)
Cast 1
Turner - Welschmeyer
Turner - Traditional



Chl-a (mg·m-3)
Depth (m)
Stn. 9 (0N, 175E)
Cast 3
Turner - Welschmeyer
Turner - Traditional
Shimadzu - non acid
Chl-a (mg·m-3)
Depth (m)
Stn. 10 (0N, 178-48E)
Cast 5
Turner - Welschmeyer
Turner - Traditional
Shimadzu - non acid
Chl-a (mg·m-3)
Depth (m)
Stn. 11 (0N, 176-17W)
Cast 5
Turner - Welschmeyer
Turner - Traditional
Shimadzu - non acid
Chl-a (mg·m-3)
Depth (m)
Stn. 12 (0N, 170-05W)
Cast 1
Turner - Welschmeyer
Turner - Traditional
Chl-a (mg·m-3)
Depth (m)
Stn. 12 (0N, 170-05W)
Cast 3
Turner - Welschmeyer
Turner - Traditional
Shimadzu - non acid

3.4.2 The measurement of phytoplankton pigment by HPLC

Hiroaki SAKOH *1, and Kazuhiko MATSUMOTO *2
(*1: Marine Works Japan Ltd., *2: JAMSTEC)

Objectives

High-performance liquid chromatography (HPLC) analysis has been shown to be a conclusive method for separating and quantifying photosynthetic pigments in natural water. In this cruise, the photosynthetic pigment were analyzed, in order to compare the phytoplankton community structure.

Materials and Methods

Samples were filtered onto Whatman GF/F glass-fiber filters and the water in filters was removed by vacuum dry in refrigerator. Photosynthetic pigments were extracted from the sample at -20 ° C in N,N-Dimethylformamid over 24 hours in the dark. Ultra pure water were added to all samples and standards before injection. They were fractionated by reverse-phase gradient elution HPLC. The chromatographic separation was carried out following a method from that of Wright et al.(1991). The gradient consisted of three solvents.

Solvent A; 80:20 methanol: 0.5M ammonium acetate
Solvent B; 90:10 acetonitrile: water
Solvent C; ethyl acetate

HPLC system were consisted as follows.

Detector: Waters 996 Photodiode Array
Pump: Waters 600
Column: Polymeric C-18 (J'sphere ODS-H80) 150 x 4.6 mm I.D.
column temperature 40。C
Auto Sampler: Waters 717 plus

The HPLC system is calibrated with commercially pigment standards (chlorophylls a and b from Sigma Chem. Co., and chlorophyll c, diadinoxanthin, fucoxanthin, a, b-carotene, neoxanthin, peridinin, prasinoxanthin, alloxanthin, violaxanthin, zeaxanthin, lutein, aphanizophyll, canthaxanthin, echinenon, myxoxanthophyll, 19'-hexanoyloxyfucoxanthin, 19'-butanoyloxyfucoxanthin and diatoxanthin from VKI). Concentration of pigment standards were determined using spectrophotometer. Chlorophyll a, and chl b were quantitatively evaluated by drawing the calibration curve using the amount of the standards and their respective peak areas. Other pigments were quantitatively evaluated using the formula from JGOFS Protocols (1994). Chlorophyll a and b peak areas were measured by Photodiode Array Detector at each maximum wavelength. Others were Measured by Photodiode Array Detector at 460 nm.

Preliminary results

In this cruise we measured only 30 samples from St. 2 and 4. Fourteen kinds of pigment were identified during this cruise. They consisted of chlorophylls and carotenoids. The number of the pigment groups were as follows : 4 kinds of chlorophyll pigments, 10kinds of carotenoids. The abundant pigment included chl a, chl b, 19'-hexanoyloxyfucoxanthin, and zeaxanthin. It was different an ordinary year that b-carotene was not found at all stations.

Chlorophyll a maximum layer were observed at 60 m depth at St. 2 and that concentaration was 0.45 ug/L. Maximum concentrations of chl b were almost found at 90 m depth at St. 2 and that was 0.17 ug/L. .

Samples from St. 5, 6 had not yet been measured, these samples will be analyzed at JAMSTEC, Yokosuka.

3.4.3 SIZE FRACTION OF PHYTOPLANKTONS

Takashi NISHIMURA (MWJ, Kinki University), Takayuki KUJI (MWJ, Tokai University), Kazu MATSUMOTO (JAMSTEC)

MWJ: Marine Works Japan Ltd.

Object:

Phytoplanktons are existed various species and sizes in the ocean. This study is investigated the vertical distribution of phytoplanktons after the size filtration procedure in the equatorial Pacific Ocean.

Method:

Seawater samples were collected at twelve sampling sites between longitude 135E and 170W in the equatorial Pacific Ocean. The samples were collected from the depth of surface to 200m with Niskin bottles, while the surface water was taken by bucket. The samples (1 L) were vacuum-filtered (< 20 cmHg) through the 47mm-diameter 10.0 μm mesh filter and Nucrepore filters (pore size of 2.0 μm, 1.0 μm and 0.4 μm). The pigments of filters were immediately resuspended in 6 ml of N, N-dimethyl-formamide and pigments of phytoplanktons were extracted in the freezer (-30 ℃) for more than 24 hours before analysis. Chlorophyll-a was measured by the acidification (1 M-HCl) and non-acidification methods of a fluorometric determination using the spectrofluorophotometer (SHIMADZU RF-5300PC). Then, we attempted to measure the chlorophyll-b by fluorometric determination.

SHIMADZU RF-5300PC analytical conditions:

Chlorophyll-a ; Excitation wavelength : 433 nm / Emission wavelength : 668 nm

Chlorophyll-b ; Excitation wavelength : 461 nm / Emission wavelength : 654 nm

Preliminary result:

Figures show the vertical profiles of chlorophyll-a size fraction at the each station. Phytoplanktons were mainly existed from 60 to 120 m of water column at the each sampling sites and from concentration of 0.3 to 0.5 mg・m^{-3}. The chlorophyll-a concentration of the 0.4- 1.0 μm size fraction was highest of all fractions except for station 3. The chlorophyll-a concentration of the >10 μm size fraction was higher than the 0.4 - 1.0 μm size fraction in the surface water of longitude 140E to 150E.

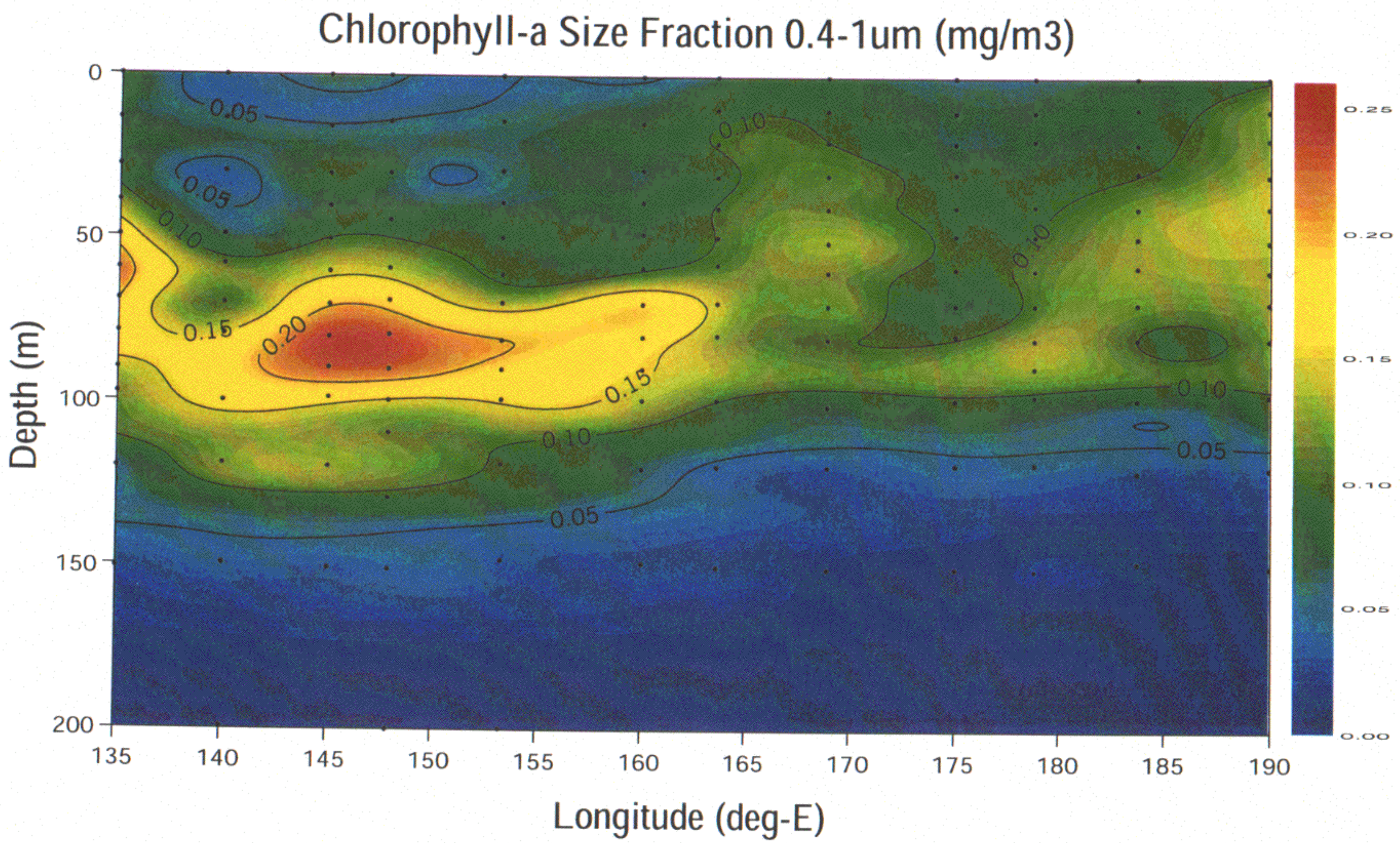
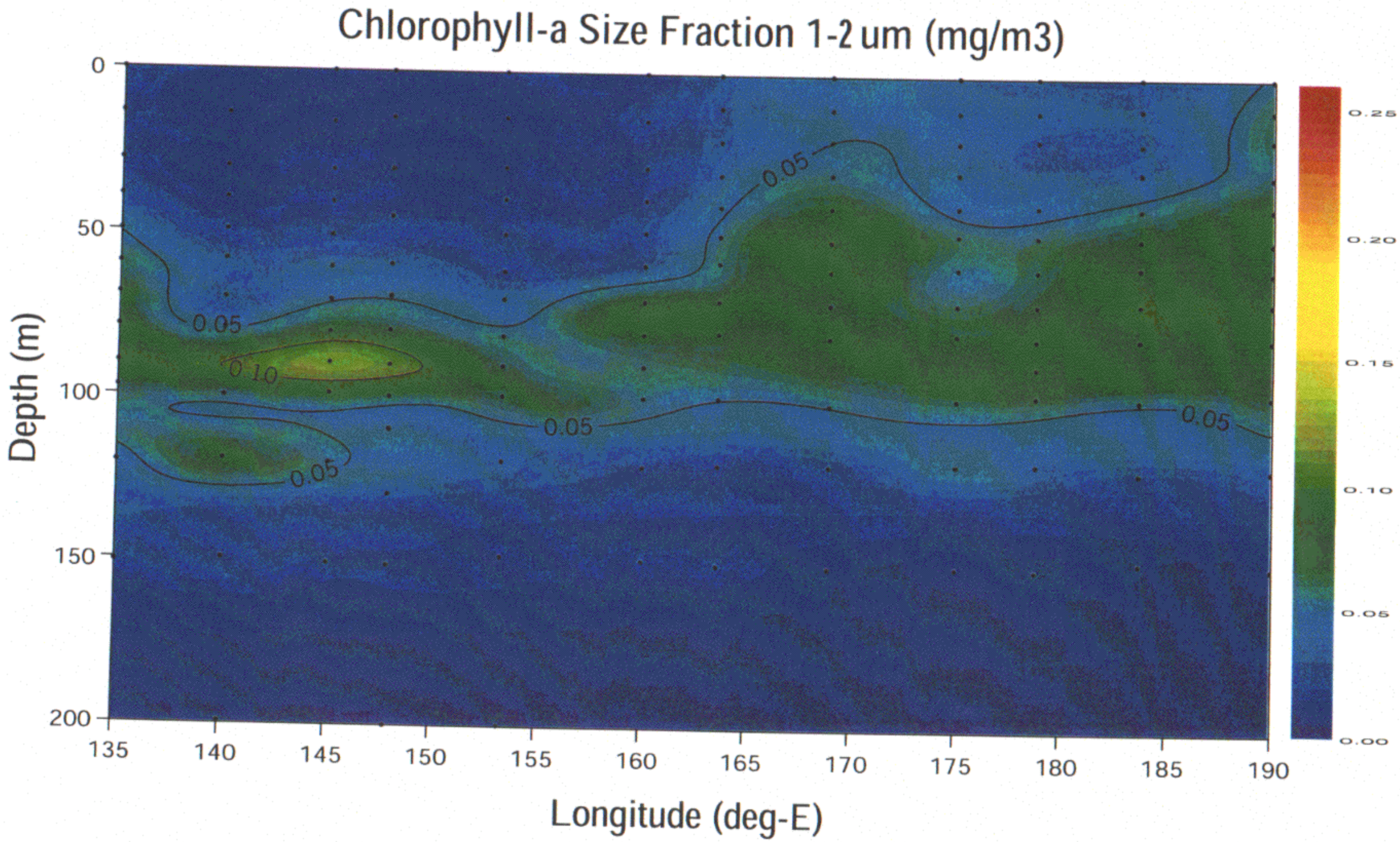
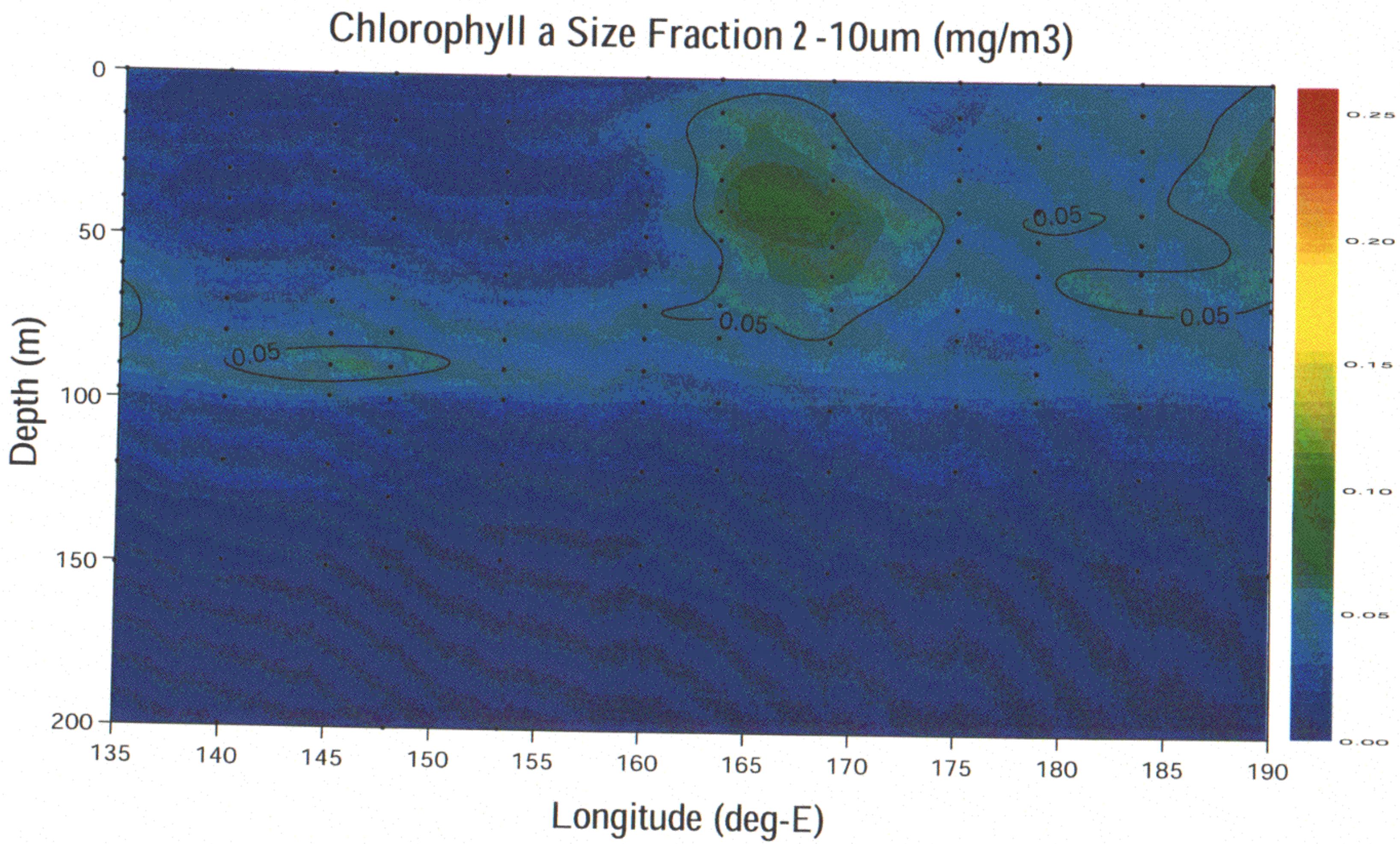

Chlorophyll-a Size Fraction 0.4-1um (mg/m3)
Depth (m)
Longitude (deg-E)
0
50
100
150
200
135
140
145
150
155
160
165
170
175
180
185
190
0.05
0.10
0.15
0.20
0.25
0.00

Figure 7



Chlorophyll-a Size Fraction 1-2 um (mg/m3)
Depth (m)
Longitude (deg-E)
0
50
100
150
200
135
140
145
150
155
160
165
170
175
180
185
190
0.05
0.10
0.00
0.15
0.20
0.25

Figure 6



Chlorophyll a Size Fraction 2 -10um (mg/m3)
Depth (m)
0
50
100
150
200
135
140
145
150
155
160
165
170
175
180
185
190
Longitude (deg-E)
0.05
0.05
0.05
0.05
0.25
0.20
0.15
0.10
0.05
0.00

Figure 5

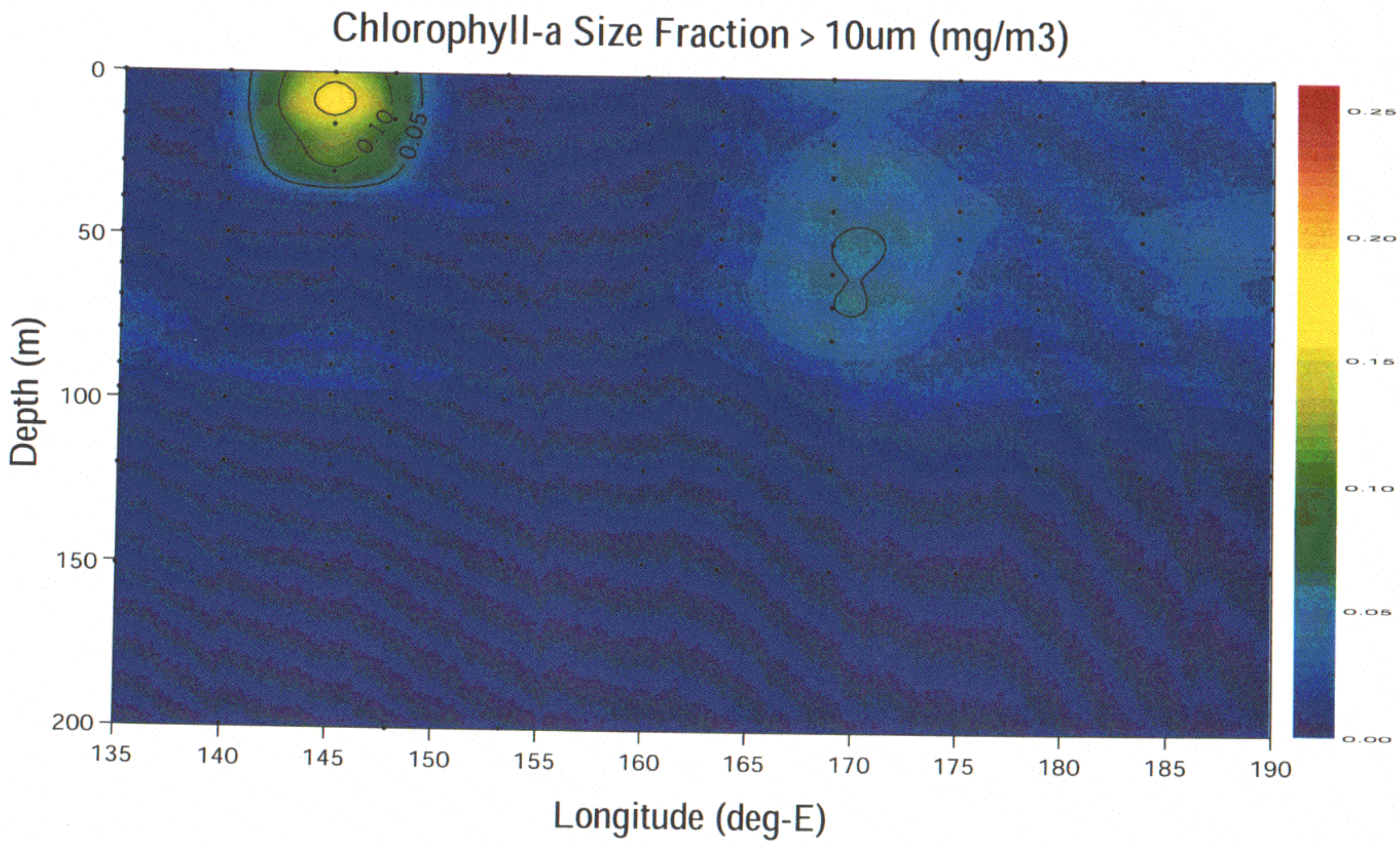
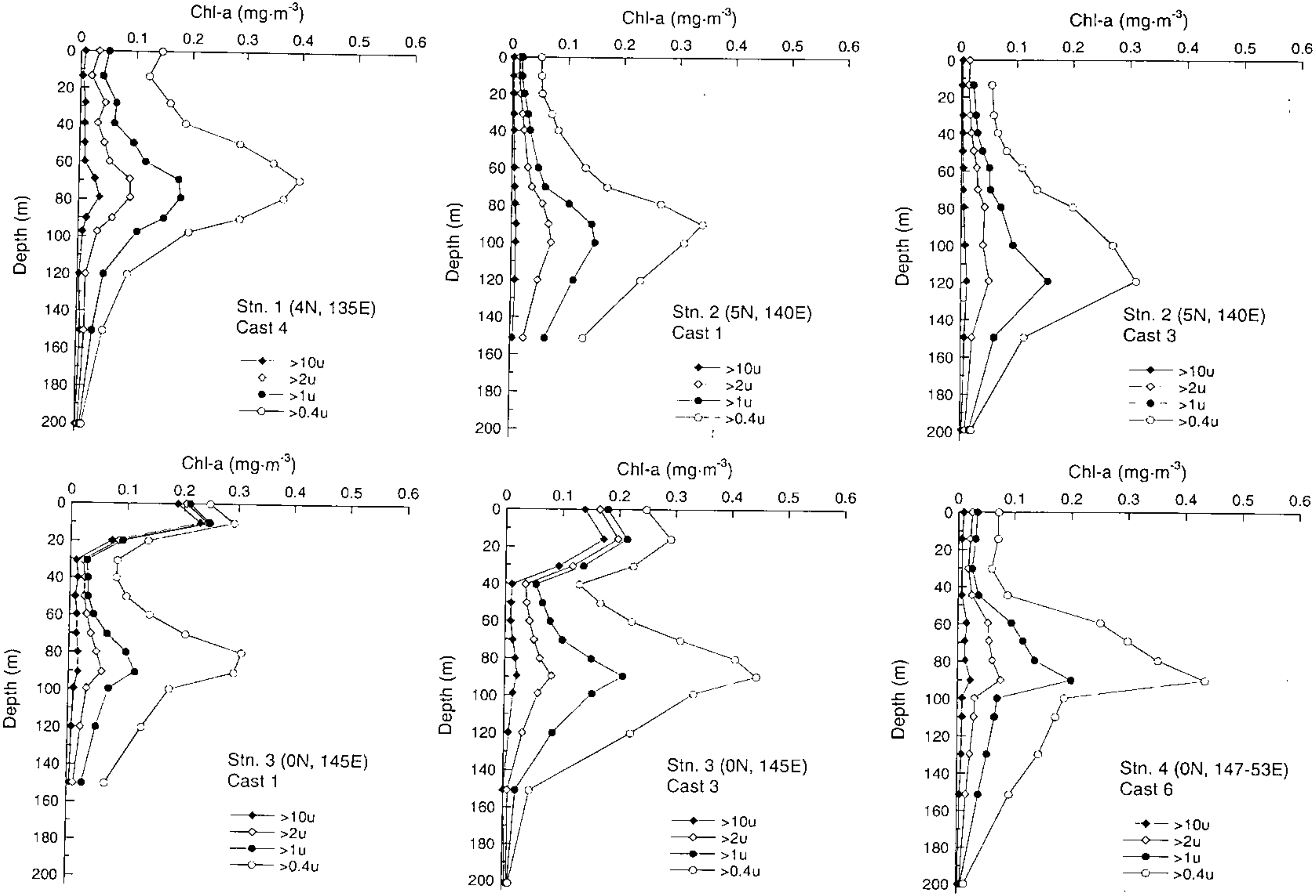
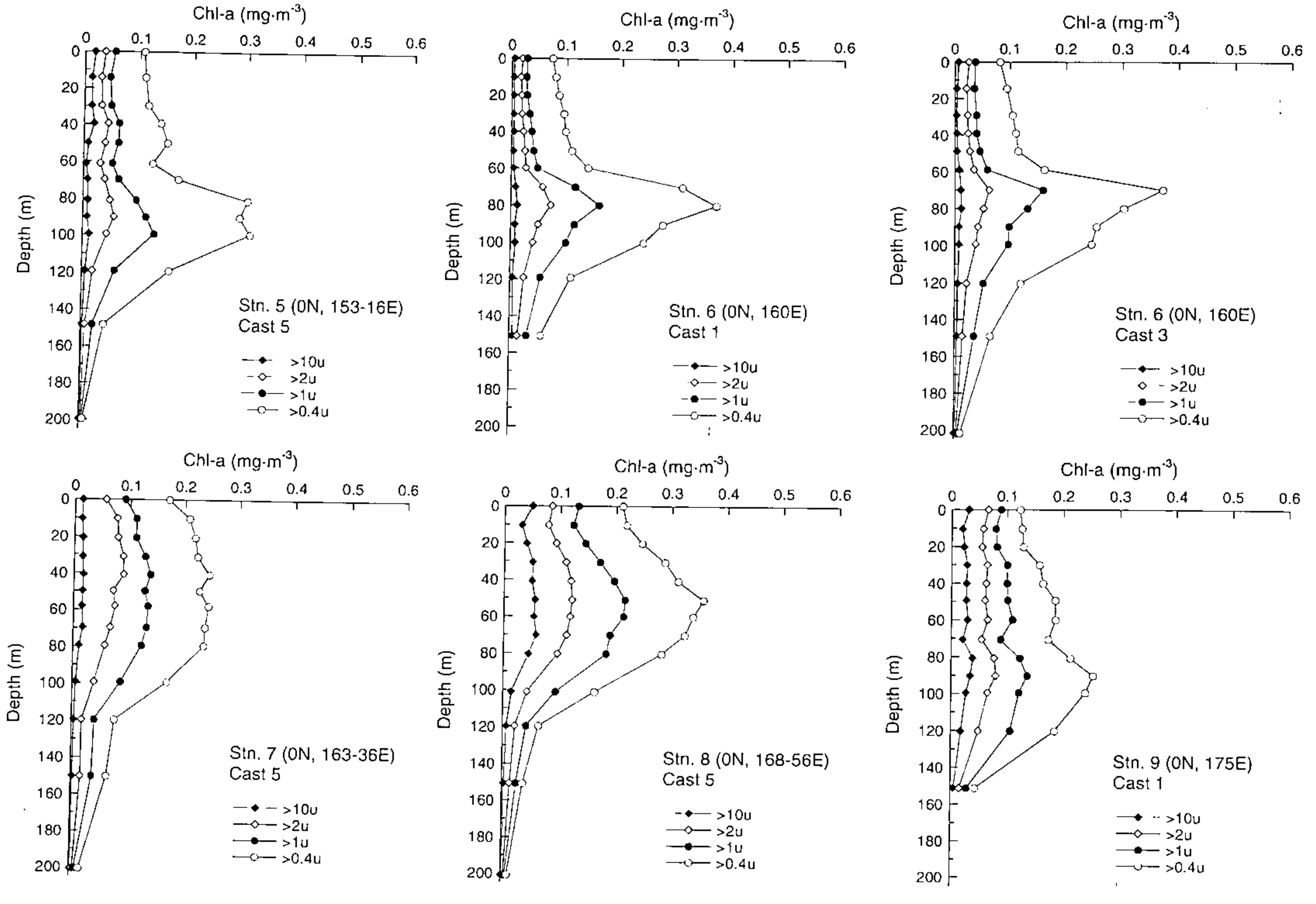

Chlorophyll-a Size Fraction > 10um (mg/m3)
0
50
100
150
200
Depth (m)
135
140
145
150
155
160
165
170
175
180
185
190
Longitude (deg-E)
0.10
0.05
0.25
0.20
0.15
0.10
0.05
0.00

Figure 4


Chl-a (mg·m-3)
0 0.1 0.2 0.3 0.4 0.5 0.6
Depth (m)
0 20 40 60 80 100 120 140 160 180 200
Stn. 1 (4N, 135E)
Cast 4
Stn. 2 (5N, 140E)
Cast 1
Stn. 2 (5N, 140E)
Cast 3
Stn. 3 (0N, 145E)
Cast 1
Stn. 3 (0N, 145E)
Cast 3
Stn. 4 (0N, 147-53E)
Cast 6
>10u
>2u
>1u
>0.4u


Chl-a (mg·m-3)
0
0.1
0.2
0.3
0.4
0.5
0.6
Depth (m)
0
20
40
60
80
100
120
140
160
180
200
Stn. 5 (0N, 153-16E)
Cast 5
Stn. 6 (0N, 160E)
Cast 1
Stn. 6 (0N, 160E)
Cast 3
Stn. 7 (0N, 163-36E)
Cast 5
Stn. 8 (0N, 168-56E)
Cast 5
Stn. 9 (0N, 175E)
Cast 1
>10u
>2u
>1u
>0.4u

igure 2

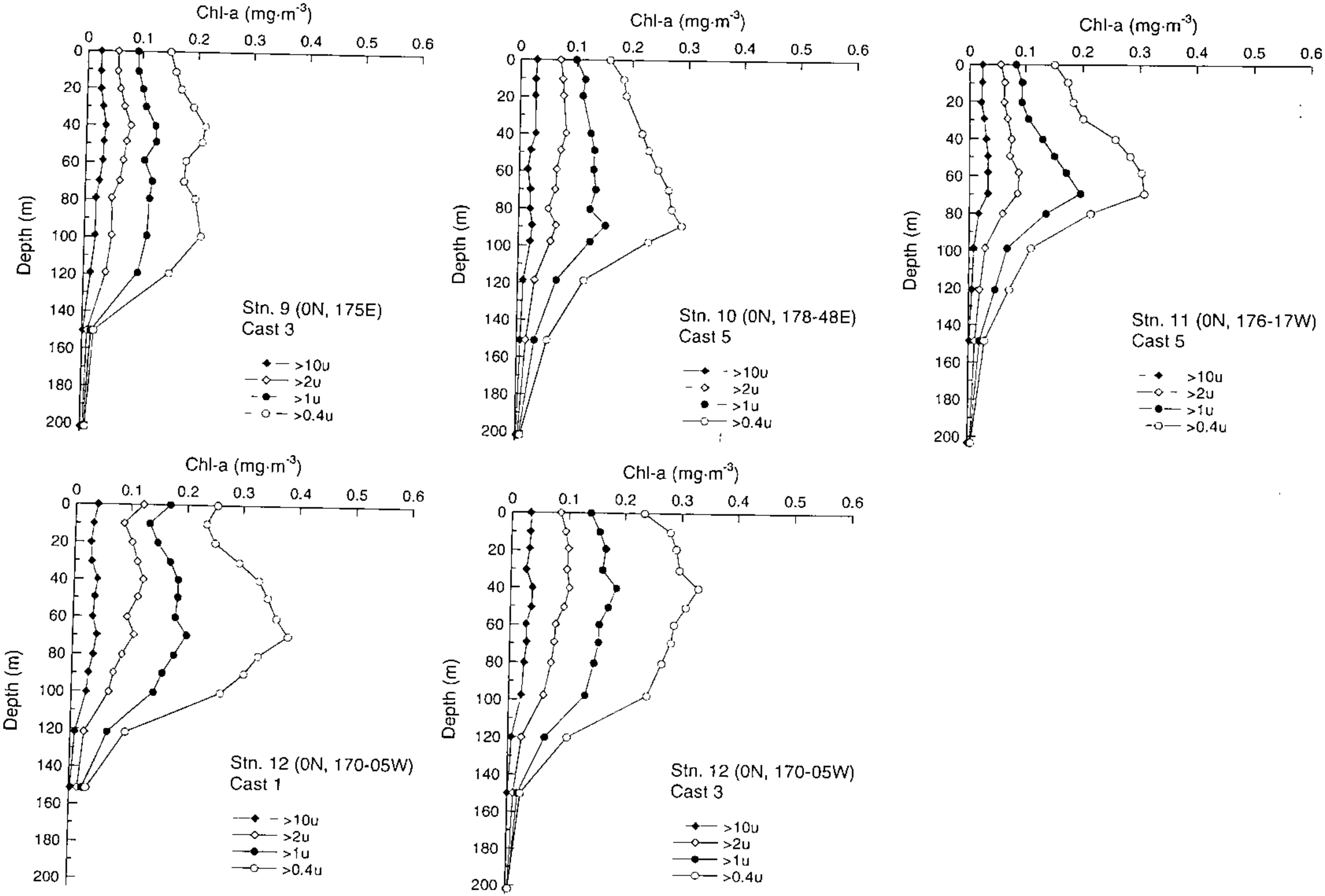

Chl-a (mg·m-3)
0 0.1 0.2 0.3 0.4 0.5 0.6
Depth (m)
0 20 40 60 80 100 120 140 160 180 200
Stn. 9 (0N, 175E)
Cast 3
Stn. 10 (0N, 178-48E)
Cast 5
Stn. 11 (0N, 176-17W)
Cast 5
Stn. 12 (0N, 170-05W)
Cast 1
Stn. 12 (0N, 170-05W)
Cast 3
>10u
>2u
>1u
>0.4u

Figure 2

3.4.4 Characterization of light absorption coefficients of phytoplanktons in the equatorial Pacific Ocean

Taeko OHAMA (MWJ, Tokyo University of Fisheries)
Kazu MATSUMOTO (JAMSTEC)

MWJ: Marine Works Japan Ltd.

Objectives:

The light absorption coefficients of phytoplanktons are important factor to control the optical property in the sea. The light absorption coefficients of phytoplanktons are also important to determine the amount of radiant energy usable photosynthesis. The purpose of this study is to understand characteristics of the light absorption coefficients of phytoplanktons in the equatorial Pacific Ocean.

Methods*:*

Seawater samples in stations 2-12 were collected at ten water depths from surface to 200 meters with Niskin bottles and bucket, except for St.1 from six water depths. The samples (approximately five liters) were filtered through Whatman GF/F glass fiber filters (pore size: 0.7 μm, diameter: 25mm) at small negative pressure of <20cmHg in the dark room. The sample filters were stored in a freezer (-30℃) .

A spectrophotometer (shimadzu MPS2400-PC) was used for the determination of optical density of particles retained on the filter (Od_{fp}). The measurements were carried out after the frozen samples kept at room temperature 1 hour or more. After that the filter samples were breached with NaClO solution (1% active Cl) for four minutes (Tassan and Ferrari, 1995), then the optical density of the decolorized particles (OD_{fd}) were measured again. The optical density of particles retained on the filter ($OD_{fp/fd}$) needs to convert to the aqueous suspensions value ($OD_{sp/sd}$). In this study, we applied the correlation of Cleveland and Weidemann (1993).

$$OD_{sp/sd}(\lambda)=0.378OD_{fp/fd}(\lambda)+0.523OD_{fp/fd}(\lambda)^2$$

The absorption coefficient of particles (a_p) and decolorized particulate matters (a_d) are calculated as following equation:

$$a_{p/d}(\lambda)=2.3\times OD_{sp/sd}(\lambda)/L;(L=V/S)$$

Where, S is the clearance area of the filter (m^2) and V is the volume of filtered water (m^3).

The subtraction of a_d from a_p shows the light absorption coefficient of the living phytoplankton (a_{ph}).

$$a_{ph}=a_p-a_d$$

3.4.5 Phytoplankton Analysis Using Flow Cytometry

Hidekazu Ota 1) Kazuhiko Matsumoto 2)

1) Kansai Environmental Engineering Center CO., LTD. (KANSO)
Environmental Chemistry Department Ocean Environmental Survey Team
2) Japan Marine Science and Technology Center (JAMSTEC)

Object

Phytoplankton, as autofluorescent particles suspended in a fluid medium, are well suited for analysis by flow cytometry. This technique can be used to rapidly count, measure, and individual cells. We have on board flow cytometer for the first time on "MIRAI" . We tried find of analysis techniques for fresh seawater at the equatorial region. Another attempt is phytoplankton analysis by flow cytometry.

Equipment

Flow cytometer : BRYTE HS system Bio-Rad Laboratories Inc.
System specification
Light source: 75W Xenon arc or 75W Xenon/Mercury arc
Excitation wavelength: 350-650nm
selectable by changing filter block
Scatter sensitivity: approx.0.2µm,Resolution: 0.02µm
Fluorescence detection:2-colour wavelength selectable by changing filter block
Detector:high-perfomance PMT
Analysed volume: Max 75µl
Flow rate: 0.5-50µl/min
Calibration beads:1.5µm 2000count/µl Bio-Rad Laboratories Inc.
Filter: filter holder with 10µm net filter.

Method

Filtered fresh seawater sample is able to directly measure by flow cytometer. We collect list mode files of signals for all parameters. (Forward angle light scatter (LS1), Large angle light scatter (LS2), Fluorescence 1(FL1), Fluorescence 2(FL2).)
We determine characteristic Phytoplankton using contour mode.

Parameter of analysis

We found parameter of analysis as follows.

Setting optical system.

B2	Excitation Filter	390-490nm
	Beam-splitter	510nm
	Emission Filter	515-720nm
OR1	Emission Filter 1	565-605nm
	Beam-splitter	600nm
	Emission Filter 2	>615nm

Setting detector system.

Parameter	PMT	Gain	Threshold
LS1	300	LOG	31
LS2	340	LOG	27
FL1	410	LOG	31
FL2	395	LOG	24

Setting fluid system.

Flow rate: 15µl/min

Operation

Warm up flow cytometer.Checking the Nozzle and normal sample flow.

Measurement sequence,

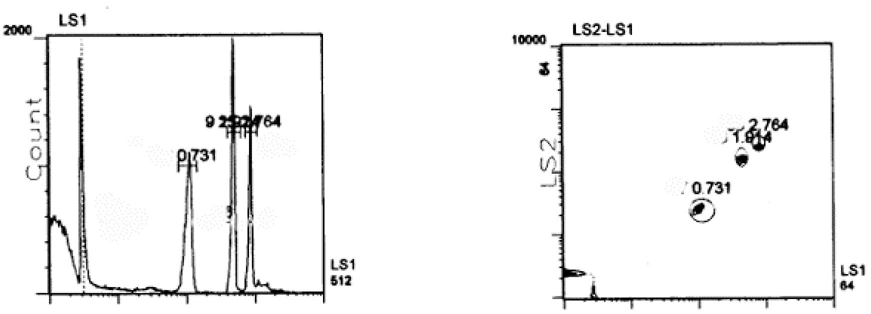
1) standard beads (3size Mixed),
2) Calibration beads: 1.5µm 10 count/µl,
3) Seawater sample,
4) Calibration beads: 1.5µm 10 count/µl,
5) standard beads (3size Mixed),
6) wash solution and pure water.

Sometime check the stability of flow cytometer, measured calibration beads.

Result.

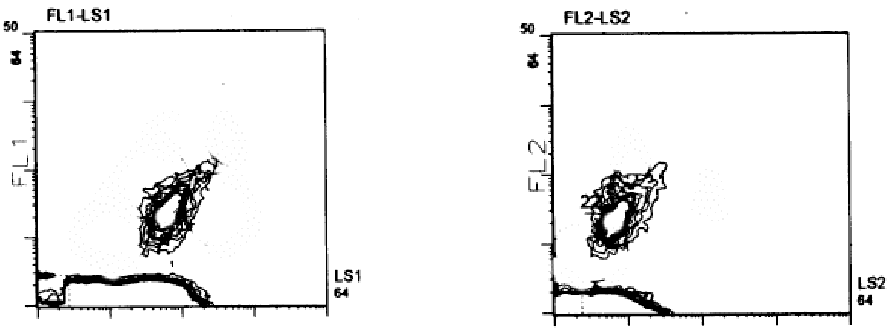
1) **Standard Beads**

Mixed solution of three different size standard beads measured separately each beads size. (Bead size: 0.731,1.914,2.764μm)

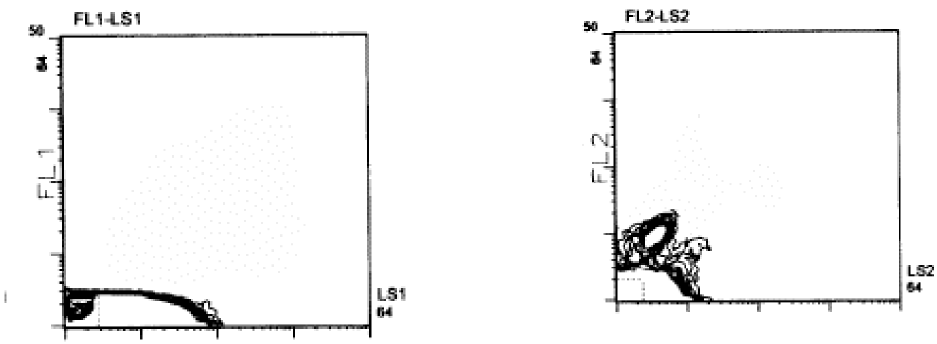


2) **Culture of Phytoplankton**

Synechococcus spp. (DC2) and Prochlorococcus marinas. These were presented from Tokyo university. We thank Miss E.Htakeyama.



Synechococcus spp. (DC2) FL1-LS1 and FL2-LS2



Prochlorococcus marinas. FL1-LS1 and FL2-LS2

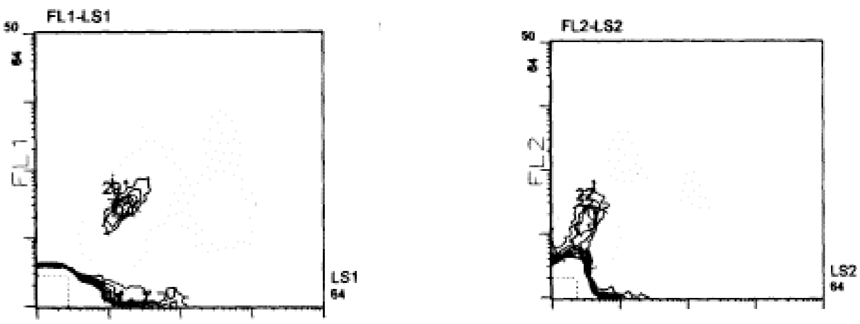
3) **Seawater sample**

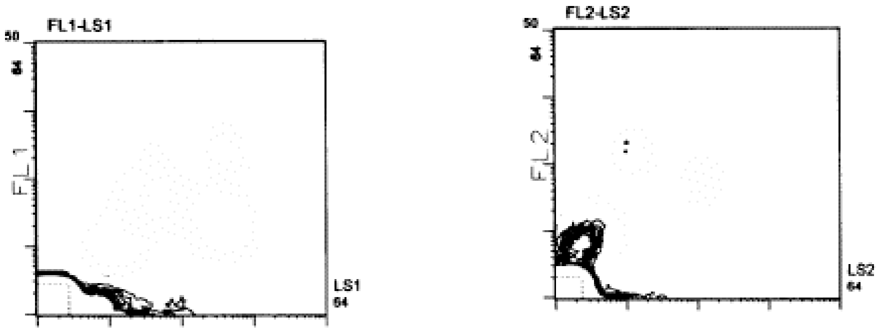
Filtered fresh seawater sample appeared contour as groups of Phytoplankton.

Near chlorophyll maximum layer.

This analysis techniques identify Synechococcus group and Prochlorococcus group .

Synechococcus group St3 C3 B7 80m

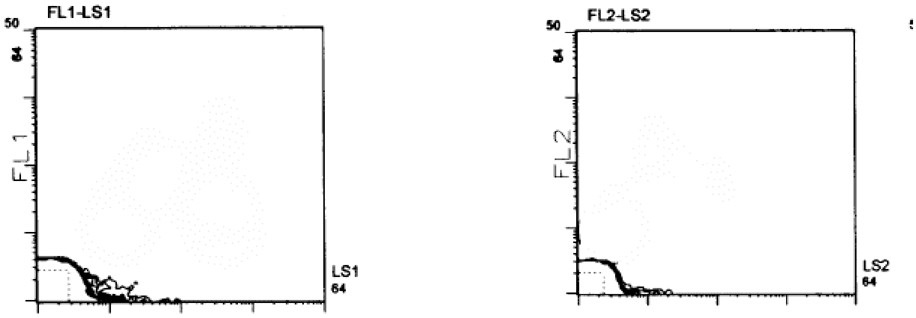




Prochlorococcus group St3 C3 B9 100m

Deep layer.

Phytoplankton was not detected by these parameter of analysis.



St3 C3 B12 200m

3.4.6 Distribution of Nanoplankton and Picoplankton in the equatorial Pacific Ocean

Yasuhiro SUZUKI (MWJ, Kinki University), Takayoshi SEIKE (MWJ, Hiroshima University) and Kazu MATSUMOTO (JAMSTEC)

MWJ: Marine Works Japan Ltd.

Objectives

Nanoplankton (size of 2-20 µm) and picoplankton (size less than 2 µm) are major contributors of plankton biomass in the equatorial Pacific Ocean. Nano-pico planktons (autotrophs and heterotrophs) play an important role in the microbial loop. The purpose of this study is to estimate the distributions of nano-pico planktons. Cell numbers of nanoplankton and picoplankton are investigated by counting with an epi-fluorescence microscope.

Method 1: for autotrophic plankton

Seawater samples were collected at 12 sampling sites in the equatorial Pacific Ocean and from 13 water depth of surface to 200 meters. Seawater samples were immediately treated with final concentration of 1 % glutaraldehyde (V/V) and they were left for 1 hour. 5 ml of the samples were filtered through cellulose acetate filter (Sartorius SM11107, pore size: 0.2 µm, diameter: 13 mm) at the low vacuum of < 20 cmHg. The sample filters were attached on the cover glass with glycerin for the permeation of filter. The sample filters were stored in the freezer (–85 ℃) for subsequent epi-fluorescence microscopic observation.

Cell numbers on the filter will be counted with Nikon epi-fluorescence microscope ECLIPSE E-800 at the final magnification of 1000 with the B-2A filter block (combination of excitation filter 450-490 nm, dichroic mirror 505 nm and barrier filter 520 nm).

Phytoplankton species will be distinguished from three types. Fist type is autotrophic eukaryotes – especially prymnesiophytes, which is 1.5-3µm size of phytoplankton, and that is containing flagellate. Second type is *Synechococcus* (spherical type of Cyanobacteria), which is 1-2 µm size of prokaryotic phytoplankton containing Phycoerythrin autofluorescence of orange color. Last type is *Prochlorococcus*, which is 0.4-0.7 µm size of prokaryotic phytoplankton.

Analysis will be scheduled at the laboratory for dozens of selective samples.

Method 2: for heterotrophic plankton

Seawaters were collected at the same sites and water depths of the method 1 samples. Seawater samples were immediately treated with the final concentration of 1 % glutaraldehyde (V/V) and were kept at room temperature (1 hour). Seawater samples were filtered through a prestained black 1 μm pore size Nuclepore filter stacked on nitrocellulose membrane filters (Millipore, pore size: 3.0 μm) at the low vacuum of < 20 cmHg. When the seawater remained approximately 10 ml, phytoplanktons on the filter and in the water were double-stained with DAPI (4’6-diamidino-2-phenylindole dihydrochloride) and proflavine (3-6-diamidino-acridine hemisulfate) for 5 minutes, respectively. The working solution of DAPI (10 μg/ml) was prepared by diluting of the stock solution (200 μg/ml) with 0.2 μm-filtered seawater. The working solution of proflavine (0.033 %) was pre-filtrated through 0.22 μm pore size of non-pyrogenic Durapore membrane filter (Millipore, Millex-GX).

The staining method was as follows; the first step, the seawater sample was stained with the working solution of DAPI (1 ml) for 5 minutes. The second step, the water sample was stained with the working solution of proflavine (0.4 ml) for 5 minutes. The third step, the seawater sample was filtered. Finally, the filter was rinsed with approximately 5 ml of the 0.2 μm-filtered seawater.

The filters were put on a slide-glass and covered with micro cover glass. The filters on the slide-glass were stored in the freezer (–85 ℃) until the observation. Cells of autotrophic planktons are seen as orange and/or red, and heterotrophic planktons are green.

Analysis will be scheduled at the laboratory for the 80 selective samples.

3.4.7 In vivo fluorescence of phytoplankton in the equatorial Pacific

Kazu MATSUMOTO (JAMSTEC)

Objectives:

Phytoplanktons have many pigments, which are specific as species. Their pigments are classified as two groups. The one is an available pigment to photosynthesis (chlorophyll a, chlorophyll b, phycoerithrin, fucoxanthin, and so on.), and the other is photoprotective pigment (zeaxanthin, diadinoxanthin, diatoxanthin and so on.), the later is rather preventing photosynthesis. The absorption peak is different in each pigment. But, living phytoplanktons transfer the absorbed light energy by each pigment to reaction center of chlorophyll a for photosynthesis. Therefore, In vivo fluorescence of chlorophyll a, when excited with scanning at the photosynthetically available wavelength is considered as the fluorescence of the available pigments for photosynthesis.

Methods:

Seawater samples from the surface to 200 m depth were collected by Niskin bottles which were attached to the CTD-rosette sampler. Seawater samples were kept in a refrigerator for shading preservation for at least one hour and left under room temperature for 30 minutes prior to analyzing. A fluorescence spectrophotometer (HITACHI, model F-4500) was used for measurements. The analytical condition was as follows.

Excitation wavelength: 300 – 700 nm, slit width: 10 nm

Emission wavelength: 450 – 800 nm, slit width: 10 nm

Fluorescence intensities were standardized by Uranin.

3.5 Primary and new productivity

Satoshi OZAWA 1), Hirofumi OKANO 2) and Takeshi KAWANO 2)
. Marine Works Japan LTD
. Japan Marine Science and Technology Center

Objective

In this cruise, the objective of this study is to be made known the mechanism of primary production at the open sea on the equator from longitude 135 degree E to 170 degree W.

1. In-situ Incubation

Bottles for incubation and filters

Bottles for incubation are ca. 1 liter Nalgen polycarbonate bottles with screw caps. Wattman GF/F 25mm filters pre-combusted with temperature of 450 degree C for at least 4 hours, were used for a filtration.

In situ incubation

In situ incubations for 24 hours were executed at station 2, 3, 6, 9 and 12. We took duplicate samples from 13 layers (every 10m from surface to 100m, 120m or 150m depth) and moored these samples which were placed in bottles, at an each depth for 24 hours. One of the duplicate samples was spiked with 0.2 mmoles/mL of $Na_2{}^{13}CO_3$ solution (1mL per 1 bottle), the other was spiked with 0.2 mmoles/mL of $Na_2{}^{13}CO_3$ solution (1mL per 1 bottle) and 0.1 μ moles/mL of $Na^{15}NO_3$ solution (0.5mL per 1 bottle from surface to maximum layer of chlorophyll a, 1mL per 1 bottle to extra layer) just before mooring. Detail of the incubation was shown in a log sheet.

Samples were filtered immediately after the incubation and were kept to freeze till the end of cruise. After that, filters were dried on the oven of 45 degree C.

Measurement

After the cruise, all samples will be made to measure by a mass spectrometer ANCA-SL system at JAMSTEC.

2. Photosynthetic irradiation curve measurement

Bottles for incubation and filters

Bottles for incubation (ca. 1 liter) was done to cut off the light on bottle’s side, upper and bottom, which did not pass the light from a lamp (light source). These bottles were numbered from No.1 to 8, on the lamp (light source). No.2, 5, 7 and 8 of bottles were shield with a film on lamp side.

Wattman GF/F 25mm filters pre-combusted with temperature of 450 degree C for at least 4 hours, were used for a filtration.

Incubation

After sampling surface seawater by a bucket, the seawater was placed in the eight of bottles. The bottles were spiked with 0.2 mmoles/mL of $Na_2{}^{13}CO_3$ solution (1mL per 1 bottle), were incubated for 3 hours at the incubation tank in laboratory. Detail of incubation was shown in log sheet, and the light intensity of bottle was shown in table 1.

Samples were filtered immediately after the incubation and were kept to freeze till the end of cruise.

Measurement

After the cruise, all samples will be made to measure by a mass spectrometer ANCA-SL system at JAMSTEC.

Tabe.1 Light intensity

Bottle number	Measurements			Average	STD
	1st	2nd	3rd		
1	460	440	440	446.67	11.55
2	190	190	190	190.00	0.00
3	145	140	140	141.67	2.89
4	115	115	115	115.00	0.00
5	51	52	52	51.67	0.58
6	42	40	42	41.33	1.15
7	18.5	18.5	18.5	18.50	0.00
8	11.0	10.5	10.5	10.50	0.00

($SEC^{-1}M^{2}$)

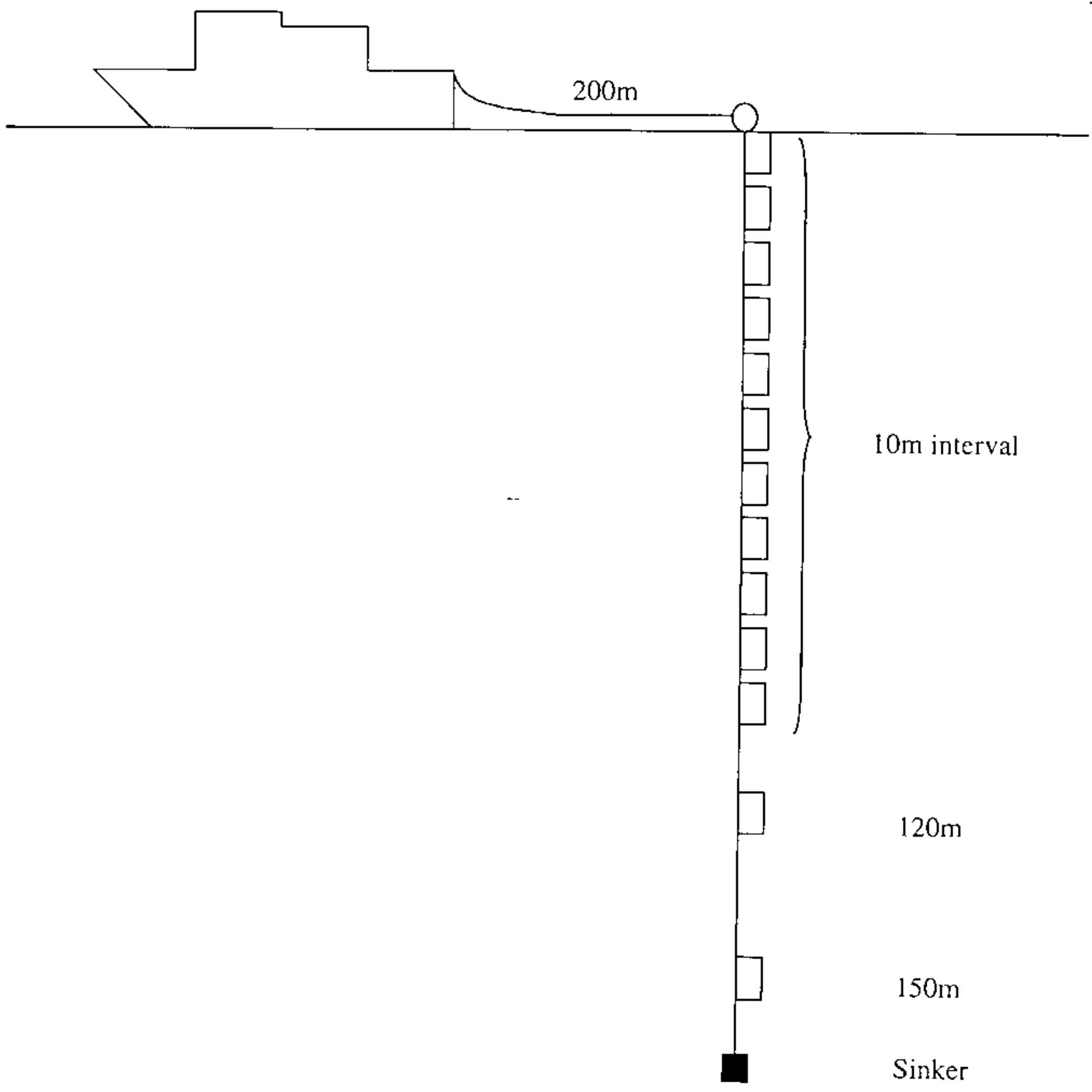


Fig.1 In-Situ Incubation Plan

3.6 Continuous measurement of surface seawater

3.6.1 Integrated monitoring system of surface water

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1-1-7 Mutsuura, Kanazawa-ku, Yokohama 236 Japan

Introduction

This system can measure temperature, salinity, dissolved oxygen and fluorescence of surface water continuously on real time. It is connected to shipboard LAN-system, and provides the acquired data for p-CO2 measurement system. It was stored in hard disk of computer minutely with time and the position of ship.

Instruments and Methods

This system located in the sea surface monitoring laboratory on this ship. Sea surface water was pumped up to the laboratory. The water sample flowed through a vinyl-chloride pipe. The flow rate was controlled some valves.

Specification of the sensors were listed below.

a) Temperature and Salinity sensor

SEACAT THERMOSALINOGRAPH
Model: SBE-21, SEA-BIRD ELECTRONICS, INC.
Serial number: 2118859-2641
(Temperature sensor is first, Salinity is second)
Measurement range: -5 to +35℃,　0 to 6.5 S/m
Accuracy: 0.01℃/6month,　0.001S/m/month
Resolution: 0.001℃,　0.0001S/m

b) Dissolved Oxygen sensor

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

c) Fluorometer

Model:10-AU-005, TURNER DESIGNS
Serial number: 5562 FRXX
Detection limit: 5 ppt or less for chlorophyl a

Stability: 0.5%/month of full scale

d) Particle Size sensor

Model P-05, Nippon Kaiyo LTD.

Serial number: P5024

Accuracy: ±10% of range

Measurement range: 0.02681mmt to 6.666mm

Reproducibility: ±5%

Stability: 5%/week

e) Flowmeter

Model:EMARG2W, Aichi Watch Electronics LTD.

Serial number: 8672

Measurement range: 0 to 30l/min

Accuracy: ±1%

Stability: ±1%/day

Measurement

We had measured from Dec. 23 1998 to Jan. 30 1999 (as UTC). We obtained the data from each sensors every one minute. We checked the value of temperature and salinity sensor at the begging of this cruise, so the value is not significantly different from the surface water which we take bucket sampling (see pCO2 section). We also checked the flow rate of the system everyday.

Preliminary result

Preliminary data along the equator are shown in Figure1-4. Note that these data need to be corrected so that they only show the trend of temperature, salinity, dissolved oxygen and fluorescence distributions on equational area every 10 minutes. The data were stored on a MO disk which will be kept in Ocean Research Department, JAMSTEC.

Fig.1 Surface sea water temperature

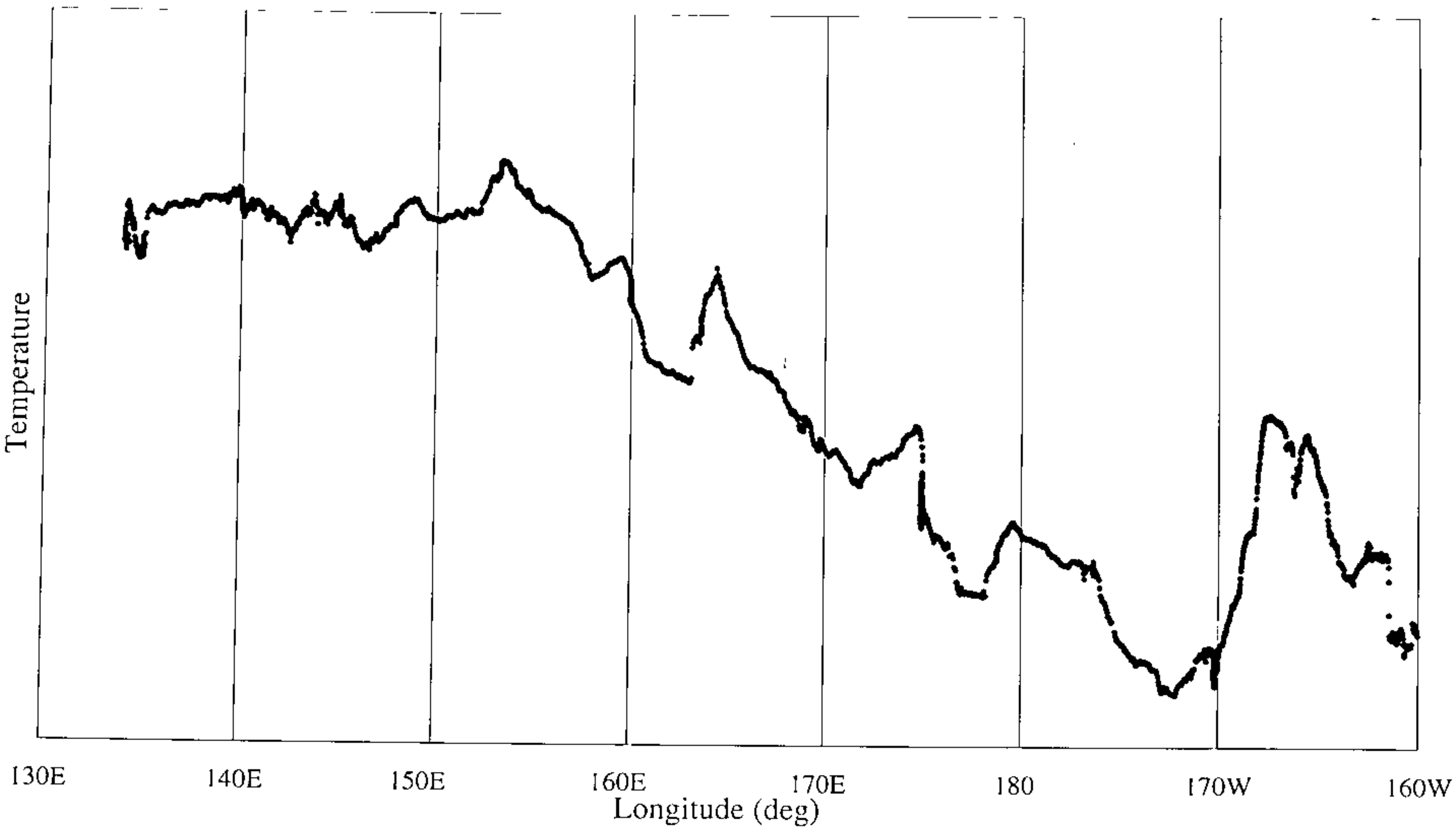


Fig.2 Surface sea water salinity

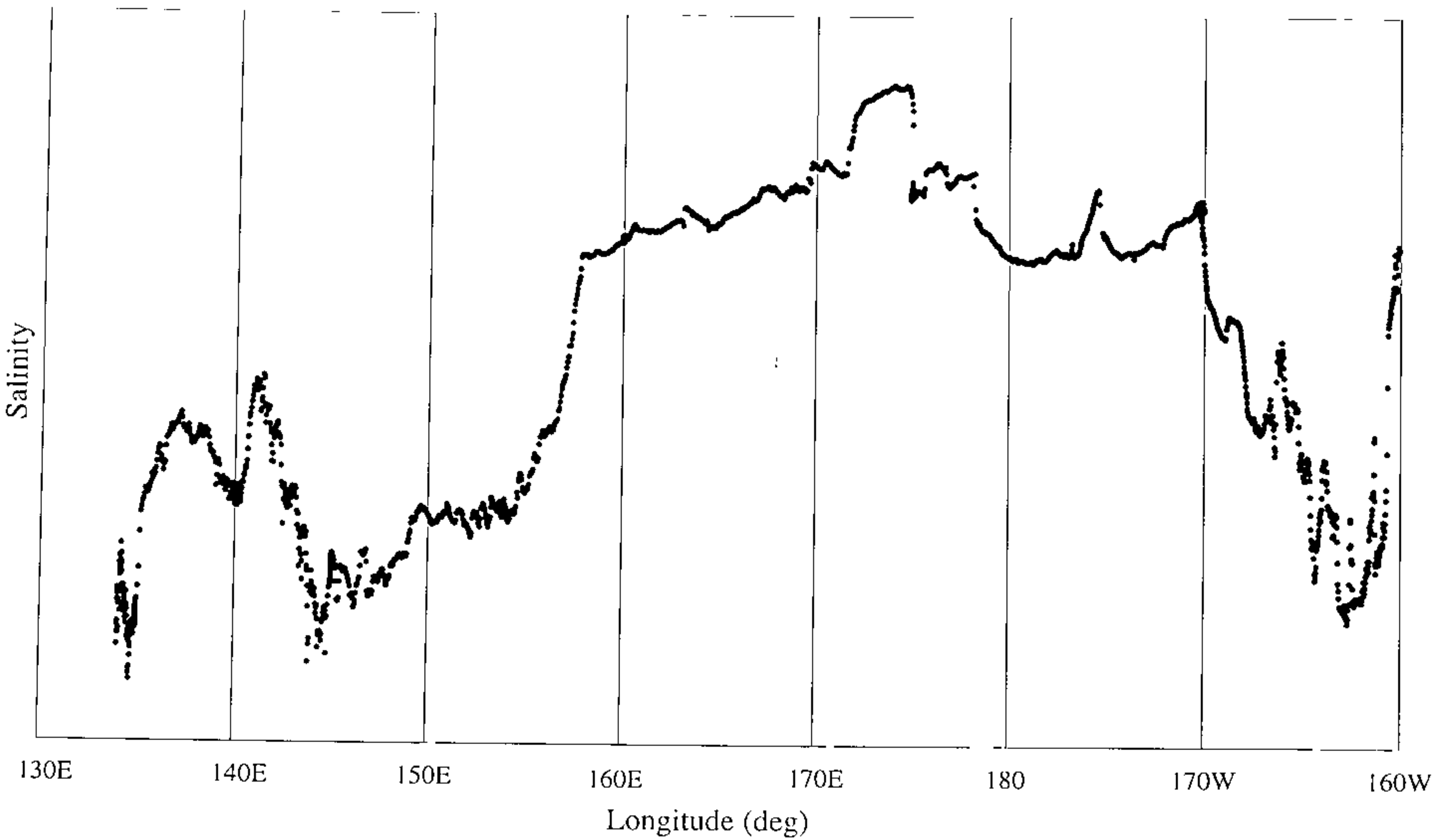


Fig.3 Surface sea water dissolved oxygen

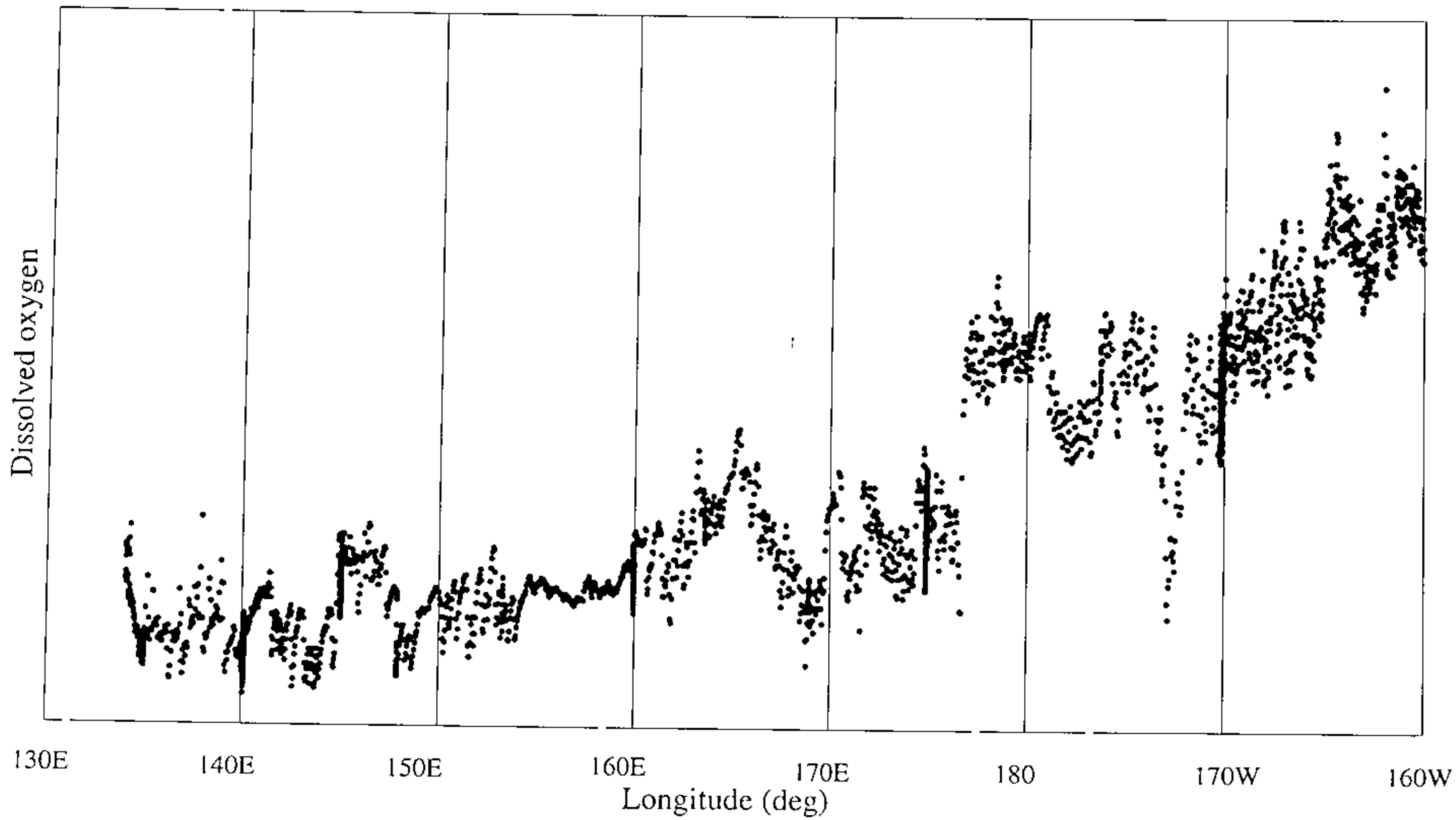
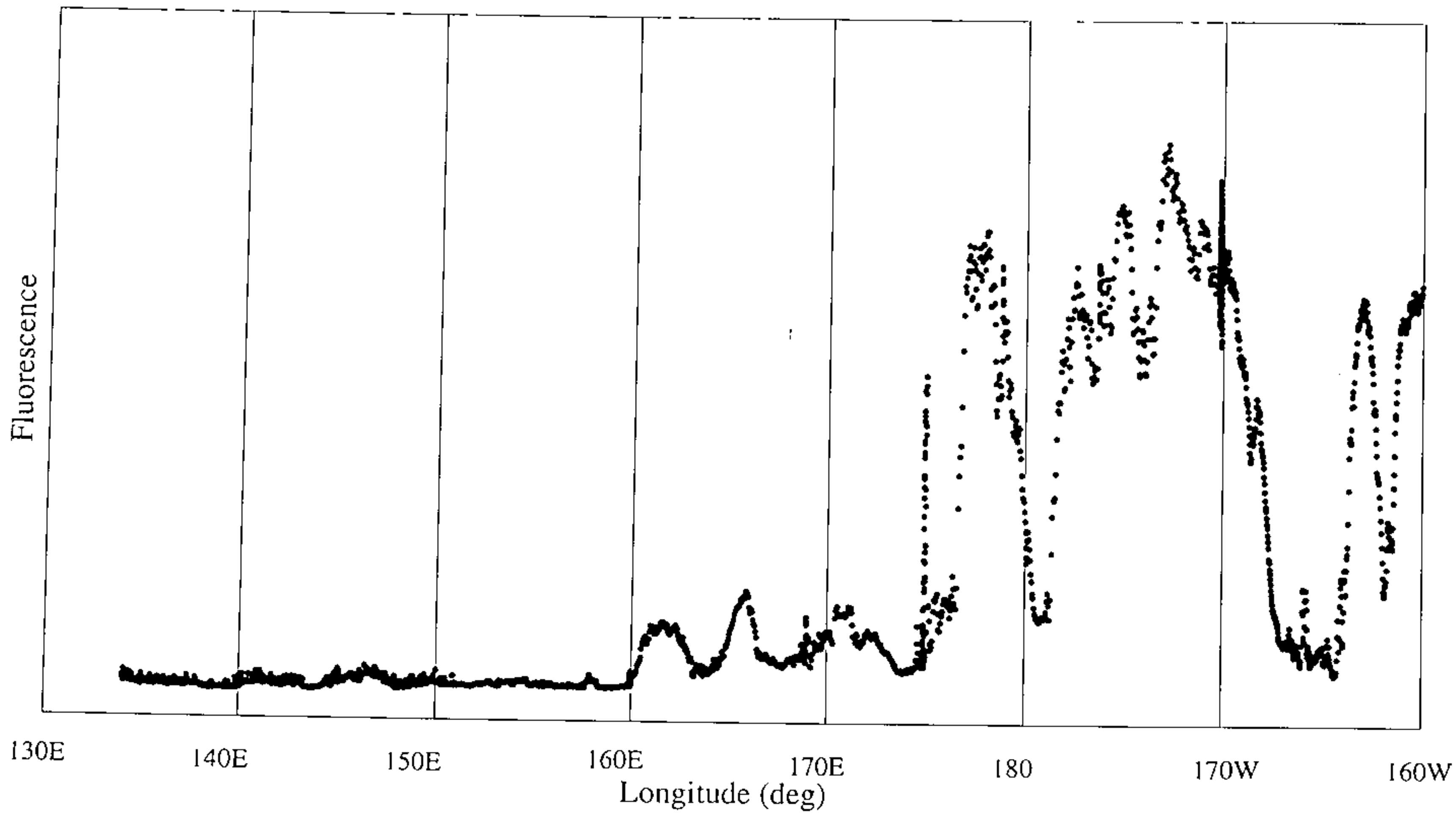


Fig.4 Surface sea water fluorescence



3.6.2 Nutrients Monitoring in Surface Seawater

Munehito KIMURA, Ken-ichiroh MASAKI, Hidekazu OHTA 1) and Hirofumi OKANO 2)

1) KANSO LTD

2) Japan Marine Science and Technology Center

Objective

The horizontal distributions of nutrients in surface seawater are one of the important factors on the study of primary production, ocean circulation and water mass structure in ocean. During this cruise, the objectives of nutrients (NO_3, NO_2, SiO_2 and PO_4) monitoring were to obtain the important and basic information on these study.

Instruments and Methods

The nutrients monitoring was performed on Bran + Luebbe continuous monitoring system Model TRAACS 800 (4 channels). The flow diagram of monitoring system is shown in Fig.1. The TRAACS 800 was located at the surface seawater laboratory for monitoring in the R/V MIRAI. The analytical methods are as follows :

Nitrate (ch.1) : Nitrate in seawater was reduced to nitrite by reduction tube (Cd - Cu tube) and the nitrite reduced was determined by the nitrite method described to next, but the flow cell used in nitrate analysis was 3 cm length type. Nitrite initially present in the seawater was corrected after measuring.

Nitrite (ch.2) : Nitrite was determined by diazotizing with sulfanilamide, by coupling with N-1-naphthyl- ethylenediamine (NED) to form a colored azo compound and by being measured the absorbance of 550 nm using 5 cm length flow cell, in the system.

Silicate (ch.3) : Silicate was determined by complexing with molybdate, by reducing with ascorbic acid to form a colored complex and by being measured the absorbance of 630 nm using 3 cm length flow cell, in the system.

Phosphate (ch.4) : Phosphate was determined by complexing with molybdate, by reducing with ascorbic acid to form a colored complex and by being measured the absorbance of 880 nm using 5 cm length flow cell, in the system.

Sampling Procedures

Seawater of 4 m depth under ocean surface was pumped up to laboratory inner R/V MIRAI, continuously, was poured in 5 L of pyrex glass beaker through a faucet of the laboratory, was introduced direct to monitoring system by narrow tube continuously.

Preliminary results

The nutrients monitoring was made the period of Hatinohe (Japan) to Palau,
Palau to Oahu (Hawaii) and Oahu to Hatinohe.

During monitoring period, monitoring cycle was 12 hour containing 1 hour for calibrating and recoating copper to the Cd reduction tube, monitoring data was obtained every 1 minute. The preliminary results of monitoring are shown in Fig.2 each the monitoring period.

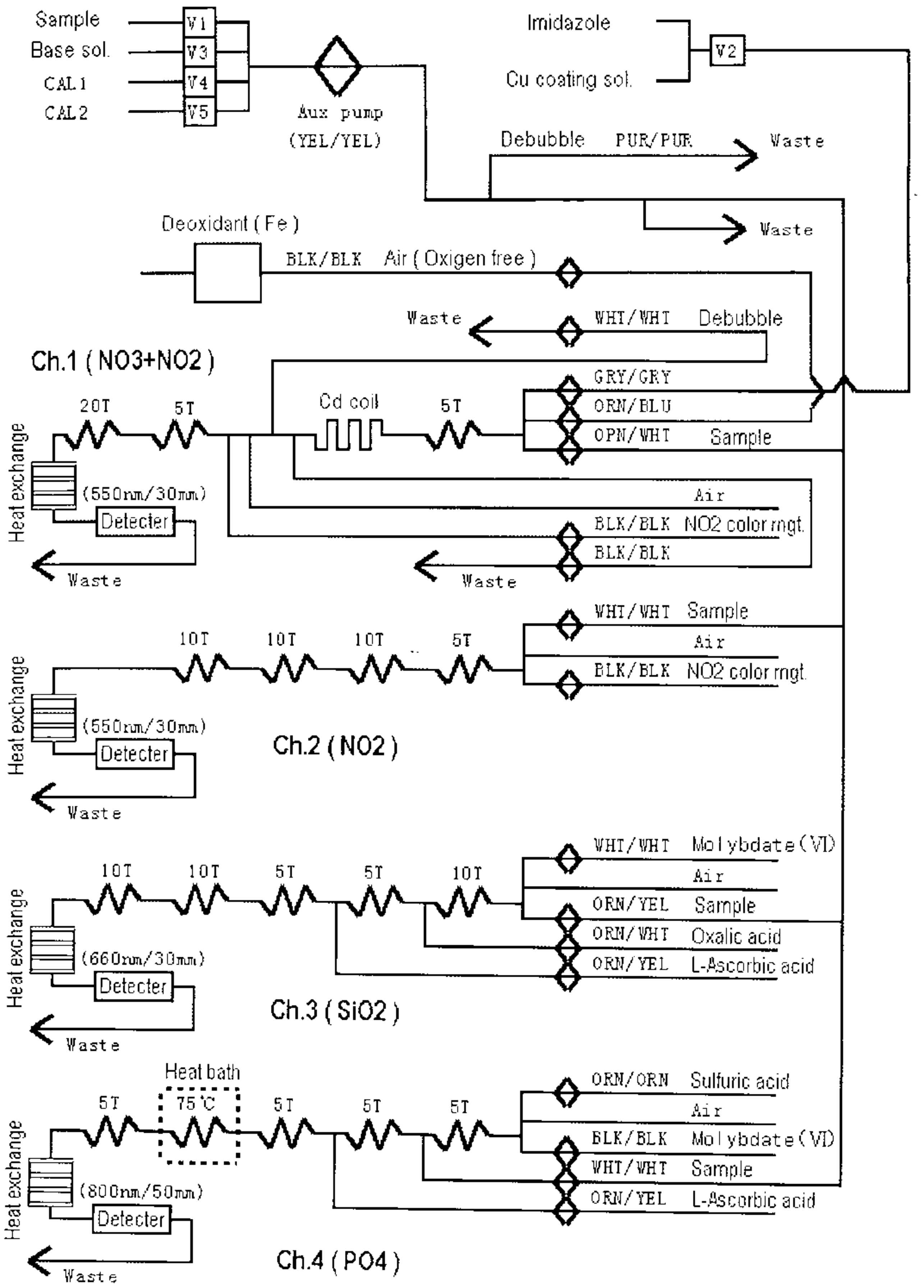


Fig.1 Flow diagram of nutrients monitoring system.

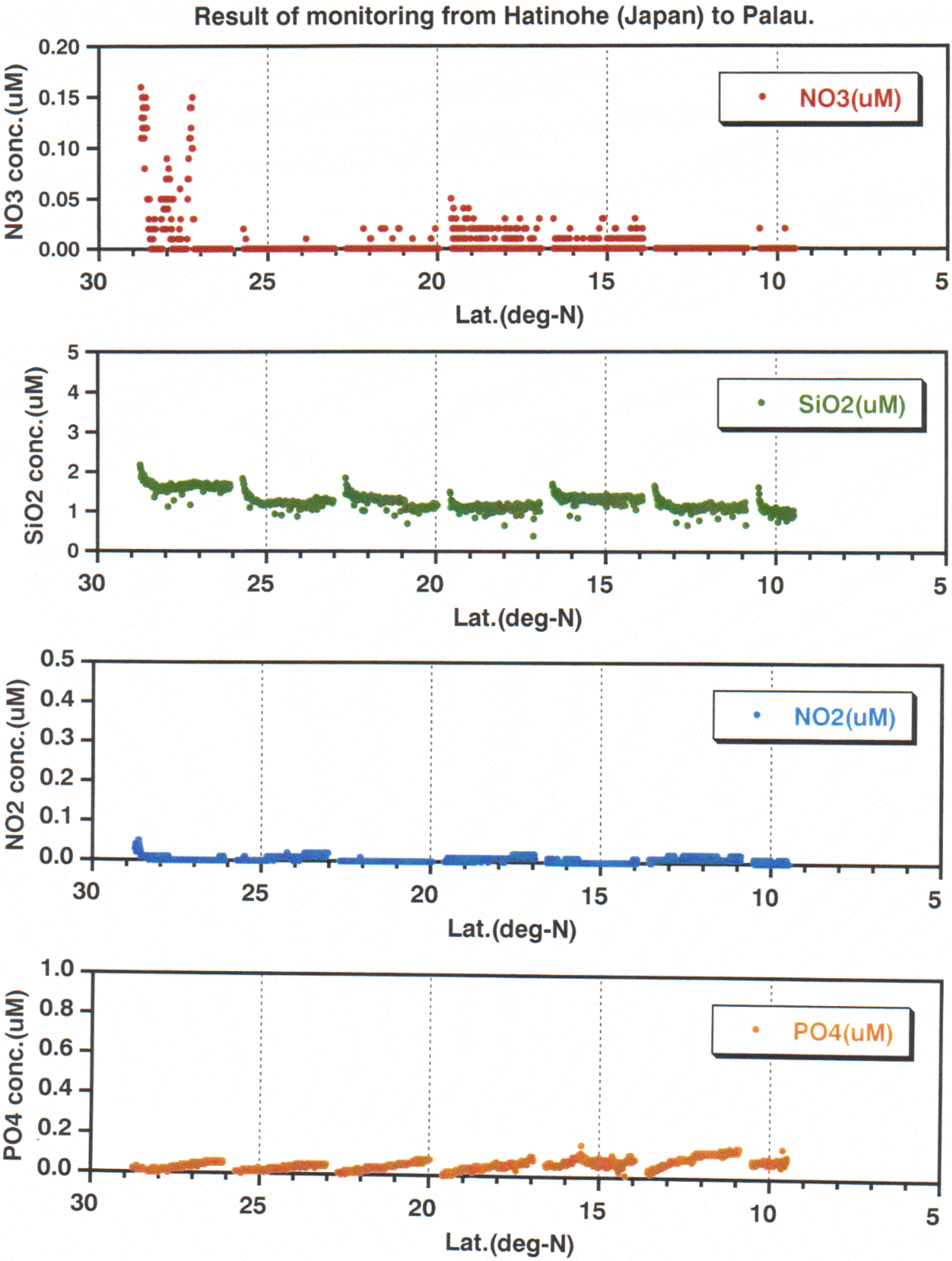


Fig.2 Results of nutrients (nitrate, silicate, nitrite and phosphate) monitoring in MR98K02.

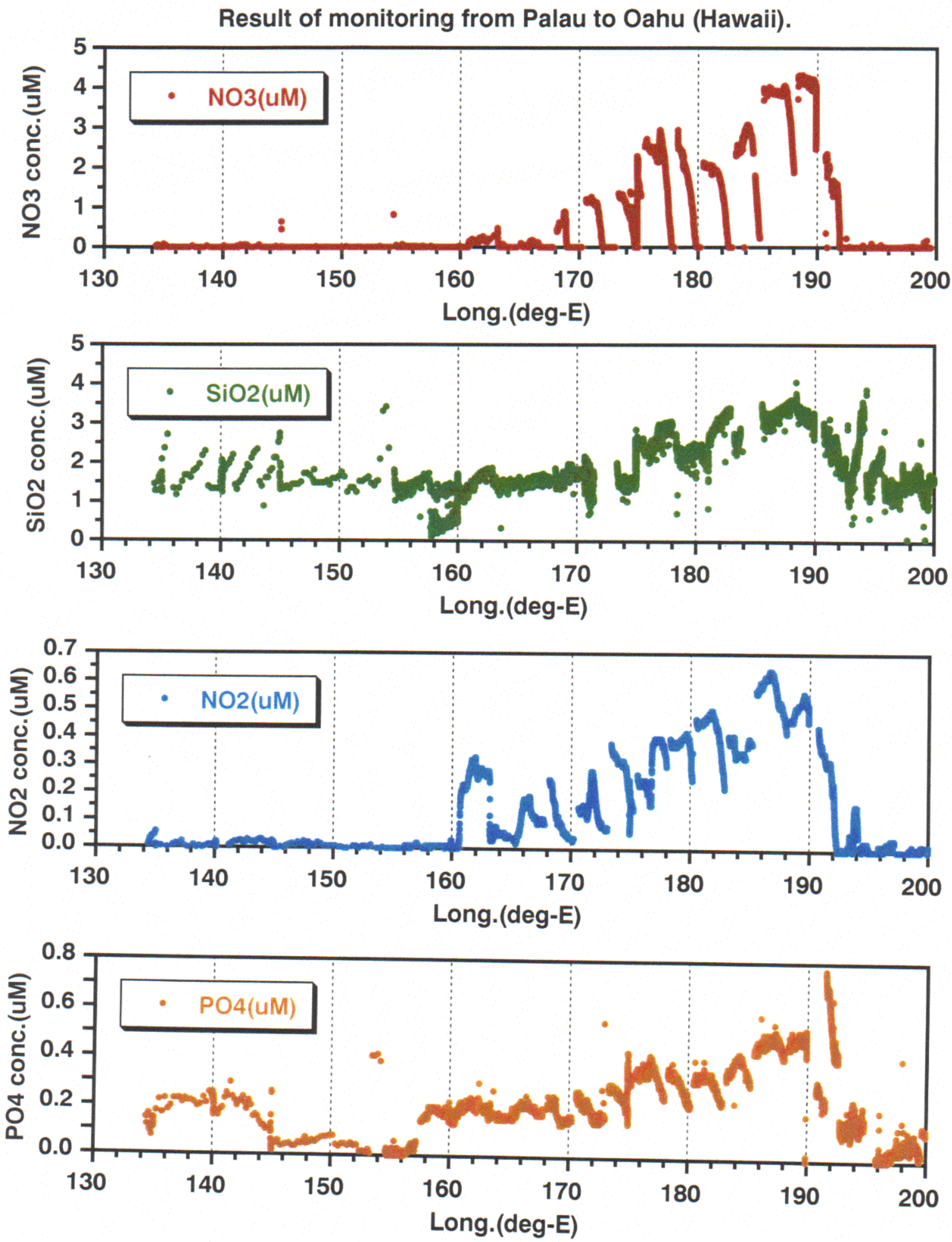


Fig.2 Continue.

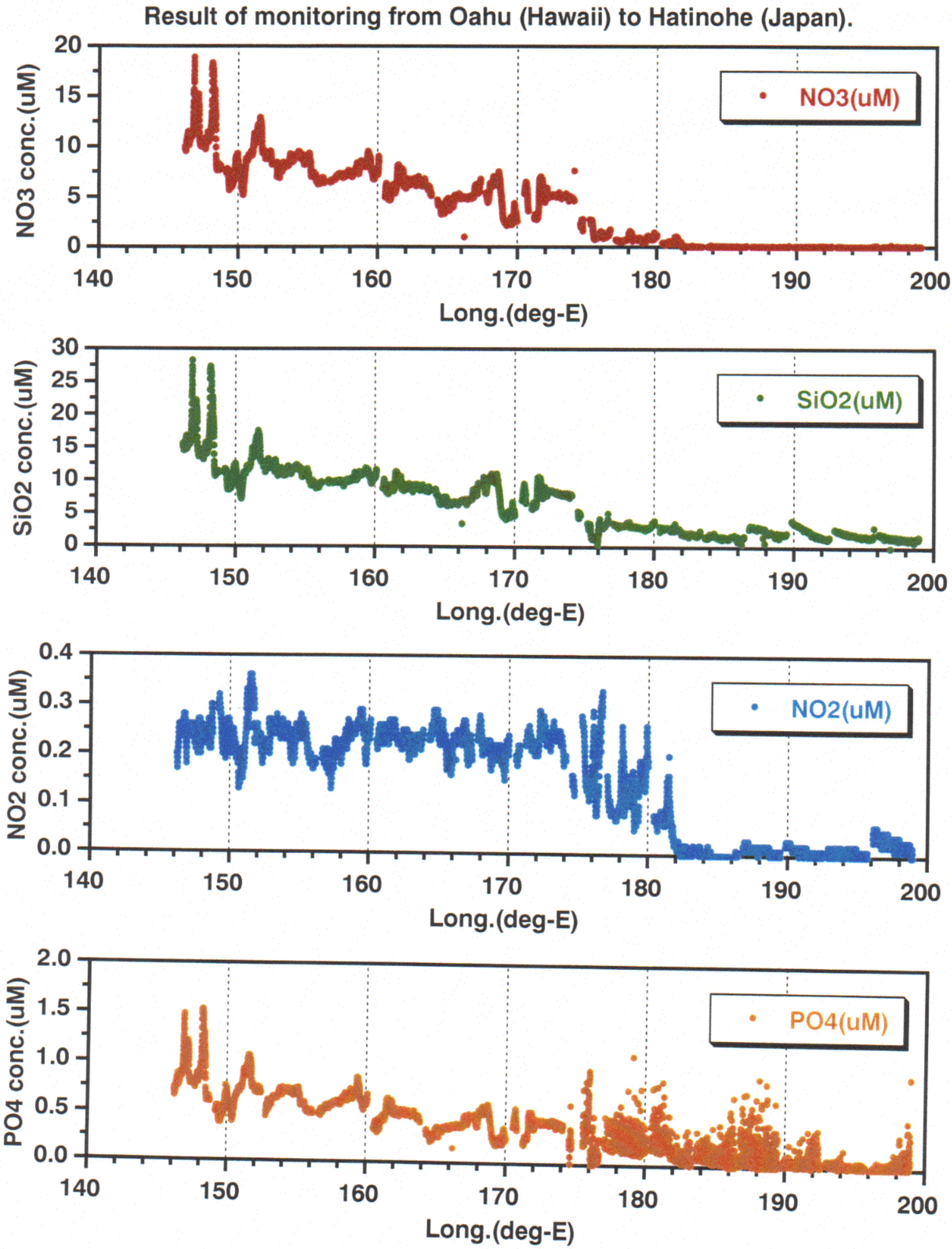


Fig.2 Continue.

3.7 Relationship between Cd and phosphate in the equatorial western Pacific.

Kazuo Abe
(Ishigaki Tropical Station, Seikai National Fisheries Research Institute)

Objective

Cd is one of the nutrient type trace heavy metals in the ocean and its behavior is strongly correlated with the marine biological activity.Generally, the plot of dissolved Cd against phosphate which is one of the major nutrient salts for the primary production shows a good linearity and the slope varies from basin to basin. Factors influencingthis relationship between the two parameters are considered to be the biological activity, the physical water mixing and so forth. The main purpose of this study in this cruise is to investigate the distributional features of Cd and to examine the relationship between Cdand phosphate in the equatorial western Pacific Ocean.

Methods

Water sampling was carried out vertically at 5 stations with a 30 l Niskin bottle attached to a CTD-RMS system aboard the R/V Mirai in January 1999 (Table 1). The water samples for dissolved Cd were transferred to acid-cleaned polyethylene bottles in a water sampling room. To check the contamination of Cd from the Niskin bottle, samplingwith a teflon coated Niskin-X bottle attached to a kevler hydro cast wasalso carried out. Cd in samples filtered through a 0.4 μm Nuclepore filter was concentrated by the modified APDC co-precipitation method of Boyle and Edmond (1977) on board in a clean room. The determination of Cd will be carried out by flameless-AAS (Atomic Absorption Spectophotometer) in the land laboratory.

Table 1　The water sampling depth.

※Stn.2 (1999.1.1～1.2)

0, 15, 30, 40, 50, 60, 70, 80, 100, 120, 150, 200, 300, 350, 500, 600,
700, 800, 1000, 1100, 1200, 1400, 1600, 1800, 2000, 2250, 2500, 2750,
3000, 3250, 3500, 3750, 4000, 4100 m

※Stn.3 (1999.1.4～1.5)

0, 15, 30, 40, 50, 60, 70, 80, 90, 100, 120, 150, 200, 300, 350, 400,
500, 600, 700, 800, 900, 1000, 1100, 1200, 1400, 1600, 1800, 2000,
2200, 2400, 2600, 2800, 3000, 3200, 3400, 3600, B-10 m

15, 30, 40, 50, 70, 100, 120, 150, 200 m (kevler hydro cast)

※Stn.6 (1999.1.7～1.8)

0, 15, 30, 40, 50, 60, 70, 80, 90, 100, 120, 150, 200, 250, 300, 350,
400, 500, 600, 700, 800, 900, 1000, 1100, 1200, 1300, 1400, 1500, 1600,
1700, 1800, 2000, 2200, 2400, 2600, 2800, B-10 m

※Stn.9 (1999.1.11～1.12)

0, 10, 20, 30, 40, 50, 60, 70, 80, 100, 120, 150, 200, 300, 400, 500,
600, 700, 800, 900, 1000, 1250, 1500, 1750, 2000, 2250, 2500, 2740,
3000,3250, 3500, 3750, 4000, 4250, 4500, 4750, B-10 m

※Stn.12 (1999.1.14～1.15)

0, 10, 20, 30, 40, 50, 60, 70, 80, 100, 120, 150, 200, 300, 400, 500,
600, 800, 1000, 1250, 1500, 1750, 2000, 2250, 2500, 2750, 3000, 3250,
3500, 3750, 4000, 4250, 4500, 4750, 5000, 5250, B-20 m

3.8 Studies on lead-210 , polonium-210 and thorium-234 in the equatorial Pacific

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These nuclides, thorium-234($t_{1/2}$ = 24.1 day), lead-210($t_{1/2}$ = 22.3 yr) and polonium-210($t_{1/2}$ = 138 days) in seawater, are especially useful for studies on material transport scavenging processes within relatively short times and on the mechanism of material transport from the surface layer, because they are highly reactive to particulate matter and its rapid removal from the water column. The aim of this study is to investigate the removal rates of these radionuclides from the water column in the equatorial Pacific through understanding of the distributions of radionuclides in the seawater and the particle matter. And, the goal of this study is to clarify the material transport and the implications for POC export in the equatorial Pacific.

The study of the disequilibria of lead-210 and polonium-210 in seawater can be used to observe relatively short term oceanic particle flux processes. The seawater samples were collected at Stns. 1, 2, 3, 6, 9 and 12 in the shallow cast #2 and the deep cast with the CTD/RMS. However, the samples were not collected at Stns. 1 and 6 in the deep cast. The collected samples has been analyzed for radioactivity by an alpha spectrometry in the laboratory.

Thorium-234 produced by decay of uranium-238 in seawater, has been used to studies on removal rates and transport processes of marine particles. The seawater samples were collected at Stns. 1, 2, 9 and 12 in the shallow cast #2 using the CTD/RMS. The collected samples has been analyzed for radioactivity by an alpha liquid scintillation spectrometry.

The settling particles were collected using a combined drifting trap. The trap array was deployed at the depth of 200m during Jan. 1 to 2, 1999 at Stn. 2 and during Jan. 14 to 15, 1999 at Stn. 12. Upon recovery of the sediment traps, the sample bottles were stored under refrigeration. The collected samples has been analyzed for radioactivity by an alpha liquid scintillation spectrometry in the laboratory.

3.9 Radioactive nuclides in settling particles and suspended particles.

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Introduction

Naturally occurring radionuclides ^{230}Th ($T_{1/2}$=7.52 x 10^4 yr), ^{231}Pa ($T_{1/2}$=3.28 x 10^4 yr), and ^{210}Pb ($T_{1/2}$=22.3 yr) can be classified into nuclides which associate with particles and are removed from seawater by scavenging or biological processes. These nuclides provide useful chronometers to determine the important rates of material transport processes in the marine environment. It is well known that ^{234}U and ^{235}U are dissolved uniformly in seawater. The production rate of ^{230}Th and ^{231}Pa in the seawater is fixed because the radioactive decay of ^{234}U and ^{235}U is the significant source. Yang et al.(1986) have reported that a fractionation between ^{230}Th and ^{231}Pa took place in the ocean. A significant fraction of ^{231}Pa relative to ^{230}Th may be transported laterally from the open ocean to the ocean margins. ^{210}Pb is transported to oceanic areas of high productivity and particle flux and scavenging by particles is a major mechanism of ^{210}Pb removal from seawater. The main purpose of this investigation is to determine the concentrations of ^{230}Th, ^{231}Pa, and ^{210}Pb in settling particles and suspended particles and to discuss the scavenging process by measuring the behavior of ^{230}Th, ^{231}Pa, and ^{210}Pb in the western equatorial Pacific.

Materials and Methods

Suspended particle samples were collected at Stns. 1, 3, 6, 9, and 12 during the MR98-K02 cruise by using *in situ* particle samplers of CHALLENGER OCEANIC SYSTEMS & SERVICES. *In situ* particle sampler is designed to filter over one cubic meter of water in a few hours at midwater depths in the open ocean. The aim is to provide sufficient quantities of particulate material for the subsequent analysis of radiochemical moieties. The basic unit consists of a 293 mm diameter polypropylene filter housing (with two in-line MnOx impregnated scavengers after the filter for the simultaneous extraction of dissolved radionuclides), a centrifugal pump mounted on the end cap of a pressure tube containing a motor and an alkaline battery pack (32 V). Two scavengers are used in order to check the removal efficiency. A magnetically switched preprogrammable electronic timer controls the sampling and the volume sampled is monitored by a mechanical displacement flow meter. Delay to start of pumping can be from 0 to 999.9 hours and duration of sampling up to 9.9 hours, both in 6 minute steps. The volume sampled depends on the concentration of the suspended particulate matter and the duration of pumping. The units are built for a safe working depth of 5500 m. *In situ* particle samplers were deployed by wire from the piston corer winch of R/V *Mirai*. Sampling information is given in Table 1. Samples will be analyzed for their radioactivities on land laboratory after radiochemical separations.

Six long-term moorings of time-series sediment traps were deployed at Stns. 1, 2, 3, 6, 9, and 12 in the western equatorial Pacific. Sampling information has been described in detail elsewhere in this cruise report (Shimamoto and Tanaka). Sediment trap samples will be analyzed for their radioactivities after being successfully recovered.

Table 1. Sampling information of *in situ* particle sampler.

Station No.	Depth(Wire out)
Stn. 1	500m, 1000m, 2000m, 3000m, 3500m, 4000m
Stn. 3	500m, 1500m, 2000m, 2500m, 3000m
Stn. 6	500m, 1500m, 2000m, 2300m, 2600m
Stn. 9	500m, 2000m, 3000m, 3500m, 4000m
Stn. 12	500m, 1000m, 2000m, 3000m, 4000m, 4500m

3.10 The spatial and depth-wise variation in the concentration and abundance of TEP

Neelam RAMAIAH and Ken FURUYA
University of Tokyo

Objective:

To study the spatial and depth-wise variation in the concentration and abundance of TEP in relation to existing phytoplankton biomass, ambient concentrations of dissolved organic products of photosynthesis and bacterial abundance in the Equatorial Pacific Ocean.

Parameters:

Water samples from surface + 11 depths of all the 12 shallow cast, and 12 depths of the deep cast stations (except stn 6) were collected for the estimation of following parameters:

Ambient concentration of TEP
TEP abundance (number and size)
Ambient concentrations of dissolved organic products of photosynthesis (Dissolved Free Amino Acids and Dissolved Carbohydrates) and
Total bacterial counts

Samples obtained from the Nagoya University floating sediment traps deployed at stns 2 and 12, were also used for the estimation of the above parameters.

Incubation experiment:

Water samples from the surface and chlorophyll maximum layer of stns 3, 6 and 12 were used for simulated on-deck incubation experiments to quantify time dependent release of photosynthetic extracellular products, variation in phytoplankton biomass (chlorophyll concentration), primary production (^{13}C uptake), TEP concentration and abundance and bacterial numbers.

Methods:

TEP concentrations were determined spectrophotometrically. Particles retained on 0.4 μm nuclepore filters were stained with alcian blue, filters soaked in 80% sulphuric acid (for 3 hrs) and the absorption measured at 787 nm. Xanthan gum was used as the calibration standard and TEP values expressed as μg L^{-1}xanthan equivalent.

Size and numbers of TEP will be determined after staining the particles with alcian blue and observing under light microscope.

Samples for the estimation of dissolved free amino acids (DFAA) and total dissolved carbohydrates

(DCHO) were stored frozen at –20°C after filtering them through ignited glass fibre filters. Analyses will be carried out in the laboratory at the University of Tokyo. DFAA will be measured flourometrically following the o-phthalaldehyde and mercaptoethanol method, while DCHO will be determined spectrophotometrically by the MBTH method.
Samples fixed in 1% glutaraldehyde will be used for the determination of bacterial counts in the laboratory after staining the cells with DAPI and counting using epiflourescence microscope.
Chlorophyll (for the experiment samples) will be determined flourometrically after extraction in DMF.

Results obtained on completion of the analyses will be submitted to JAMSTEC at the earliest.

3.11 Distribution of Phycoerythrin in the Equatorial Pacific Ocean

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Graduate school of Agricultural Life and Science,
University of Tokyo

Objective

Phycoerythrin(PE) is one of the major light-harvesting phycobiliproteins in the three algal classes: cyanophyta, cryptophyta and rhodophyta. Small coccoid cyanobacteria, *Synechococcus* spp., contain high concentration of phycobiliproteins and seem to use them as nitrogen reserves as well as light-harvesting pigments. Althogh ecologically important, simple and standardized method for estimation of phycobiliproteins has not been established yet mainly due to the difficulty involved in the extraction of these pigments. This had led to a lack of information on the natural concentration of phycobiliprotein, which is important to study the distribution and physiology of cyanobacteria.

Recently, some simple methods were proposed for the estimation of PE. Our objective in this cruise is to measure the natural concentrations of PE in the equatorial pacific ocean using these methods, and to study the natural abundance and physiology of cyanobacteria

Method

Seawater samples were collected from 13 depths in the upper 200m water column. One liter samples were filtered through 0.4 μm pore sized Nuclepore filters to collect particles, and the materials were resuspended in 50% glycerol. Fluorescence emission of the samples were measured by Turner fluorometer equipped with optical filters (excitation: 500nm or 550nm, emission: 570nm; half-bandwidth 5nm), and excitation spectra were measured by Hitachi spectrofluorometer (emission:570nm). The PE concentrations of samples were determined from calibration curve derived from cultures of *Synechococcus* spp..

Synechococcus spp. cells will be counted in the concentrated glycerous suspension and in untreated natural seawater sample by epifluorescence microscopy.

3 to 4L seawater samples were collected from various depths at St.2,3,6,9, and 12, and were filtered through Whatman GF/F filters. They were immediately frozen in a <-80℃ deep freezer, and PE will be quantified later in the laboratory.

3.12 Concentration and isotope ratio of boron in the marine atmosphere

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Objective

Boron is a minor constituent of the atmosphere, existing as both gaseous and particulate forms although the former is predominant. The potential major sources for gaseous boron are degassing from sea salt and volcanic emission but the present estimates of those fluxes have large uncertainties. Boron has two isotopes, ^{10}B and ^{11}B. Since ocean water and volcanic gas have the different $^{11}B/^{10}B$ isotopic composition ($\delta^{11}B$=+40‰ for sea water and $\delta^{11}B$=+2.3 to +21.4‰ for fumarolic condensates, measurement of boron isotopes in the atmosphere should help us understand the relative contribution of their sources. And we would expect the boron isotope fractionation, because there is a relatively larger difference of masses between two isotopes. In this study, I will make the distributions of the marine atmospheric boron concentration and the boron isotope ratio clear and discuss on the factors of them and on the role of the sea as the source for atmospheric boron.

Method

Atmospheric boron samples were collected from the upper deck of R/V Mirai by a cold-trap method with a dry/ice-ethanol. Air sample was passed through two successive traps consisting of a 60 ml Savillex Teflon cyrindrical vessel with an inlet and an outlet tubes which were bathed with ethanol saturated with dry ice (～-74℃) at a flow rate of <1.8 l/min for about 4 hours. Boron was quantitatively trapped together with water vapor in the tubes. After sampling, the condensate was melted at a room temperature and transferred into a pre-cleaned Teflon bottle. About thirty samples were obtained in the north Pacific including on the equator. The isotope ratios of atmospheric boron will be measured by the negative thermal ionization mass spectrometry (NTIMS) using a Finnigan MAT THQ quadruple mass spectrometer at the Ocean Research Institute (ORI), the University of Tokyo. The results of the isotope ratios will normalized to the $\delta^{11}B$ values using the NIST SRM-951 standard. The concentrations of them will be determined by a NTIMS isotope dilution method using the NIST SRM-952 standard (^{10}B-enriched boric acid)

Results

Results will be reported within one year.

3.13 Atmospheric and oceanic CO_2 measurements

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Objectives

Carbon dioxide (CO_2), known as a major greenhouse gas, has been increasing in the atmosphere as a result of the anthropogenic emission. Its current global mean concentration is approximately 30% larger than that in the pre-industrial era (280ppm). In order to predict the atmospheric CO_2 level in the future, it is necessary to understand the processes which are controlling the fluxes among the global carbon reservoirs: the atmosphere, the terrestrial biosphere and the ocean, as well as to estimate the present CO2 inventory among these reservoirs.

The difference in CO_2 partial pressure (pCO_2) between the sea surface and the marine boundary air (ΔpCO_2) is a driving force for the CO_2 exchange between the ocean and the atmosphere. The temporal and spatial variability of pCO_2 in surface seawater is thought to be playing an important role for the variability of the atmospheric CO_2 growth rate. The equatorial Pacific is known to act as a source of CO_2 to the atmosphere due primarily to the equatorial upwelling in the central and the eastern zones. Its flux has been reported to exhibit a significant interannual variability that is associated with the ENSO event. However, the temporal and spatial variations in ΔpCO_2 enough to deduce the interannual variation in CO_2 outflux from the whole equatorial zone has not been well documented.

Partial pressure of CO_2 in seawater is governed by the carbonate system in seawater. It is expected that total inorganic carbon (TCO_2; the sum of the concentrations of hydrate carbon dioxide, carbonic acid, bicarbonate, and carbonate) in the upper water column in the equatorial Pacific also exhibits pronounced temporal and spatial variability as a result of the changes in meteorological, ocean-physical, and biological conditions including upwelling, extension of the warm water pool, biological production, and air-sea CO_2 exchange.

In this cruise, we made underway concurrent measurements of pCO_2 and TCO_2 in surface seawater and measurements of TCO_2 and pH in water columns in the central and western equatorial Pacific in order to investigate the air-sea CO_2 flux and the carbonate system、 and to clarify the controlling factors which are responsible for their variations.

Methods

We made measurements of the CO_2 concentration (mole fraction of CO_2 in air; χCO_2) in marine boundary air (twice every 1.5 h) and in air equilibrated with surface seawater (four times every 1.5 h) using the χCO_2 measuring system in the surface seawater monitoring laboratory. Seawater was taken continuously from the seachest and was introduced into the MRI-shower-type equilibrator. Membrane-type equilibrator was also used in Leg 3.

We used non-dispersive infrared (NDIR) gas analyzer (BINOS 4) and four CO_2 standard gases (265, 311, 357, 400 ppm in Leg 1 and Leg 3; 311, 357, 400, 446 ppm in Leg 2; Nippon Sanso Co.) to determine the CO_2 concentration. Concentration of CO_2 will be published on the basis of the WMO X85 mole fraction scale after this cruise. Corrections for the temperature-rise from the seachest to the equilibrator and drift of CO_2 concentration in standard gases are also to be made. Partial pressure of CO_2 will be calculated from χCO_2 by taking the water vapour pressure into account.

We made underway measurement of TCO_2 in surface seawater using the coulometric TCO_2 measuring system in the surface seawater monitoring laboratory. Seawater was taken continuously from the seachest and was introducted into the system. A portion of the seawater (～30cm^3) was taken into a pipette twice every 1.5 hrs, and its TCO2 was automatically analyzed. We also analyzed TCO_2 in Reference Seawaters we prepared in MRI (batch L; 1950.2±1.6 μmol/kg and batch M; 1967.0±1.1 μmol/kg) which is traceable to the CRM provided by Dr. Dickson in Scripps Institute of Oceanography at least once during the each run of the system.

Disrete samples for TCO_2 and its $\delta^{13}C$ analyses were taken from Niskin bottles on RMS at each station (from both shallow- and deep- cast) and from surface seawater taken by a bucket. Total of 67 disrete surface seawater samples were also taken in the surface seawater monitoring laboratory. These samples were stored in 250 cm3 boro-silicae glass bottle (Sibata) with ground –glass stopcock lubricated with Apiezon L grease, and were poisoned with 0.2 cm^3 of saturated $HgCl_2$ solution. TCO_2 in these disrete samples were determined using the MRI-automated TCO_2 extraction unit and a coulometer (UIC 5012). Analyses of Reference Seawaters were also made twice during each run of the system. From the duplicate analyses of surface seawater taken at each stations, the precision was evaluated to be 0.8 μmol /kg (1σ).

$\delta^{13}C$ will be measured in the laboratory on land with a mass spectrometer after extracting the CO_2 from the samples in a vacuum line.

We measured pH (total hydrogen ion scale) in water columns at each station. Subsamples for pH analysis were taken from Niskin bottles and a bucket at each station in the same manner as for TCO_2 and $\delta^{13}C$. The pH were determined spectrophotometrically using a dye (m-cresol purple) and UV-VIS spectrophotometer V-550 (JASCO) at 20℃. Analyses were completed within 10 hours after RMS arrived on deck. Correction for the addition of $HgCl_2$ solution is to be made. Nine replica measurements of the surface seawater gave an average of 8.076±0.003 pH unit (1σ standard deviation).

Results

Data analyses have not been completed, hence we only describe the results briefly.

Concentration of total inorganic carbon normalized at S = 35 ($N35TCO_2$) in surface seawater along the equator was 1943.8±2.1 μmol/kg
(preliminary data) between 145°E and 156°E, which is in fair agreement with 1946.5±2.6 μmol/kg that observed between 143°E and 180°E in December 1997 during the strong ENSO event, and increased gradually to the east to reach 2028 μmol/kg at 170°W (Fig.1 and 2) due to the enhanced equatorial upwelling. In the eastern region of higher $N35TCO_2$, surface seawater was supersaturated with CO_2 and ΔpCO_2 reached about +100 μatm at 170°W (data not shown).

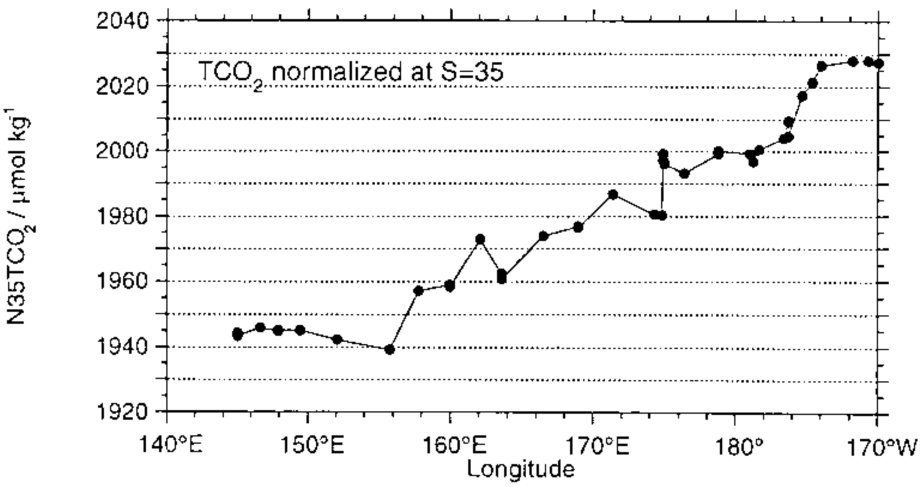


Fig.1 Longitudinal distribution of TCO_2 normalized at S=35 in surface waters along the equator.

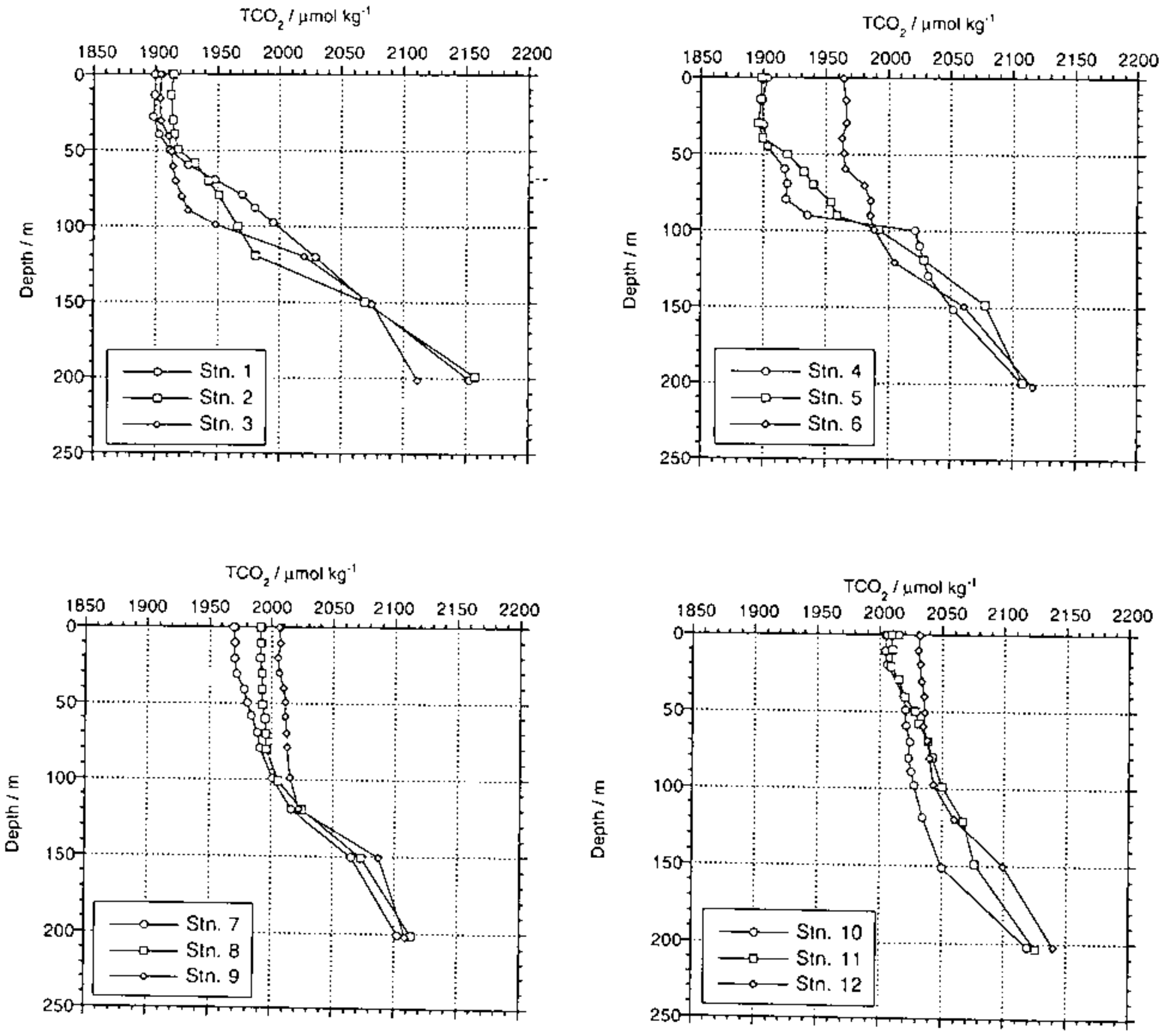
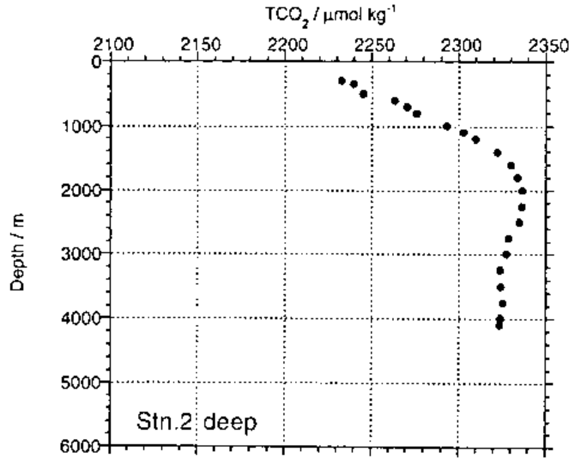
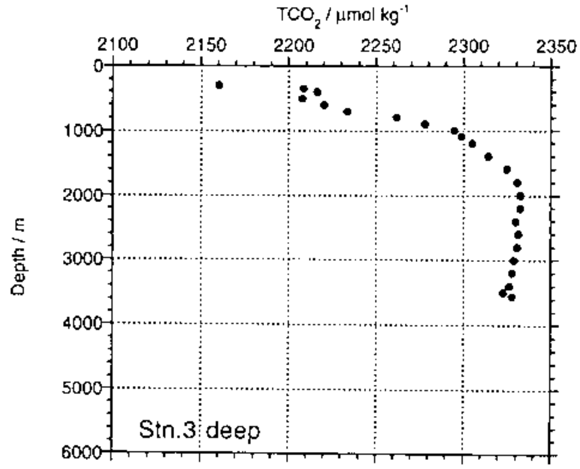
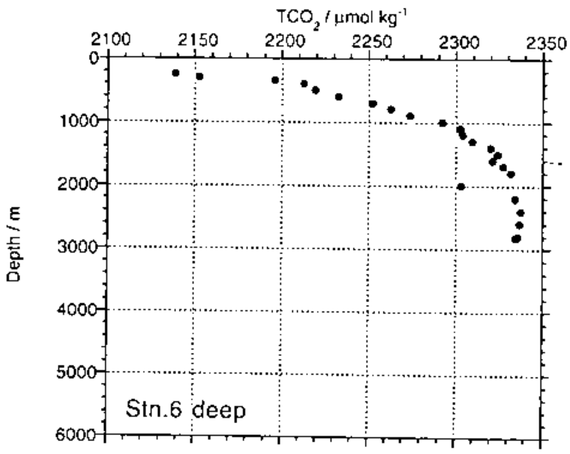
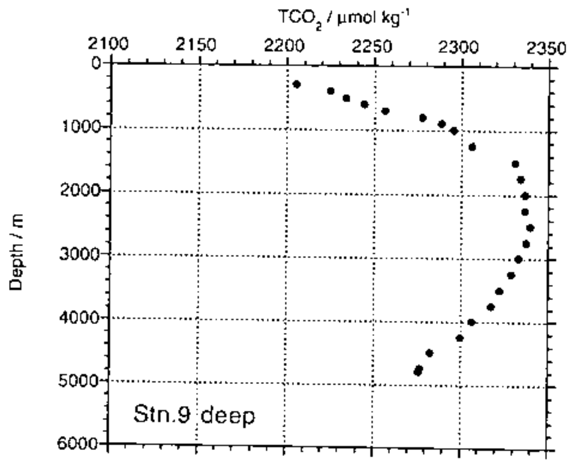


Fig.2 Vertical profiles of TCO_2 ~~(continued)~~









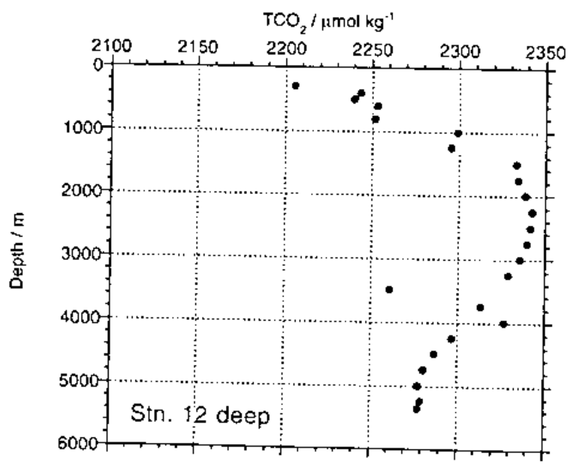


Fig.2 Vertical profiles of TCO$_2$ (continued).

3.14 Determination of carbonate (total dissolved inorganic carbon, alkalinity and pH), sulfur hexafluoride (SF6) and nitrous oxide (N2O) in sea water at the equatorial area

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and
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Yoshiaki MAEDA

1. OBJECTIVES

In the view of the problem of the global warming, it is important to know the concentration level of green house effect gases in the ocean and the penetration rate of the gases trough air-sea surface interface. Our purpose of this cruise is to collect the date of carbonate (total carbon dioxide, alkalinity and pH), sulfur hexafluoride (SF_6) and nitrogen oxide (N_2O) at the equator area. We will estimate the flux of antholopogenic carbon dioxide in this area using the obtained data.

2. DESCRIPTION OF METHODS

<pH>

Sea water samples were collected in 100ml polyethylene bottles with inner caps from Niskin-type water samplers. The sample bottles were capped after an overflow of about 100ml sea water. All samples were stored at room temperature after sampling and analyzed within a few hours. Samples were transferred into a closed and jacketed glass measurement cell with a volume of ~30ml. The cell temperature was maintained at a constant temperature of 25ºC± 0.1ºC. The electric potential and temperature of the sample were measured for 10 minutes with a Ag/AgCl combined electrode (Radiometer Analytical A/S, GK2401C) and a temperature sensor (Radiometer Analytical A/S, T901) connected to a high precision pH meter (Radiometer Analytical A/S, model PHM93). Tris and 2-Aminopyridine Buffers (Dickson and Goyet, 1994) were employed to calibrate pH electrodes. Calibrations were made at the beginning, middle and end of set of measurements for every station.

< Total Alkalinity>

Total Alkalinity samples were collected in 250ml polyethylene bottles with inner caps from Niskin-type water samplers and capped after an overflow of about 150ml of sea water. All samples were stored at room temperature after sampling and analyzed within a few hours. Samples were transferred into a glass titration cell using a 50ml transfer pipette and titrated at 25ºC± 0.1ºC with 0.1 M HCl containing 0.6M NaCl within 10 min. The electric potential and temperature of the sample were followed with a Ag/AgCl combined electrode (Radiometer Analytical A/S, GK2401C) and a temperature sensor (Radiometer Analytical A/S, T901) connected to a TitraLab^{TM} (Radiometer Analytical A/S) system. The titration was controlled automatically and the titration curve was analyzed with the inflection point titration method by the system. The precision of the method was determined to be ±0.0047mmol/kg (n=8) from replicate analysis of the Certified Reference Solutions (CRMs (batch 44) supplied by Dr. Andrew Dickson of Scripps Institution of Oceanography (SIO)). Standardization of the titrant (0.1 M HCl) was accomplished with Na_2CO_3 (99.99% pure; Asahi Grass) standards.

<Total dissolved inorganic carbon (T-CO_2)>

The T-CO_2 concentration in seawater samples were determined by using the coulometric titration system (UIC Inc., Carbon Coulometer model 5011) described by Jhonson et al. (1985) with the modified CO_2 extraction system described by Shitashima et al. (1996). Samples for T-CO_2 analysis were drawn from the Niskin samplers into 125ml glass vial bottles after an overflow of about 100ml of the sea water. The samples were immediately poisoned with 50μl of 50% saturated $HgCl_2$ in order to restrict biological alteration prior to sealing the bottles. All samples were stored at room temperature after sampling and analyzed within a few hours.

Seawater was introduced manually into the thermostated (25ºC±0.1ºC) measuring pipette with a volume of ~30ml by a pressurized headspace CO_2-free air that had been passed through the KOH scrubber. The measured volume was then transferred to the extraction vessel. The seawater sample in the extraction vessel was acidified with 1.5 ml of 3.8% phosphoric acid and the CO_2 was extracted from the sample for 10 minutes by bubbling with the CO_2-free air. After passing through the Ag_2SO_4 scrubber and polywool to remove sea salts and water vapor, the evolved CO_2 gas was continuously induced to the coulometric titration cell by the stream of the CO_2-free air. All reagents were renewed every day. The T-CO_2 concentration in seawater was calculated using a calibration carve constructed by measuring five to six different concentrations of dissolved Na_2CO_3 (99.99% pure; Asahi Grass) used as a standard solutions (Dickson and Goyet, 1994). The precision of the T-CO_2 measurements was tested by analyzing CRMs (batch 44) at the start of the measurement of samples every day. Figure 2 shows a comparison between the results of our shipboard measurements of these CRMs during the cruise and certified values provided by Dr. Andrew Dickson. Our shipboard measurements yielded a mean value of 1995.6±2.8 μmol/kg (n=40), which compares with 1997.6±1.4 μmol/kg (n=9) certified by SIO. We also prepared and analyzed sub-standards that were bottled into 125ml glass vial bottles from a 20l bottle of filtered and poisoned offshore surface water in order to check the condition of the system and the stability of measurements every day. The resulting standard deviation form replicate analysis of 19 sub-standards was ±1.8 μmol/kg.

<Sulfur hexafluoride (SF_6)>

SF_6 Sample was drawn from the Niskin samplers into 500ml DURAN glass bottles after an overflow of about 250ml of the sea water. The bottle was sealed tightly and stored at room temperature. The analysis of SF_6 will be carried out on land laboratory. The SF_6 gas in seawater is concentrated by a purge-and-trap method and measure by gas chromatography with electron capture detector. Seawater sample (480ml) is transferred into the extraction vessel and bubble (flow rate : 220ml/min) for 10 minuets with nitrogen gas in order to extract SF_6 gas from seawater and the SF_6 is trapped by using the Porapak Q (80-100μm) column. The column is heated at about 80ºC for disorption of SF_6 and the SF_6 is introduced to gas chromatography (HP 5890 series II, column : HP Molecular Sieve 5A (80-100μm) 30m x 0.53mm) and detecte with non-radioactive electron capture detector (VICI, Pulsed discharge Detector (ECD mode)).

<Nitrogen Oxide (N_2O)>

Samples for N_2O analysis were drawn from the Niskin samplers into 125ml glass vial bottles after an overflow of about 100ml of the sea water. The samples were immediately poisoned with 50μl of 50% saturated $HgCl_2$ in order to restrict biological alteration prior to sealing the bottles. All samples were stored in a refrigerator before measurement, and were analyzed within 12 hours of collection. The N_2O gas in seawater was measured by gas chromatography with electron capture detector on board. About 15ml of headspace gas (N_2) was introduced into a glass vial bottle by removing seawater with syringe. Subsequently, samples were stand in thermostatic water bath (40± 0.5ºC) for at least 2 hours in order to make a gas-liquid equilibration. The N_2O in headspeas gas was took with a gas syringe and injected to gas chromatograph (column : Molecular Sieve 5A 60/80 2m ×3Ø) with ^{63}Ni electron capture detector (SHIMADZU GC-14B ECD).

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3.15 Variability in the quantum yield of photochemistry in photosystemⅡ in the western and central equatorial Pacific.

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Objective

The spatial distribution of phytplankton and its productivity is highly variable and is largely controlled by geophysical factors.

In order to understand regional primary productivity in the ocean, it is important to evaluate phytoplankton physiological status and its correlation with environmental condition. In this cruise, we used Fast Repetition Rate (FRR) fluorometry (Kolber and Falkowski 1992) to examine the spatial variability in the quantum yield of photochemistry in photosystemⅡ(Fv/Fm) in natural phytoplankton communities in western equatorial Pacific, that indicates physiological characteristics and reflects environmental forcing of photosynthesis.

Method

FRR fluorometer exposes phytoplankton to a train of subsaturating blue-light flashes and measure the change in red light in vivo chlorophyll fluorescence from initial dark-adapted state(F0), when all functional PSⅡ reaction center are oxidized, to the light-saturated state(Fm), all PSⅡ reaction center have been photochemically reduced.

Normalized variable fluorescence(Fv=Fm-F0) by Fm, Fv/Fm, yields a quantitative measure of photochemical energy conversion efficiency in PSⅡ.

We deployed the submersible FRR fluorometer mounted on a 24-bottle CTD rosette at each station in the middle of the day.

Result

Vertical distribution of Fv/Fm in this cruise station are shown in Fig.1,2.

The open symbol represents the Fv/Fm measured in the light-exposed sample chamber, closed symbol represents one in the dark chamber.

In phytoplankton grown under nutrient-replete conditions, the maximal value of Fv/Fm is 0.65 and independent on growth irradiance (Kolber et al.1998).

The relatively low value of Fv/Fm in this study area appear to reflect low vertical supply of essential nutrients into euphotic zone.

We will evaluate the result obtained in this cruise in relation to other environmental parameters and estimate primary production from FRR data set.

Fig1.

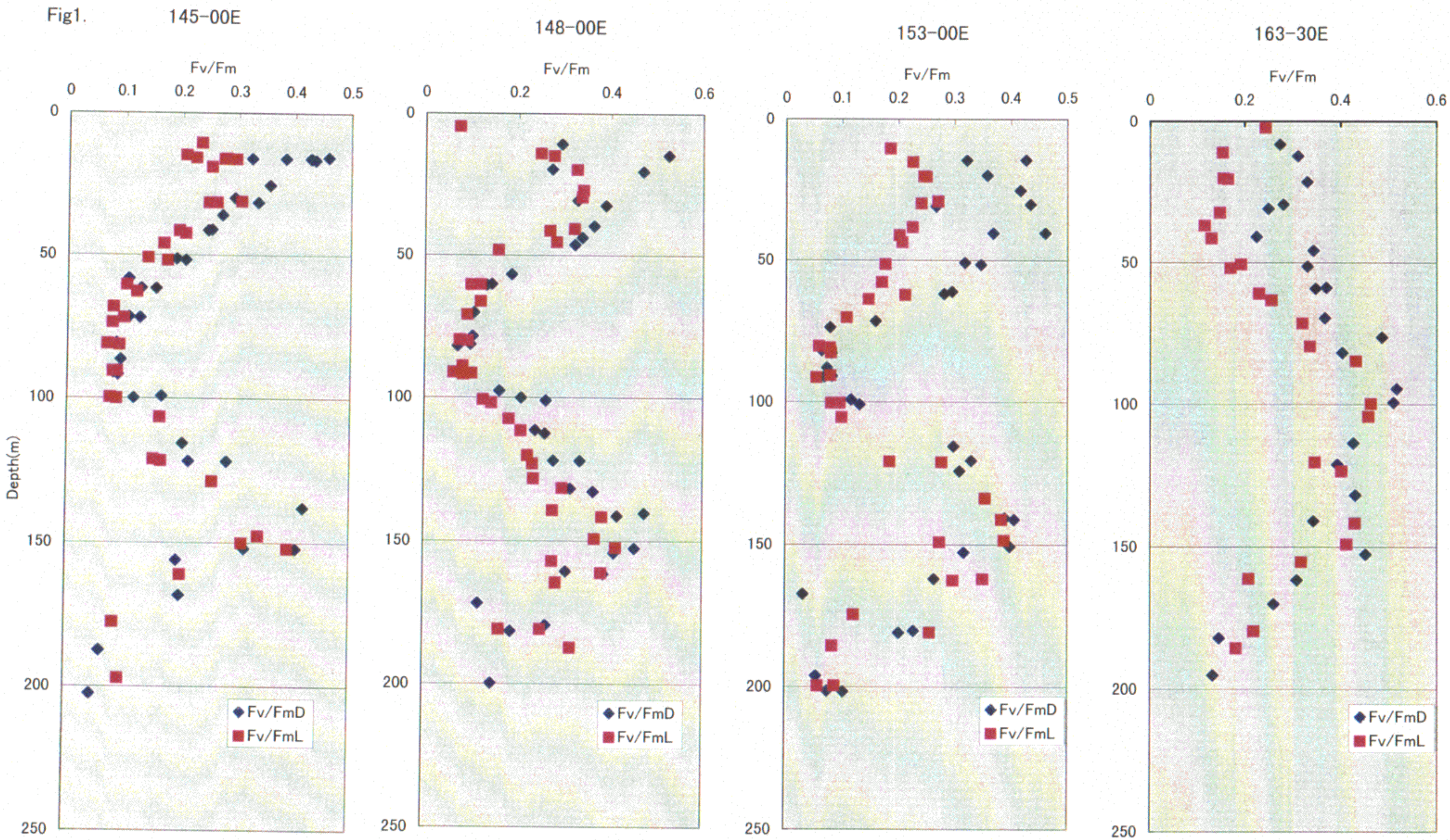
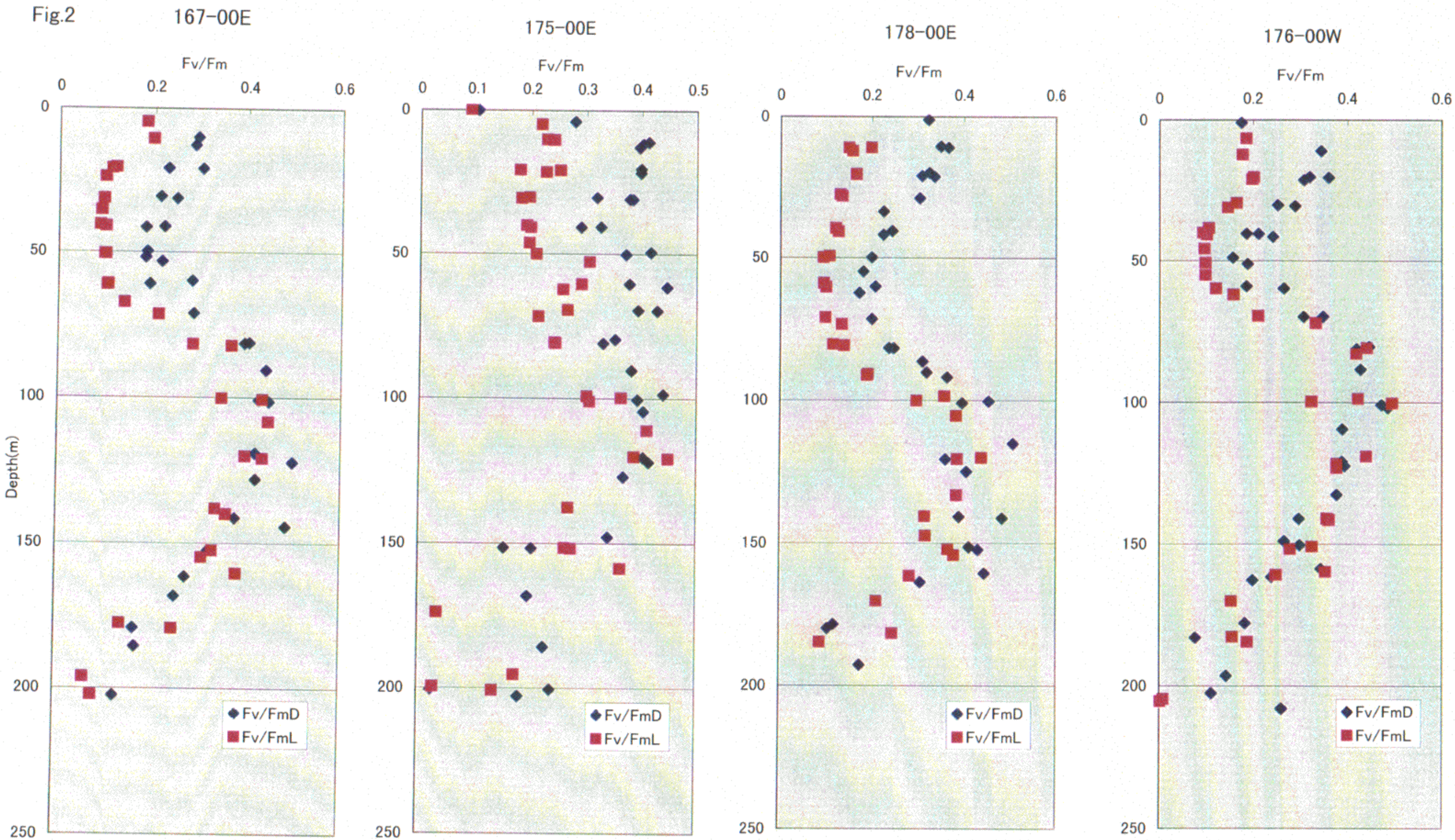

145-00E
148-00E
153-00E
163-30E
Fv/Fm
Depth(m)
0
0.1
0.2
0.3
0.4
0.5
0.6
50
100
150
200
250
Fv/FmD
Fv/FmL

Fig.2



3.16 Nitrogen uptake by natural phytoplankton in western equatorial Pacific.

Yoshihisa Mino
Institute for Hydrospheric-Atmospheric Sciences, Nagoya univ.

The spatial and temporal distribution of phytoplankton is largely governed by geophysical factors that affect the depth of the mixed layer, the vertical fluxes of essential nutrients and the distribution of PAR.

Especially nitrogenous nutrients supply has been inferred to limit primary productivity in the oligotrophic open ocean such as western equatorial Pacific.

In this cruise we measured the rate of nitrate uptake by natural phytoplankton in surface water by means of 15N tracer technique to examine the regional variability of uptake capacity.

Methods

Surface water samples were collected with a plastic bucket (St.6.9.12) before dawn and were immediately transferred to 500mL polycarbonate bottles after passage through a 200-um-mesh screen to exclude grazer.

Tracer experiments were conducted in temperature control incubator that maintained at SST, under constant illumination from a bank of daylight fluorescent lamps or in darkness.

After 2 hr pre-incubation in the light and dark, 15N-labeled KNO3(99.6 atm%) were added to each bottle. The concentrations of added 15N tracers were at five different levels, ranging from 0.10 to 4.00 ug-atoms N liter-1.

These samples were incubated for 12hr and the experiments were terminated by filtration onto pre-combusted 25mm GF/F Whatman filters which were stored frozen until analyses of PN and ^{15}N content.

Uptake rates of nitrate nutrients were calculated by equation of Dugdale and Goering (1967).

3.17 Studies on variation of carbon and nitrogen isotope ratios and biological processes in the equatorial Pacific

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NAGOYA UNIVERSITY

Objective

The hydrological and biological properties of the central equatorial Pacific are strongly contrasted with that of the western equatorial Pacific during the La-Nina event. Upwelling results in cooler surface water along equator in the central equatorial Pacific and higher biological productivity. On the other hand, the western equatorial Pacific is known to have warm surface water and low productivity. During this cruise, we attempt to evaluate the utilization of C and N isotope ratios as natural tracer for understanding the carbon and nitrogen cycling in the western and central equatorial Pacific.

Vertical distribution of isotopic composition of C and N

For the determination of ^{13}C and ^{15}N in particulate organic matter (PON) and ^{15}N in nitrate, 20litre seawater samples were collected from the surface to 200m with 20m interval at station2,3,4,6,9,10 and 12. Seawater samples for ^{15}N in nitrate were also collected at 6 layers from 300m to sea bottom at station2,3,6,9 and 12. These samples were filtered through precombusted Whatman GF/F filter(47mm diameter). After filtration, the filters were rinsed with particle free salt water and frozen at -20 degree until analyses of ^{13}C and ^{15}N in PON and 3liter filtered seawater samples were stored in glass bottles with addition of 4ml conc. HCl, for ^{15}N – nitrate.

Horizontal distribution of isotopic composition of C and N

For the determination of ^{13}C and ^{15}N in PON and ^{15}N in nitrate, 13litre surface seawater samples were pumped up from various location along the equator 3 times a day. Samples for ^{13}C and ^{15}N in PON and ^{15}N in nitrate were stored as described above.

Microbial remineralization of organic nitrogen and its transformation to nitrate

In order to estimate value of isotopic fractionation factor(ε) of nitrification process, a incubation experiment was carried out for 61days. Seawater samples were collected from 10 and 200m respectively in the sea and were transferred to polycarbonate bottles. These bottles stored in dark and cold(7-8℃)storage. For determination of concentration of nitrite and nitrate in the incubation bottles, the samplings were conducted periodically. Samples for analysis of isotopic composition of PON and nitrate were filtered thought precombusted Whatman and were stored as mentioned above.

Floating sediment trap experiment

The experiments were carried out at station2 and station12. Before deployment, the traps were cleaned and filled with filtered seawater (GF/F). Each sediment trap, which consisted of 8 cylinder of 65mm diameter, was deployed at 40, 60,80,100,120,140,160,180 and 200m depth for a period of 24 hour. After retrieval, the overlying seawater was siphoned off. A few intact zooplankton were found in the cup of the traps. They were assumed to have actively entered the traps and were removed by picking through the samples with careful visual inspection. Each bottom cup contents were transferred to bottles and stored frozen until further analyses for ^{13}C and ^{15}N in sinking PON.

3.18 Study on the distribution of coccolithophorids in the Pacific ocean

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2: Graduate School of Science, Hokkaido University

Introduction

The climate in Equatorial Western Pacific are characterized by the Asia Monsoonal changes and in a strong ENSO event, causing large shift in direction of surface currents and a seasonal variation in upwelling and downwelling. The effect of the monsoonal winds on the physical and chemical characteristics of the water masses has a direct biological response in the phytoplankton and the primary production.

Coccolithophorids are important constituents of the phytoplankton and are major contributed to transport inorganic carbon from sea surface to deep sea floor. These distribution and productivity are reflected in the topography and surface water current system. On the other hand, coccolithophorids preserved in deep-sea sediments carry information relating to paleoproductivity, paleoceanographical conditions in the surface waters and the historic influence of Asian Monsoon. Although the coccolithophorids are the most important calcium carbonate producing group in the marine environment, the coccolith content, floral change of the surface and subsurface samples from the Equatorial Western Pacific proved to be very low.

The purpose of this study is to investigate the biogeography and vertical distribution of the coccolithophorids between the western Pacific Warm Water Pool and normal equatorial Pacific water, and also the time progressive changes in these parameters associated with the development / disappearance of El Nino event.

Method

Samples from 10 to 11 layers were taken from the Stns. 1-12 (Table 1). Surface water samples were collected at intervals of 2 and 3 degrees between St. 12 and Hawaii, and between Hawaii and Japan (Table 2). Aboard ship 6-10 liters of seawater of the surface and sub-surface samples were filtered through 47 mm diameter, 0.45 m um pore size milipore filters by means of a vacuum pump. The filters were air dried one day and stored in plastic petri dishes.

In the laboratory we investigate the community and the flux of coccolithophorids.

Table 1. List of water samples for coccolithophorids

Filter No.	Station	Depth (m)	Volume (l)	Clorophyll max
1	1	0	6	
2		20	6	
3		40	6	
4		60	6	
5		70	6	
6		80	6	
7		100	6	
8		120	6	
9		140	6	
10		160	6	
11		200	6	
12		90	6	*
13	2	0	6	
14		20	6	
15		40	6	
16		60	6	
17		70	6	
18		80	6	
19		100	6	
20		120	6	
21		140	7	
22		160	7	
23		200	7	
24		90	6	*
25	3	0	6	
26		20	6	
27		40	6	
28		60	6	
29		80	6	
30		100	6	
31		120	6	
32		140	7	
33		160	7	
34		180	7	
35		200	7	
36		90	6	*
37	4	0	6	
38		20	6	
39		40	6	
40		60	6	
41		80	6	
42		100	6	
43		110	4.77	
44		140	7	
45		160	7	
46		180	7	
47		200	7	
48		90	6	*
49		0	10	
50		20	10	
51		40	10	
52		60	10	
53		80	10	
54		100	10	
55		140	9.77	
56		160	10	
57		180	10	
58		200	9.7	
59		90	10	*
60	5	0	6	
61		20	6	
62		40	6	
63		60	6	
64		80	6	
65		100	6	
66		120	6	
67		140	7	
68		160	7	
69		180	7	
70		200	7	
71		90	6	*
72	6	0	10	
73		20	10	
74		40	10	
75		60	10	
76		80	6	
77		100	10	
78		120	10	
79		140	10	
80		160	10	
81		180	10	
82		200	10	
83		90	10	*
84		0	6	
85		20	6	
86		40	6	
87		60	6	
88		80	6	
89		100	6	
90		120	7	
91		140	7	
92		160	7	
93		180	7	
94		200	7	
95		70	6	*
96	7	0	6	
97		20	6	
98		40	6	
99		60	6	
100		80	6	

Table 1. List of water samples for coccolithophorids

Filter No.	Station	Depth (m)	Volume (l)	Clorophyll max
101		100	6	
102		120	7	
103		140	7	
104		160	7	
105		180	7	
106		200	7	
107		50	6	*
108		0	10	
109		20	10	
110		40	10	
111		60	10	
112		80	10	
113		100	10	
114		120	10	
115		140	10	
116		160	10	
117		180	10	
118		200	10	
119		50	10	*
120	8	0	6	
121		20	6	
122		40	6	
123		60	6	
124		80	6	
125		100	6	
126		120	7	
127		140	7	
128		160	7	
129		180	7	
130		200	7	
131		50	6	*
132		0	9.15	
133		20	10	
134		40	10	
135		60	10	
136		80	10	
137		100	10	
138		120	10	
139		140	10	
140		160	10	
141		180	10	
142		200	10	
143		50	10	*
144	9	0	6	
145		20	6	
146		40	6	
147		60	6	
148		80	6	
149		100	6	
150		120	7	

Filter No.	Station	Depth (m)	Volume (l)	Clorophyll max
151		140	7	
152		160	7	
153		180	7	
154		200	7	
155		90	6	*
156	10	0	6	
157		20	6	
158		40	6	
159		60	6	
160		80	6	
161		100	6	
162		120	7	
163		140	7	
164		160	7	
165		180	7	
166		200	7	
167		90	6	*
168		0	9	
169		20	9	
170		40	10	
171		60	10	
172		80	10	
173		100	10	
174		120	10	
175		140	7	
176		160	7.5	
177		180	10	
178		200	10	
179		90	10	*
180	11	0	6	
181		20	6	
182		40	6	
183		60	6	
184		80	6	
185		100	6	
186		120	7	
187		140	7	
188		160	7	
189		180	7	
190		200	6.2	
191		50	6	*
192		0	9	
193		20	9	
194		40	10	
195		60	10	
196		80	10	
197		100	10	
198		120	10	
199		140	10	
200		160	10	

Table 1. List of water samples for coccolithophorids

Filter No.	Station	Depth (m)	Volume (l)	Clorophyll max
201		180	10	
202		50	10	*
203	12	0	6	
204		20	6	
205		40	6	
206		60	6	
207		80	6	
208		100	6	
209		120	7	
210		140	7	
211		160	7	
212		180	7	
213		200	7	
214		50	6	*

Table 2. List of surface water samples for coccolithopholids

sample No.	latitude	longitude	date	time (LST)
1	02-03.507N	169-01.109W	1.16.1999	10:33
2	03-45.677N	168-00.433W	1.16.1999	18:34
3	06-51.107N	166-13.767W	1.17.1999	8:24
4	09-04.692N	164-56.158W	1.17.1999	18:30
5	11-55.061N	163-17.299W	1.18.1999	8:35
6	13-58.820N	161-53.786W	1.18.1999	18:21
7	17-05.921N	160-17.545W	1.19.1999	8:27
8	18-59.597N	159-12.727W	1.19.1999	17:43
9	23-14.743N	158-49.194W	1.21.1999	18:09
10	25-00.965N	161-54.415W	1.22.1999	8:37
11	25-27.740N	164-30.817W	1.22.1999	18:03
12	27-12.855N	168-37.923W	1.23.1999	8:43
13	28-29.415N	171-01.671W	1.23.1999	18:09
14	30-31.475N	175-00.802W	1.24.1999	8:35
15	31-46.373N	177-28.600W	1.24.1999	18:04
16	33-42.889N	178-31.964E	1.26.1999	8:32
17	34-57.063N	175-53.424E	1.26.1999	18:06
18	36-39.397N	171-44.264E	1.27.1999	8:26
19	36-54.639N	168-50.216E	1.27.1999	18:05
20	38-38.944N	164-48.792E	1.28.1999	8:33
21	39-04.198N	161-45.730E	1.28.1999	18:09
22	39-44.842N	156-47.821E	1.29.1999	8:36
23	40-02.178N	153-38.847E	1.29.1999	17:59
24	40-20.963N	149-03.017E	1.30.1999	8:32
25	40-32.062N	146-25.797E	1.30.1999	18:14

3.19 Horizontal distribution of diatoms in the Equatorial Pacific

Hirofumi Asahi (Kyushu Univ.) and Naoki Fujitani (Kyushu Univ.)

Diatoms are well known as environmental indicators for temperature and salinity and live in surface sea-waters of the ocean. However their distributions are not well understood. Studies on their distribution patterns with environmental parameters will give us basical understandings for sedimentation and particle flux, which are indispensable for analyzing past and present climate signals. The main purpose of this study is to understand the surface-water distribution pattern of diatoms in the equatorial Pacific.

Surface water samples were collected from shipboard pump for 2*l* then filtered through Gelman filters (diameter: 25 mm, pore-size: 0.4 μm). These samples were taken at every 5 。 longitude at equator, all hydrographic stations, in the morning and the evening after following Station 12 in order to compare distribution patterns of planktonic foraminifera and coccoliths whose research were proceeded. These filtered samples are scheduled to be observed at Kyushu University.

3.20 Oxygen isotopic composition of sea water and planktonic foraminifera.

Makoto YAMASAKI and Rumiko TAZOE (Kumamoto University)

Objective:

Planktonic foraminifers have calcium carbonate tests. In this study, we aim to measure oxygen isotopic composition in the water, and compare oxygen isotope of sea water with that of planktonic foraminiferal tests.

Method:

We collected water samples in waters of 0-1000 m depth obtained from CTD-RMS casts (Shallow cast No. 3 and Deep cast) at the Stations where plankton tow samples were collected.

These water samples will be measured oxygen isotope in the laboratory.

Collected Sation：Stn 2 (5 °N, 140 °E), 3 (0 °N, 145 °E), 6 (0 °N, 160 °E), 9 (0 °N, 175 °E), 12 (0 °N, 170 °W)

3.21 Distribution of radiolaria and planktonic foraminifera

Naoki Fujitani (Kyushu Univ.), Makoto Yamasaki (Kumamoto Univ.), Hirofumi Asahi (Kyushu Univ.) and Rumiko Tazoe (Kumamoto Univ.)

Radiolarian and planktonic foraminifer taxa are known to live in various depths of the mesopelagic and epipelagic zones. Only few attempts have so far, however, been made at a study of habitat depths. Knowledge on the depth habitats is crucial in comprehensive understanding of past climate change involving studies of particle flux and sediment core analyses. The main purpose of this study is to clarify radiolarian and planktonic foraminiferal vertical and horizontal distribution patterns along the Equator in the western Pacific, where the Western Warm Water Pool (SST > 28 °C) line in non El Niño situation.

Plankton samples were collected using a closing type plankton net (diameter: 1 m, length: 4.5 m, mesh size: 63 µm). This net can be closed at a designate depth by sending a messenger while towing upward, and hence a sample of discrete depth-interval can be obtained. Samples were preserved at 4 % buffered formalin solution with Rose Bengal, which was buffered to pH 7.6 with sodium borate. Sampled intervals can be categorized in two types. The first type includes: 0-10 m, 10-30 m, 30-50 m, 50-75 m, 75-100 m, 100-125 m, 125-150 m, 150-200 m, 200-500 m and 500-1000 m for Station 2. The second type includes: 0-40 m, 40-80 m, 80-120 m, 120-160 m, 160-200 m and 200-500 m for Station 3, 6, 9, 12 and 500-1000 m except for Station 9 and 12, 500-750 m for Station 9.

Identification and counting of samples will be proceeded in shore laboratories.

3.22 Distribution of planktonic foraminifera in the surface water.

Yuichiro TANAKA (Geological Survey of Japan), Makoto YAMASAKI and Rumiko TAZOE (Kumamoto University)

Objective:

As we hope to understand the oceanographic environmental changes by using planktonic foraminifers, we must know the geographic distribution. The oxygen isotope ratios in the foraminiferal tests should reflect the $d^{18}O$ values of the seawater and its temperature. Steens et al. (1992) indicated when strong upwelling drives *Neogloboquadrina dutertrei* to the surface, the two species (*Globigerina bulloides* and *N. dutertrei*) will build their tests in the same waters and the difference of $d^{18}O$ of the two species will become smaller, whereas in non-upwelling areas the species have different depth habitats in a stratified water column and the difference of $d^{18}O$ of the two species will be larger.

The purposes of this study are : (1) to reveal the distribution pattern of planktonic foraminifera in the surface water in the Pacific Ocean; (2) to investigate the intensity of upwelling or downwelling in the western Pacific Ocean by measuring the difference of oxygen isotope values of foraminiferal tests.

Method:

Plankton samples were collected throughout the voyage (Table 1). A continuous set of samples was obtained by surface water pomp equipped on the R/V MIRAI. The samples were filtered 1-2 m^3 of seawater through the 75 μm seive in morning and/or evening, and were preserved in about 20 % alcohol.

The planktonic foraminiferal samples will be identified each species and counted in the laboratory. Then, the shell of these specimens will be measured oxygen isotope.

3.22 Sediment trap mooring

A. SHIMAMOTO[1)], Y. Tanaka[2)]

1) Kansai environmental engineering center Co. Ltd.
Envieonmental chemistry department ocean environmental survey team
2) Geological Survey of Japan

OBJECT

We are planning next items about how to use collected settling particles.

A) Total mass flux and main component

To analyze total mass flux and main component (Opal, Carbonate, Organic carbon, Organic nitrogen).

B) Carbonate flux by calcareous nannoplankton.

To analyze seasonal varieties of the coccolith species, and annual and vertical changes of the coccolith flux.

C) Planktonic foraminifera flux.

To analyze planktonic foraminifera flux, and the dissolution process of settling foraminiferal shell in the water column.

D) Flux of silicoplankton (1.Diatom, 2.Radiolaria, 3.Silicofragellate, 4.Silicodinofragellate)

To estimate vertical flux of the carbon and silica based on that analyzing each species flux of the time-series settling particles.

E) Radio-nuclide (U-238, Th-230, Pa-231, Pu-239+240, Pb-210, Po-210, etc.)

To consider that settling particle flux, and horizontal and vertical transport process.

METHOD & RESULT

We deploy six systems of the sediment trap mooring arrays for about one year. The detailed data is followed as next table. All of used the sediment trap and releaser are SMD26S-6000 and Model-L (Nichiyu-Giken Co. Ltd.). The sampling layer of mooring array is about 1 and 2 or 3 km depth.

We made preservative compounded seawater filtered with 0.6μm nuclepore filter for formalin neutralized with sodium tetraborate. Each collecting interval is divided a month the first and latter half. Most of sampling schedule is synchronized.

Station	1	2	3	6	9	12
Start time (LST)	1998/12/31 8:20	1999/1/2 6:11	1999/1/4 8:00	1999/1/8 6:18	1999/1/12 6:15	1999/1/15 7:00
Mooring start point	3-58.166N 134-57.840E 4,762m	5-04.950N 140-07.408E 4,175m	00-00.752S 144-59.929E -----m	00-04.371N 159-58.713E 2,834m	00-02.280N 174-55.561E -----m	00-02.25S 170-10.78W -----m
End time (LST)	1998/12/31 10:19	1999/1/2 7:44	1999/1/4 9:20	1999/1/8 7:40	1999/1/12 7:54	1999/1/15 8:47
Deployed anchor point	4-02.911N 135-00.019E 4,762m	5-03.615N 140-06.329E 4,174m	00-00.843S 145-01.580E 3,680m	00-02.808N 159-57.127E 2,802m	00-02.343N 174-56.432E 4,828m	00-02.31S 170-09.71W 5,686m
Collecting layer	970m 2,940m	1,000m 2,970m	1,020m 2,060m	970m 2,010m	1,040m 3,000m	1,020m 3,090m
Start time (JST)	1999/1/1 1:00	1999/1/3 1:00	1999/1/5 1:00	1999/1/9 1:00	1999/1/13 1:00	1999/1/17 1:00
End time (JST)	1999/11/21 1:00				1999/12/1 1:00	
Interval	c.a. 15days (see next time table)					
Preservative	Seawater and formalin neutralized with sodium tetraborate					
Recovery	MR99-K07					

Sampling schedule (JST)

Event #	Station. 1	Station. 2	Station. 3	Station. 6	Station. 9	Station. 12
1	1999/1/1 1:00	1999/1/3 1:00	1999/1/5 1:00	1999/1/9 1:00	1999/1/13 1:00	No sample
2	1999/1/16 1:00					1999/1/17 1:00
3	1999/2/1 1:00					
4	1999/2/16 1:00					
5	1999/3/1 1:00					
6	1999/3/16 1:00					
7	1999/4/1 1:00					
8	1999/4/16 1:00					
9	1999/5/1 1:00					
10	1999/5/16 1:00					
11	1999/6/1 1:00					
12	1999/6/16 1:00					
13	1999/7/1 1:00					
14	1999/7/16 1:00					
15	1999/8/1 1:00					
16	1999/8/16 1:00					
17	1999/9/1 1:00					
18	1999/9/16 1:00					
19	1999/10/1 1:00					
20	1999/10/16 1:00					
21	1999/11/1 1:00					
22	1999/11/16 1:00					
23	1999/11/21 1:00				1999/12/1 1:00	

3.23 Bio-optical measurement

Marlon Lewis, Cyril Dempsy, Gary Maillet
Dalhousie University

Introduction.

This report is a preliminary description of measurements taken by Dalhousie University and the Japan Marine Science and Technology Center (JAMSTEC) aboard the R/V Mirai, operated by JAMSTEC, on cruise Mirai 98K02, from 29 December, 1998 to 20 January, 1999, from Koror, Republic of Palau, to Honolulu, Hawaii. In addition to the description of protocols and sampling specifics, some initial data analysis is presented. The work reported herein has been supported by the Canadian NSERC, NASA, NASDA, and JAMSTEC.

Overall Objectives

The overall scientific objectives are to establish the magnitude and variability of certain processes that are responsible for the fluxes of heat, nitrogen, and carbon in the western equatorial Pacific Ocean. This cruise represents the sixth in an ongoing collaboration between Dalhousie University and JAMSTEC to examine the physical, chemical and biological variability in this large and important region. A further objective is to provide vicarious calibration and validation of visible band, satellite imaging spectrometers ("ocean color sensors") operated by the United States (SeaWiFS) and Japan (OCTS).

Cruise Track

The ship departed from Koror, Republic of Palau (7.5N, 136E) at 1400 on 29 December, 1998, and traversed a track intersecting the equator at longitude 145E. Two stations were occupied prior to arrival on the equator. A line of stations was taken along the equator to approximately 170W. The ship then transited to berth in Honolulu, Hawaii on the morning of 20th January, 1999.

Specific Measurements

(1) SeaWiFS Profiling Multichannel Radiometer.

Objectives:

This instrument suite is used for the derivation of the penetration of visible light in the ocean, and for determination of the vertical distribution of apparent optical properties for comparison with in-situ pigment measurements. The precise, multispectral vertical profiles permit the computation of the net energy flux in the vertical associated with visible light. It also provides a means to validate ocean color satellites measuring upwelling radiance fields at the same bands as those used in this instrument.

Methodology

The primary instrument deployed was the SeaWiFS Profiling Multichannel Radiometer System SPMR (Satlantic Inc.) . It consists of two separate instrument packages. The first instrument floats with an irradiance sensor just above the water surface. This instrument is known as reference. The second instrument profiles in a free-fall mode through the water column (profiler). The profiler carries both a 13 channel irradiance sensor (looking up), and a 13 channel radiance sensor (looking down), as well as tilt, and instrument temperature sensors. The reference carries a 13 channel irradiance sensor (looking up. The profiler is also configured with a sensor package for the measurement of water temperature and pressure.

The SPMR was deployed once per station throughout the cruise, near 1200 local time in order to coincide with the overflight of the SeaWiFS instrumet. Usually, two vertical profile were taken at each deployment to a depth of 200 meters.

Sampling

Stations were occupied periodically along the equator, and are given sequential station numbers as per the following table describing the casts made:

Raw File Name	Cast Letter	Julian Day	Time Local	Time UTC	Latitude	Longitude
M980201	B	365	13:09	04:09	04 03.3 N	135 01.31 E
M980201	C	365	13:17	04:17	04 03.3 N	135 01.31 E
M980202	A	002	11:05	02:05	05 02.0 N	140 05.80 E
M980202	B	002	11:12	02:12	05 02.0 N	140 05.80 E
M980203	A	004	12:02	02:02	0 N	145 00.00 E
M980203	B	004	12:14	02:14	0 N	145 00.00 E
M980204	A	005	12:20	02:20	0 N	147 53.20 E
M980204	B	005	12:28	02:28	0 N	147 53.20 E
M980205	A	006	11:52	01:52	0 N	153 15.90 E
M980206	A	008	11:27	00:27	0 N	160 00.00 E
M980206	B	008	11:36	00:36	0 N	160 00.00 E
M980207	A	009	12:31	01:31	00 00.2 N	163 35.70 E
M980207	B	009	12:39	01:39	00 00.2 N	163 35.70 E
M980208	A	010	11:40	00:40	00 00.45 N	168 59.00 E
M980209	A	012	11:30	23:30	00 00.40 N	174 54.60 E
M980209	B	012	11:38	23:38	00 00.40 N	174 54.60 E
M980210	A	013	11:40	23:40	00 00.40 S	178 47.00 E
M980210	B	013	11:50	23.50	00 00.40 S	178 47.00 E
M980211	A	013	11:52	23:52	00 00.10 S	176 17.7 W
M980211	B	013	12.01	00.01	00 00.10 S	176 17.7 W
M980212	A	015	11:40	00:40	00 03.30 S	170 11.22 W
M980212	B	015	11:52	00:52	00 03.30 S	170 11.22 W

Data Processing To Date

In what follows, detailed descriptions of data gathered with the optical instruments are presented, as well as description of derived data products. All data will be made publicly available on *raptor.ocean.dal.ca*, directory ftp/pub/mirai98k02.

A summary of data processing steps carried out so far is given in the below:

MR98K02 Processing Notes

Raw File Name	Cast letter	pro	ref	bin	par	K	lwn	Ave Pro tilts	Ave Ref tilts	Wave Height (M)
M980201	B	X	X	X				1.82	19.5	1.5
M980201	C	X	X	X	X	X	X	1.80	19.5	1.5
M980202	A	X	X	X				1.98	15.8	1
M980202	B	X	X	X	X	X	X	1.96	15.9	1
M980203	A	X	X	X				1.61	8.10	< 1
M980203	B	X	X	X	X	X	X	1.60	10.2	< 1
M980204	A									< 1
M980204	B									< 1
M980205	A	X	X	X	X	X	X	1.49	7.72	1
M980206	A	X	X	X	X	X	X	1.38	9.2	1 - 2
M980206	B	X	X	X		X		1.40	15.2	1 - 2
M980207	A	X	X	X	X	X	X	1.60	7.30	1 - 2
M980207	B	X	X	X		X		1.58	8.90	1 - 2
M980208	A	X	X	X	X	X	X	1.63	16.6	1 - 2
M980209	A	X	X	X	X	X	X	1.72	20.6	1
M980209	B	X	X	X		X		1.79	19.7	1
M980210	A	X	X	X		X		1.32	14.4	1 – 2
M980210	B	X	X	X	X	X	X	1.43	16.7	1 – 2
M980211	A	X	X	X	X	X	X	1.90	17.9	1 – 2
M980211	B	X	X	X		X		1.93	18.3	1 – 2
M980212	A	X	X	X	X	X	X	1.93	27.9	2
M980212	B	X	X	X		X		1.94	26.2	2

Data Products

SPMR/SMSR Data File Naming Conventions Used:

M9802ssc.RAW - LEVEL1 raw binary data

M9802ssc.DAT - LEVEL2 file produced by ASCIICON (Lw files only)

M9802ssc.PRO - profiler LEVEL2 file produced by ProSoft (PRO012g.CAL)

M9802ssc.REF - reference LEVEL2 file produced by ProSoft (use cal file REF012e.CAL)

M9802ssc.BIN - LEVEL3C binned data (1m bins)

Available data products:

M9802ssc.K - diffuse attenuation coefficients from Ed and Lu
M9802ssc.RFL - reflectance (Eu/Ed)
M9802ssc.RRS - remote sensing reflectance (Lu/Ed)
M9802ssc.LWN - normalized water leaving radiances
M9802ssc.PIG - pigment profile estimates
M9802ssc.FLX - energy fluxes
M9802ssc.PAR - photosynthetically available radiation (also has % light levels)

Where:

M9802 refers to this cruise.
ss = station number (ie 01, 02 ,03, etc)
c = profiler cast letter (ie A, B, C, etc)

File Formats (SPMR/SMSR Data)

- LEVEL 1 Data

All **.RAW** files are coded in binary and can only be read by ProView or ASCIICON.

- LEVEL 2 Data

.PRO files are (large) ASCII files which contain only the data from the profiler instrument (SPMR). The data is tab delineated and can be read directly into EXCEL. Check the file name (as listed above) to see if the file is the full data set or an edited one if you are trying to align the records. The file has a series of header records (which start with SATHDR) which contain various parameters which are used by ProSoft in data processing. The record beginning with # contains the id for each column in the file. Time is not directly available in this data set but can be easily calculated using the header record SATHDR START_TIME hh.hhhhhh (where hh.hhhhhh is in decimal hours) which represents the time the first record was written. Time for each record can be calculated for each record using

REC_TIME = REC_NUM*(1 / RATE / 3600) + START_TIME

where RATE=6.000Hz

Column #	Column	ID	Units	Description
1	A	Lu406.2	UW/cm2/nm/sr	Profiler Upwelling Radiance
2	B	Lu412.2	UW/cm2/nm/sr	Profiler Upwelling Radiance
3	C	Lu442.7	UW/cm2/nm/sr	Profiler Upwelling Radiance
4	D	Lu469.9	UW/cm2/nm/sr	Profiler Upwelling Radiance
5	E	Lu489.2	UW/cm2/nm/sr	Profiler Upwelling Radiance
6	F	Lu509.7	UW/cm2/nm/sr	Profiler Upwelling Radiance
7	G	Lu519.8	UW/cm2/nm/sr	Profiler Upwelling Radiance
8	H	Lu554.7	UW/cm2/nm/sr	Profiler Upwelling Radiance
9	I	Lu565.1	UW/cm2/nm/sr	Profiler Upwelling Radiance
10	J	Lu619.4	UW/cm2/nm/sr	Profiler Upwelling Radiance
11	K	Lu665.8	UW/cm2/nm/sr	Profiler Upwelling Radiance
12	L	Lu670.3	UW/cm2/nm/sr	Profiler Upwelling Radiance
13	M	Lu683.7	UW/cm2/nm/sr	Profiler Upwelling Radiance
14	N	Ed406.2	UW/cm2/nm	Profiler Downwelling Irradiance
15	O	Ed411.9	UW/cm2/nm	Profiler Downwelling Irradiance
16	P	Ed442.4	UW/cm2/nm	Profiler Downwelling Irradiance
17	Q	Ed470.3	UW/cm2/nm	Profiler Downwelling Irradiance
18	R	Ed490.0	UW/cm2/nm	Profiler Downwelling Irradiance
19	S	Ed509.7	UW/cm2/nm	Profiler Downwelling Irradiance
20	T	Ed519.9	UW/cm2/nm	Profiler Downwelling Irradiance
21	U	Ed554.5	UW/cm2/nm	Profiler Downwelling Irradiance
22	V	Ed565.4	UW/cm2/nm	Profiler Downwelling Irradiance
23	W	Ed619.4	UW/cm2/nm	Profiler Downwelling Irradiance
24	X	Ed665.1	UW/cm2/nm	Profiler Downwelling Irradiance
25	Y	Ed669.9	UW/cm2/nm	Profiler Downwelling Irradiance
26	Z	Ed683.9	UW/cm2/nm	Profiler Downwelling Irradiance
27	AA	PRES	M	depth (negative number)
28	AB	LUDARK	Counts	radiance dark diode
29	AC	EDDARK	Counts	irradiance dark diode
30	AD	TW	C	external water temperature
31	AE	TI	C	internal irrad sensor temperature
32	AF	TR	C	internal rad sensor temperature
33	AG	TILTX	deg	profiler X axis tilt
34	AH	TILTY	deg	profiler Y axis tilt
35	AI	Frame	counts	frame counter 0..255

.REF files are (large) ASCII files which contain only the data from the reference instrument (SMSR). The data is tab delineated and can be read directly into EXCEL. Check the file name (as listed above) to see if the file is the full data set or an edited one if you are trying to align the records. The file has a series of header records (which start with SATHDR) which contain various parameters which are used by ProSoft in data processing. The record beginning with # contains the id for each column in the file. Time is not directly available in this data set but can be easily calculated using the header record SATHDR START_TIME hh.hhhhhh (where hh.hhhhhh is in decimal hours) which represents the time the first record was written. Time for each record can be calculated for each record using

REC_TIME = REC_NUM*(1 / RATE / 3600) + START_TIME

where RATE=6.000Hz

Column #	Column	ID	Units	Description
1	A	Es406.4	uW/cm2/nm	Reference Downwelling Irradiance
2	B	Es411.6	uW/cm2/nm	Reference Downwelling Irradiance
3	C	Es442.6	uW/cm2/nm	Reference Downwelling Irradiance
4	D	Es470.1	uW/cm2/nm	Reference Downwelling Irradiance
5	E	Es490.1	uW/cm2/nm	Reference Downwelling Irradiance
6	F	Es509.7	uW/cm2/nm	Reference Downwelling Irradiance
7	G	Es519.1	uW/cm2/nm	Reference Downwelling Irradiance
8	H	Es554.9	uW/cm2/nm	Reference Downwelling Irradiance
9	I	Es565.9	uW/cm2/nm	Reference Downwelling Irradiance
10	J	Es619.5		
11	K	Es666.0	uW/cm2/nm	Reference Downwelling Irradiance
12	L	Es669.8	uW/cm2/nm	Reference Downwelling Irradiance
13	M	Es682.5	uW/cm2/nm	Reference Downwelling Irradiance
14	N	PRES	m	NO PRESSURE DATA
15	O	EVDARK	counts	NO DATA
16	P	ESDARK	counts	irradiance dark diode
17	Q	TW	C	NO DATA
18	R	TI	C	internal irrad sensor temperature
19	S	TR	C	NO DATA
20	T	TILTX	deg	Reference X axis tilt
21	U	TILTY	deg	Reference Y axis tilt
22	V	Frame	counts	frame counter 0..255

LEVEL3 Data

.BIN files are ASCII files which contain binned data from both the profiler and the reference. The data is tab delineated and can be read directly into EXCEL. The binning interval for these files is usually one meter. .BIN file records are usually only computed for records in which the profiler orientation is acceptable, however when the profiler is not under its own freefall descent, records in t he middle of the cast may be contaminated. It is prudent to check the tilt column if the data look unusual (tilts greater the 2-3 degrees are to be used with caution, above 5 are not accepatble) Since this does not normally occur when the profiler is under its own descent, ProSoft does not flag it. The file has a series of header records (which start with SATHDR) which contain various parameters which are used by ProSoft in data processing. Note that there are three processing levels for .BIN data, check the header records for SATHDR PROCLVL 3x.

3A = binned data (no corrections)

3B = binned data with surface reference fluctuation corrections

3C = binned data with Ed/Lu depth corrections (ie Lu data shifted up to Ed sensor)

Only PROCLVL 3C data should be used.

The record beginning with # contains the id for each column in the file.

Column #	**Column**	ID	Units	Description
1	A	Time	decimal hours	bin time
2	B	Pres	meters	depth (negative)
3	C	Lu406.2	uW/cm2/nm/sr	Profiler Upwelling Radiance
4	D	Lu412.2	uW/cm2/nm/sr	Profiler Upwelling Radiance
5	E	Lu442.7	uW/cm2/nm/sr	Profiler Upwelling Radiance
6	F	Lu469.9	uW/cm2/nm/sr	Profiler Upwelling Radiance
7	G	Lu489.2	uW/cm2/nm/sr	Profiler Upwelling Radiance
8	H	Lu509.7	uW/cm2/nm/sr	Profiler Upwelling Radiance
9	I	Lu519.8	uW/cm2/nm/sr	Profiler Upwelling Radiance
10	J	Lu554.7	uW/cm2/nm/sr	Profiler Upwelling Radiance
11	K	Lu565.1	uW/cm2/nm/sr	Profiler Upwelling Radiance
12	L	Lu619.4	uW/cm2/nm/sr	Profiler Upwelling Radiance
13	M	Lu665.8	uW/cm2/nm/sr	Profiler Upwelling Radiance
14	N	Lu670.3	uW/cm2/nm/sr	Profiler Upwelling Radiance
15	O	Lu683.7	uW/cm2/nm/sr	Profiler Upwelling Radiance
16	P	Ed406.2	uW/cm2/nm	Profiler Downwelling Irradiance
17	Q	Ed411.9	uW/cm2/nm	Profiler Downwelling Irradiance
18	R	Ed442.4	uW/cm2/nm	Profiler Downwelling Irradiance
19	S	Ed470.3	uW/cm2/nm	Profiler Downwelling Irradiance
20	T	Ed490.0	uW/cm2/nm	Profiler Downwelling Irradiance
21	U	Ed509.7	uW/cm2/nm	Profiler Downwelling Irradiance
22	V	Ed519.9	uW/cm2/nm	Profiler Downwelling Irradiance
23	W	Ed554.5	uW/cm2/nm	Profiler Downwelling Irradiance
24	X	Ed565.4	uW/cm2/nm	Profiler Downwelling Irradiance
25	Y	Ed619.4	uW/cm2/nm	Profiler Downwelling Irradiance
26	Z	Ed665.1	uW/cm2/nm	Profiler Downwelling Irradiance
27	AA	Ed669.9	uW/cm2/nm	Profiler Downwelling Irradiance
28	AB	Ed683.9	uW/cm2/nm	Profiler Downwelling Irradiance
29	AC	LUDARK	Counts	Dark Counts, Lu
30	AD	EDDARK	Counts	Dark Counts, Ed
31	AE	TW	C	pro external water temperature
32	AF	TI	C	pro internal irrad sensor temp
33	AG	TR	C	pro internal rad sensor temperature
34	AH	TILTX	deg	profiler X axis tilt
35	AI	TILTY	deg	profiler Y axis tilt
36	AJ	Frame	counts	profiler frame counter 0..255
37	AK	Cond	mmho/cm	NO DATA
38	AL	Fluor	Ug/l	NO DATA
39	AS	Ptilt	deg	profiler vector tilt
40	AT	Vel	m/sec	freefall velocity (+ve down)
41	AU	Es406.4	uW/cm2/nm	Reference Downwelling Irradiance
42	AV	Es411.6	uW/cm2/nm	Reference Downwelling Irradiance

43	AW	Es442.6	uW/cm2/nm	Reference Downwelling Irradiance
44	AX	Es470.1	uW/cm2/nm	Reference Downwelling Irradiance
45	AY	Es490.1	uW/cm2/nm	Reference Downwelling Irradiance
46	AZ	Es509.7	uW/cm2/nm	Reference Downwelling Irradiance
47	BA	Es519.1	uW/cm2/nm	Reference Downwelling Irradiance
48	BB	Es554.9	uW/cm2/nm	Reference Downwelling Irradiance
49	BC	Es565.9	uW/cm2/nm	Reference Downwelling Irradiance
50	BD	Es619.5		
51	BE	Es666.0	uW/cm2/nm	Reference Downwelling Irradiance
52	BF	Es669.8	uW/cm2/nm	Reference Downwelling Irradiance
53	BG	Es682.5	uW/cm2/nm	Reference Downwelling Irradiance
55	BH	PRES	depth (meters)	reference depth (-ve)
56	BI	LsDARK	counts	Reference radiance dark diode
57	BJ	EsARK	counts	Reference irradiance dark diode
58	BK	TW	C	NO DATA
59	BL	TI	C	ref internal irrad sensor temp
60	BN	TILTX	deg	Reference X axis tilt
61	BO	TILTY	deg	Reference Y axis tilt
62	BP	Frame	counts	Reference frame counter 0..255
63	BY	Rtilt	deg	Reference vector tilt

LEVEL4 Data

.PAR files are ASCII files which contain binned data from the profiler irradiance sensor integrated to calculate quanta/cm^2/sec. The file also gives, in the comments, various selected % light levels which are referenced to the surface reference irradiance values. The data is tab delineated and can be read directly into EXCEL. The binning interval for these files is usually one meter. The file has a series of header records (which start with SATHDR) which contain various parameters which are used by ProSoft in data processing.

The record beginning with # contains the id for each column in the file.

Column #	Column	ID	Units	Description
1	A	Depth	meters	depth
2	B	SPAR	quanta/cm^2/sec	PAR at reference
3	C	PAR(0+)	quanta/cm^2/sec	PAR above sea surface
4	D	PPAR	quanta/cm^2/sec	PAR at profiler
5	E	%light	%	percent light level

.K files are ASCII files which contain binned data from the profiler optical sensors which have been used to calculate the attenuation coefficients Kd and Ku for each wavelength using the Smith and Baker method. The data is tab delineated and can be read directly into EXCEL. The binning interval for these files is usually one meter. The file has a series of header records (which start with SATHDR) which contain various parameters which are used by ProSoft in data processing.

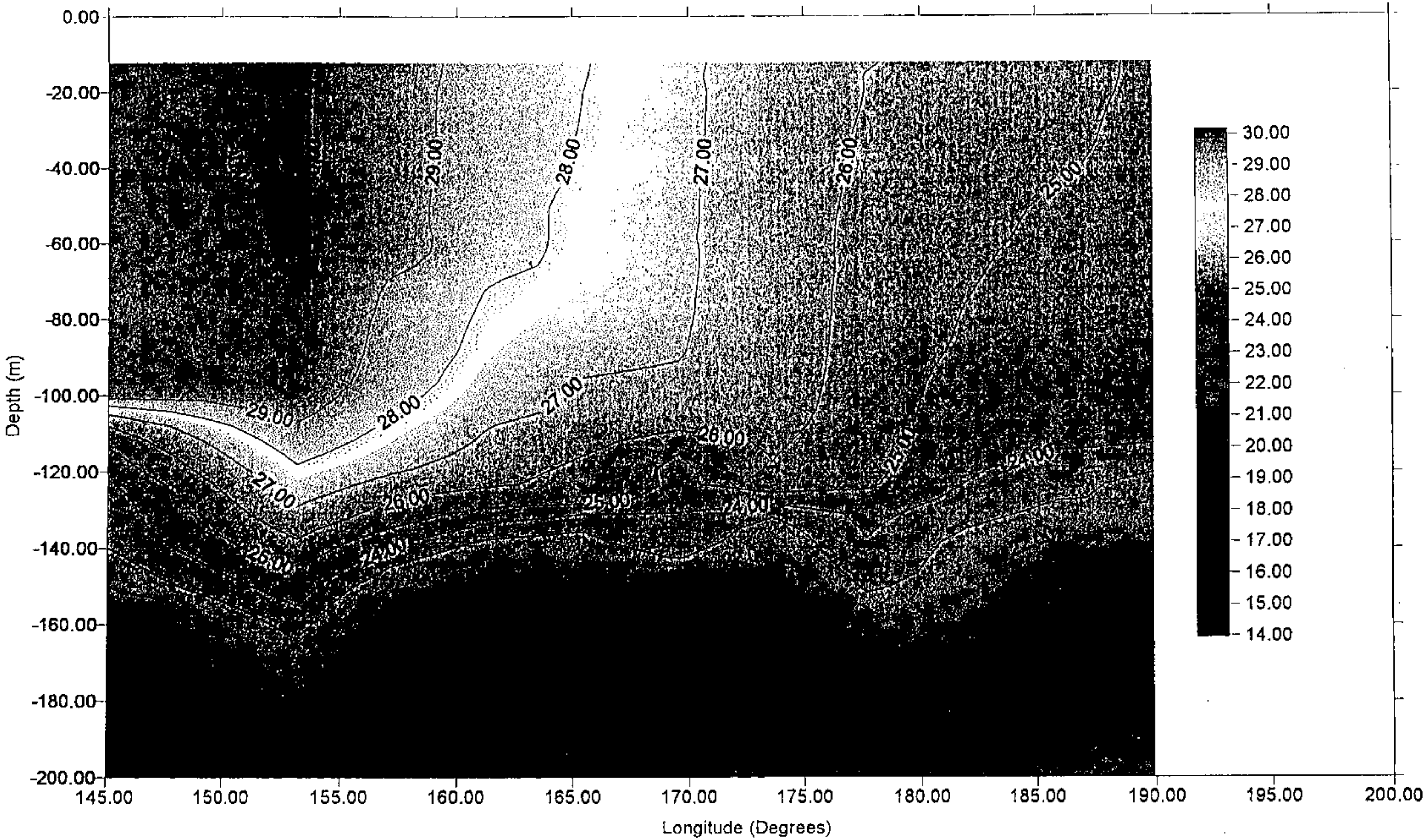
Note that the first few bins of the profile have a K of zero, as does the end of the profile. These values are considered invalid. The first computed K value is at the start of the profile plus NUM_K_BINS/2. The ones before this are zero so the rows match up with other binned and LEVEL4 products. The bottom of the profile is set to zero when a minimum threshold of Ed or Lu is detected. This is only an estimate for general cases so it is possible the the K values in the file near the bottom are not valid and should be checked before using them. Often if the darks used were too high, the K profile will shoot off to infinite K. If the darks used were too low, the K profile may drop below the value for pure water at the end of the cast (it may also go to zero).Also the PAR profiles should be checked before using a K profile. A 'bump' in the PAR reference profile indicates that a cloud passed during the cast which imparts a characteristic high spike and then a low spike in the K profile.

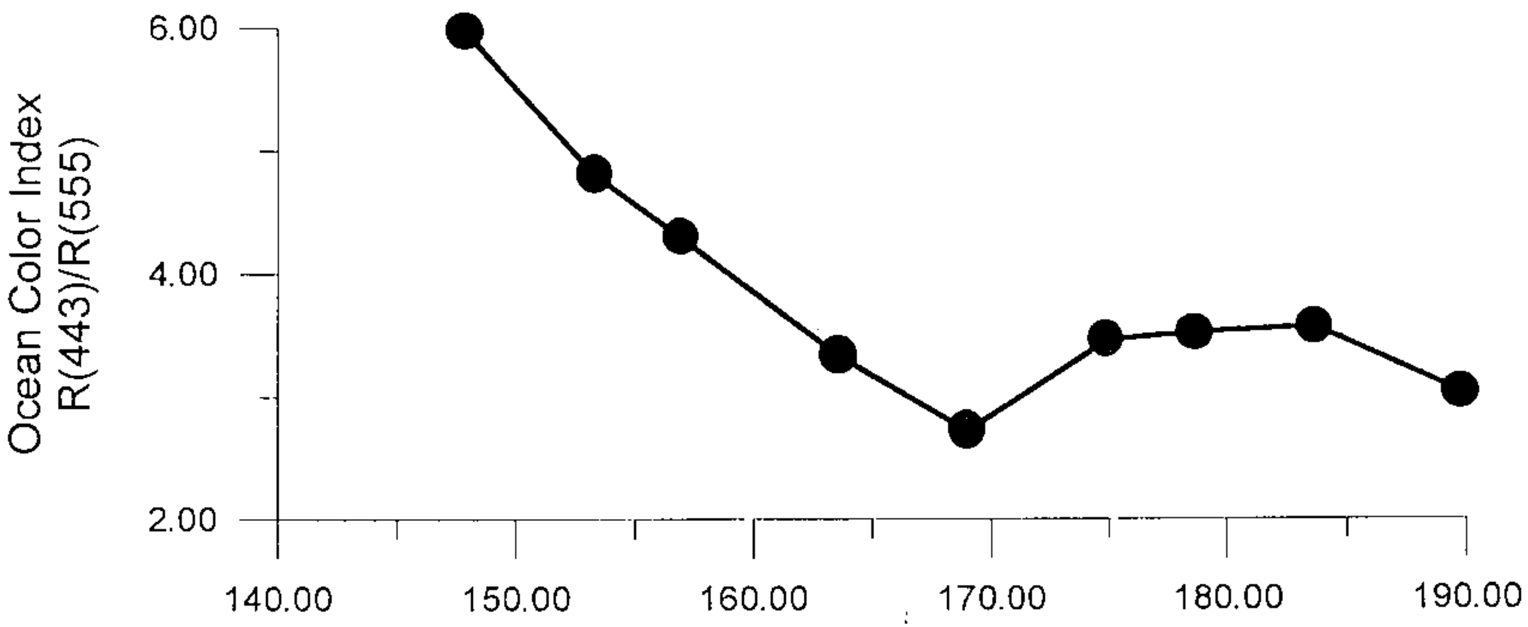
The record beginning with # contains the id for each column in the file.

Column #	Column	ID	Units	Description
1	A	Depth	meters	Depth
2	B	Kd406.2	/meter	downwelling diffuse attenuation coeff
3	C	Kd411.9	/meter	downwelling diffuse attenuation coeff
4	D	Kd442.4	/meter	downwelling diffuse attenuation coeff
5	E	Kd470.3	/meter	downwelling diffuse attenuation coeff
6	F	Kd490.0	/meter	downwelling diffuse attenuation coeff
7	G	Kd509.7	/meter	downwelling diffuse attenuation coeff
8	H	Kd519.9	/meter	downwelling diffuse attenuation coeff
9	I	Kd554.5	/meter	downwelling diffuse attenuation coeff
10	J	Kd565.4	/meter	downwelling diffuse attenuation coeff
11	K	Kd619.4	/meter	downwelling diffuse attenuation coeff
12	L	Kd665.1	/meter	downwelling diffuse attenuation coeff
13	M	Kd669.9	/meter	downwelling diffuse attenuation coeff
14	N	Kd683.9	/meter	downwelling diffuse attenuation coeff
15	O	Kd700.4	/meter	downwelling diffuse attenuation coeff
16	P	Ku406.2	/meter	upwelling diffuse attenuation coeff
17	Q	Ku412.2	/meter	upwelling diffuse attenuation coeff
18	R	Ku442.7	/meter	upwelling diffuse attenuation coeff
19	S	Ku469.9	/meter	upwelling diffuse attenuation coeff
20	T	Ku489.2	/meter	upwelling diffuse attenuation coeff
21	U	Ku509.7	/meter	upwelling diffuse attenuation coeff
22	V	Ku519.8	/meter	upwelling diffuse attenuation coeff
23	W	Ku554.7	/meter	upwelling diffuse attenuation coeff
24	X	Ku565.1	/meter	upwelling diffuse attenuation coeff
25	Y	Ku619.4	/meter	upwelling diffuse attenuation coeff
26	AA	Ku665.8	/meter	upwelling diffuse attenuation coeff
27	AB	Ku670.3	/meter	upwelling diffuse attenuation coeff
28	AC	Ku683.7	/meter	upwelling diffuse attenuation coeff

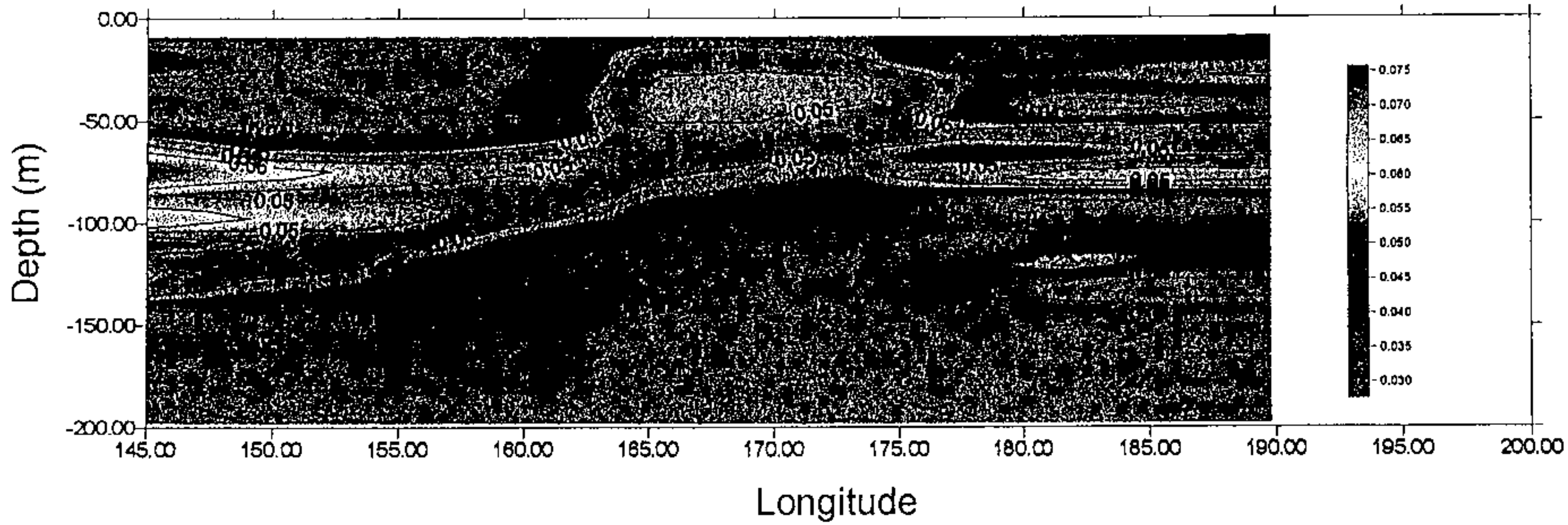
Preliminary Graphs

Temperature Section, Mirai 98K02

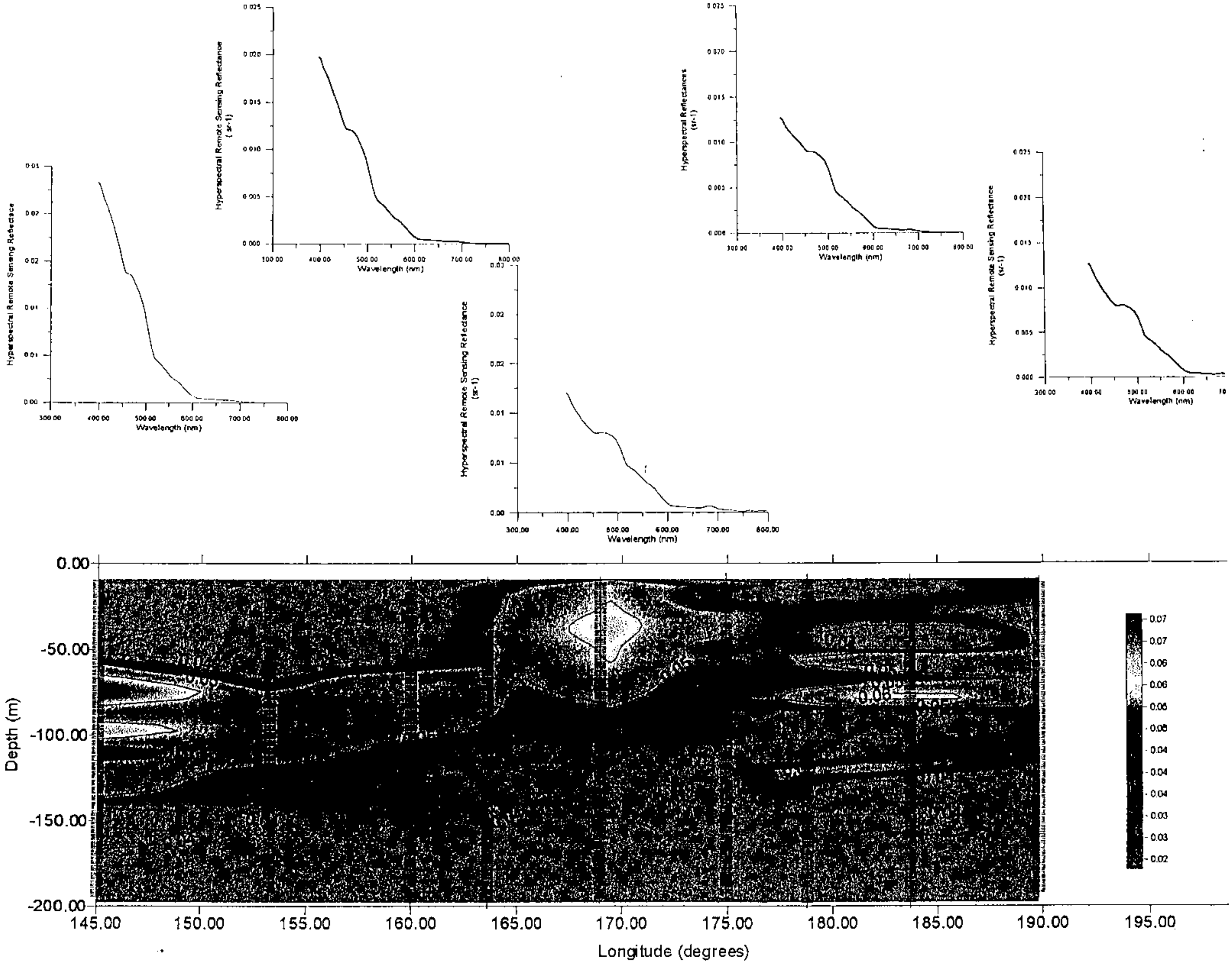




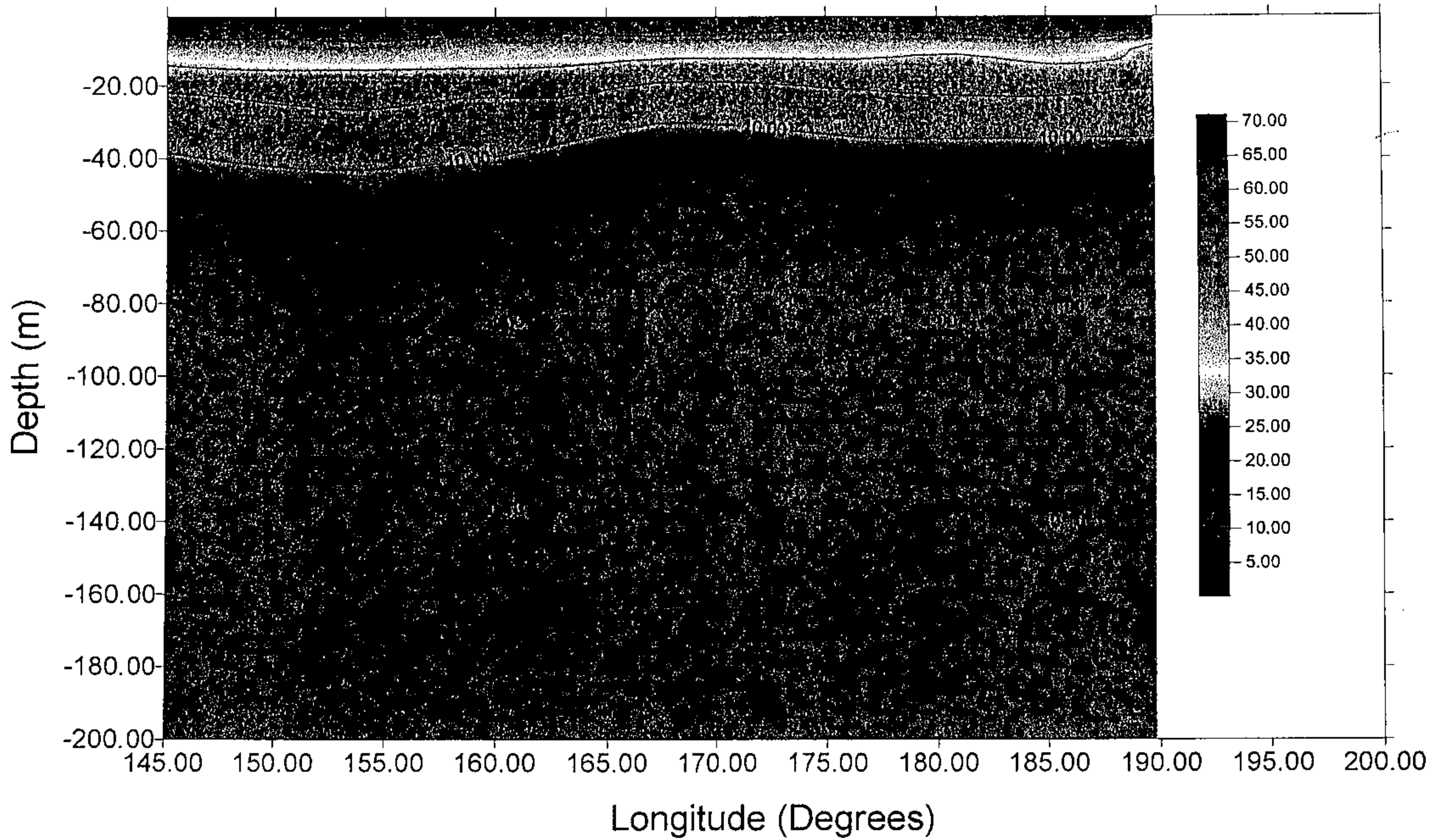
Ocean Color Index
R(443)/R(555)
6.00
4.00
2.00
140.00
150.00
160.00
170.00
180.00
190.00

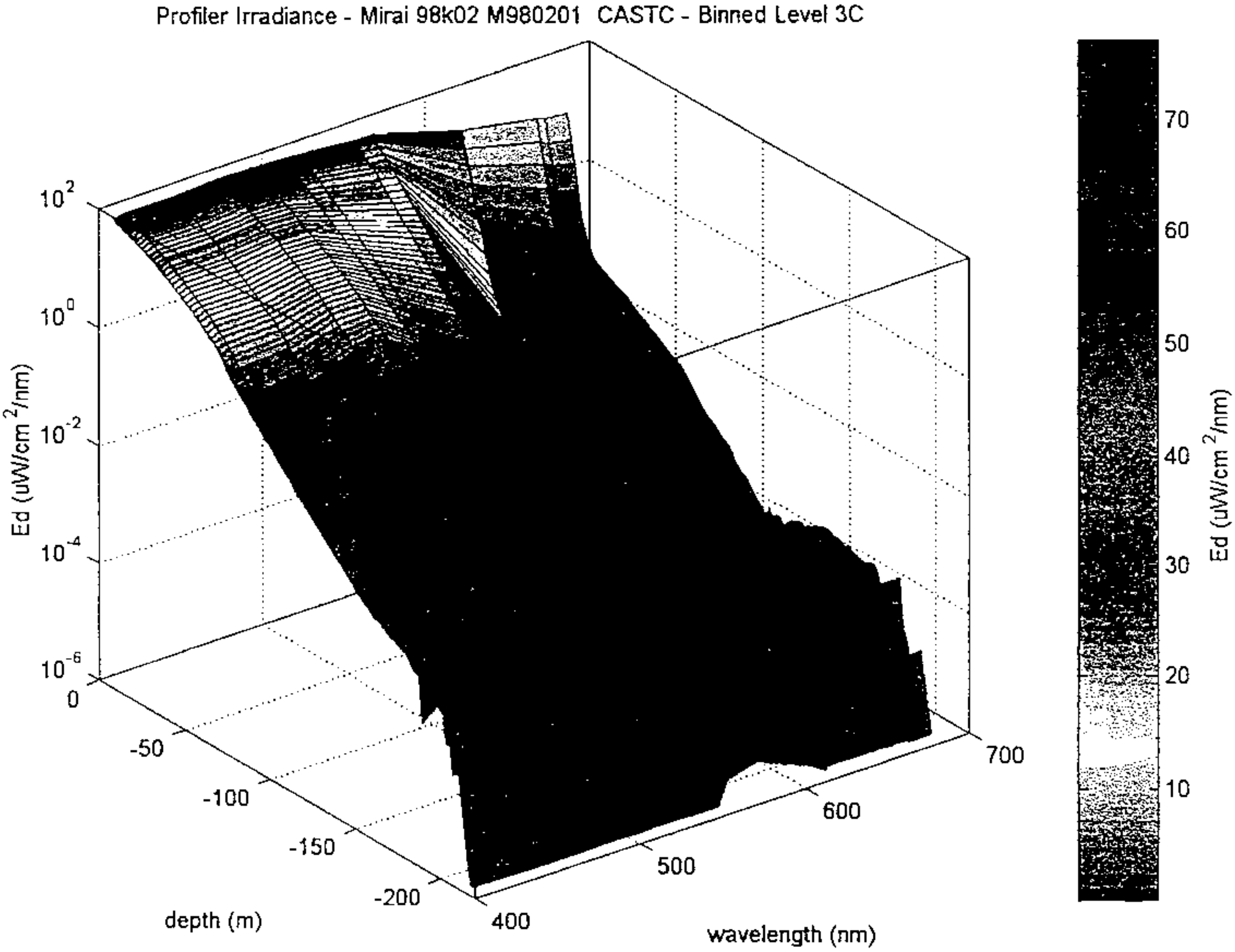


Depth (m)
0.00
-50.00
-100.00
-150.00
-200.00
145.00
150.00
155.00
160.00
165.00
170.00
175.00
180.00
185.00
190.00
195.00
200.00
Longitude
0.075
0.070
0.065
0.060
0.055
0.050
0.045
0.040
0.035
0.030

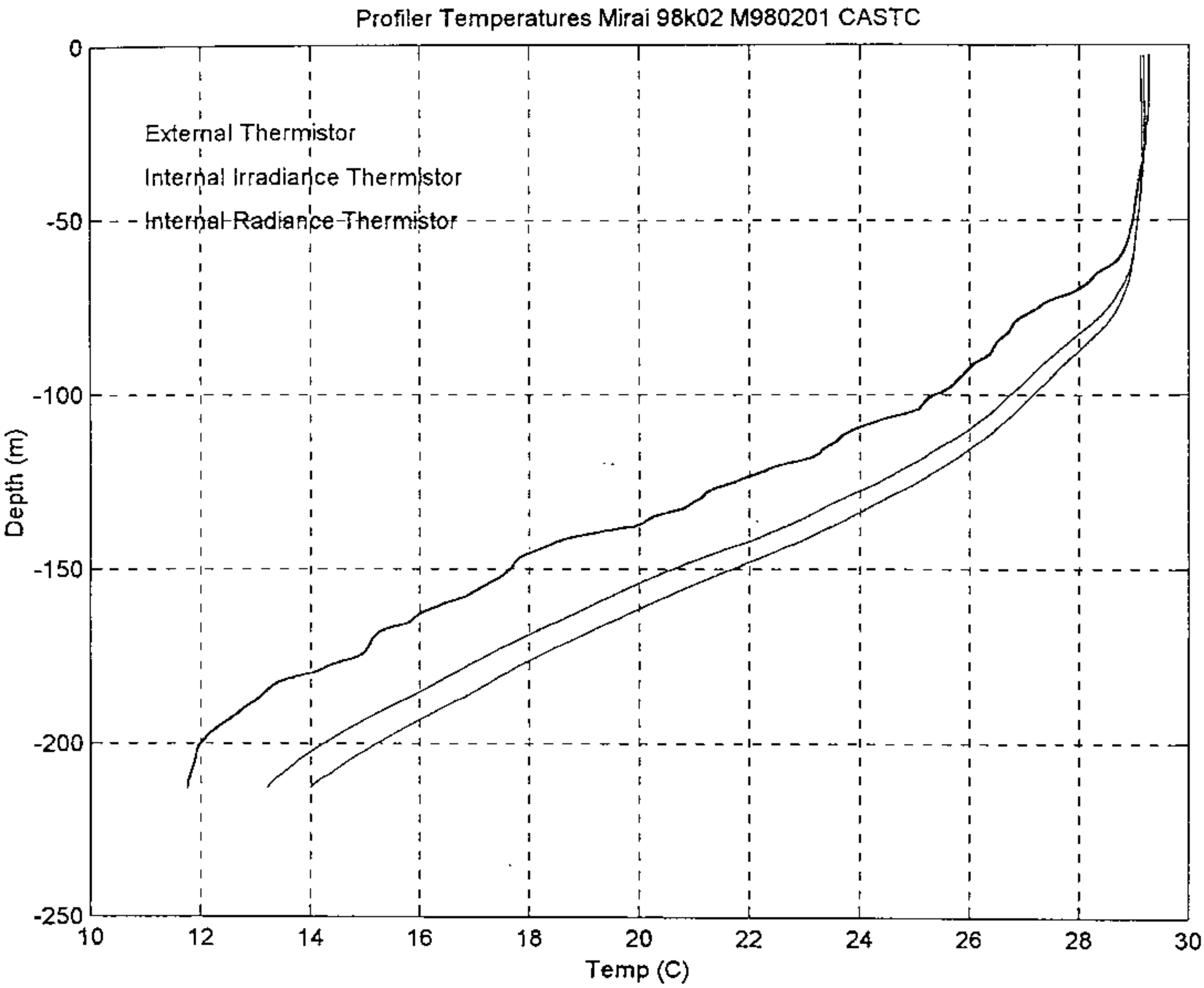

Hyperspectral Remote Sensing Reflectance
Wavelength (nm)
Hyperspectral Remote Sensing Reflectance (sr-1)
Wavelength (nm)
Hyperspectral Remote Sensing Reflectance (sr-1)
Wavelength (nm)
Hyperspectral Reflectances (sr-1)
Wavelength (nm)
Hyperspectral Remote Sensing Reflectance (sr-1)
Wavelength (nm)
Depth (m)
0.00
-50.00
-100.00
-150.00
-200.00
145.00
150.00
155.00
160.00
165.00
170.00
175.00
180.00
185.00
190.00
195.00
Longitude (degrees)
0.07
0.07
0.06
0.06
0.05
0.05
0.04
0.04
0.04
0.03
0.03
0.02

PAR Penetration (Percentage of Incident Surface Irradiance)

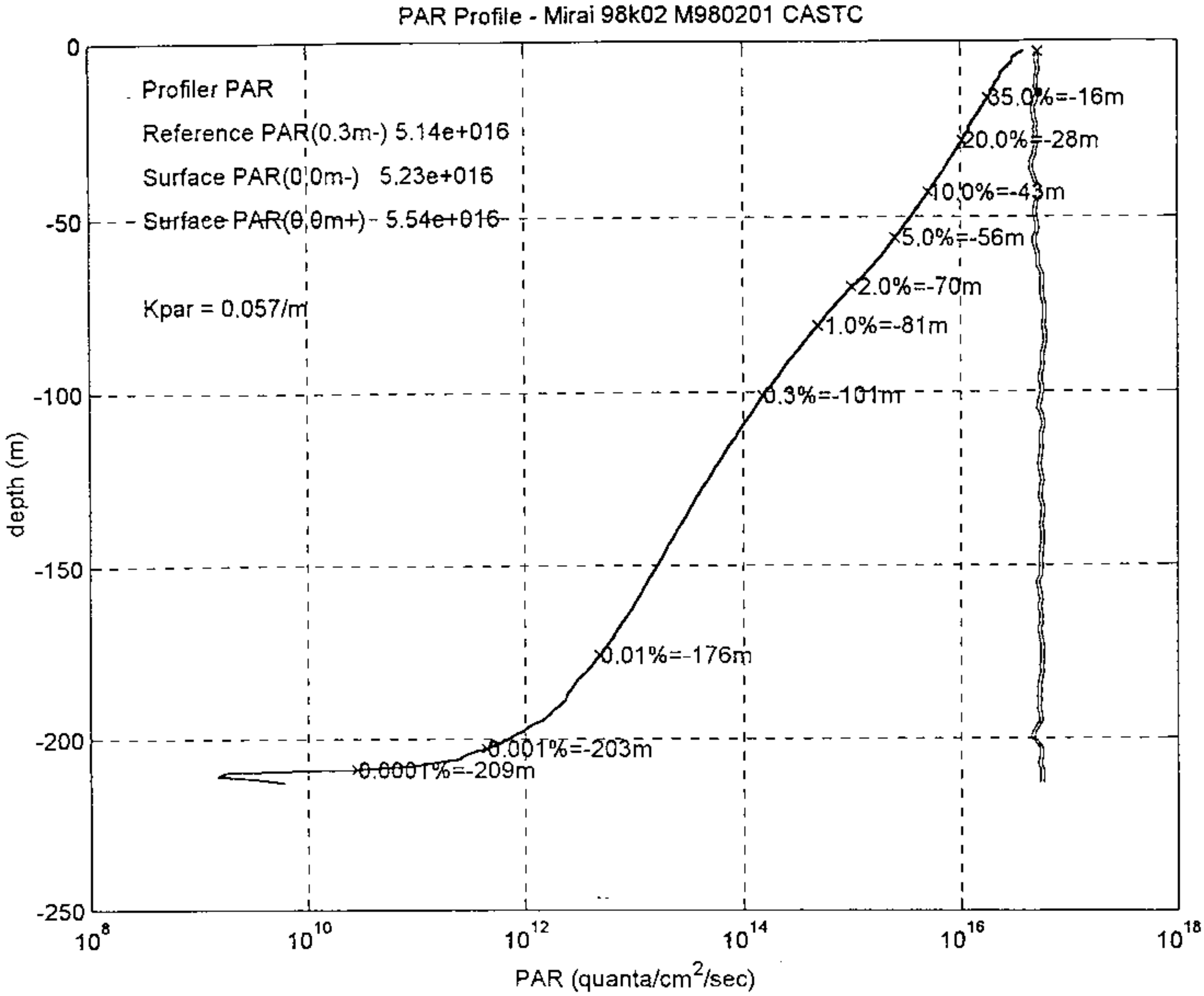


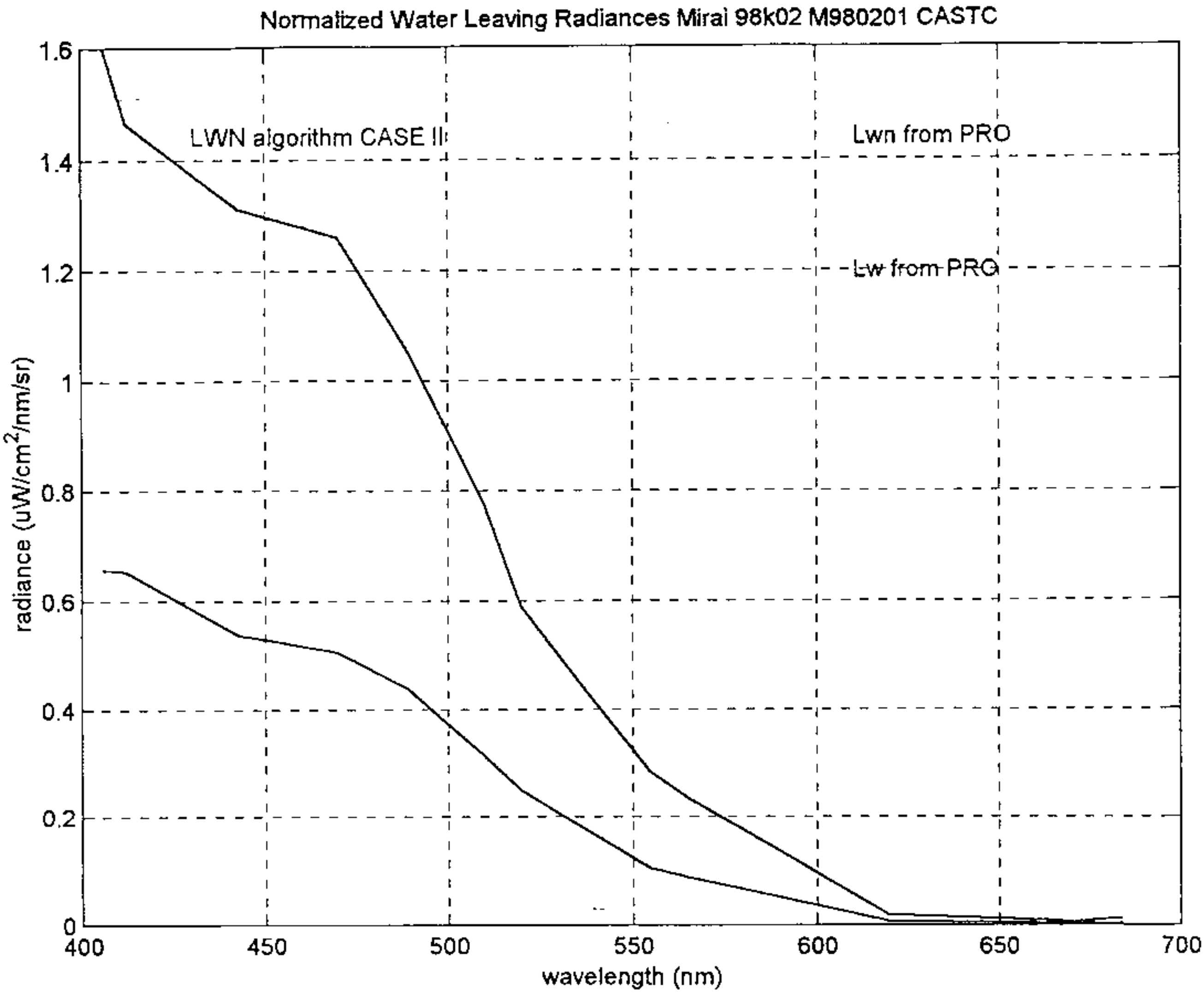


Profiler Irradiance - Mirai 98k02 M980201 CASTC - Binned Level 3C
10^2
10^0
10^{-2}
10^{-4}
10^{-6}
Ed (uW/cm ^{2}/nm)
0
-50
-100
-150
-200
depth (m)
400
500
600
700
wavelength (nm)
70
60
50
40
30
20
10
Ed (uW/cm ^{2}/nm)

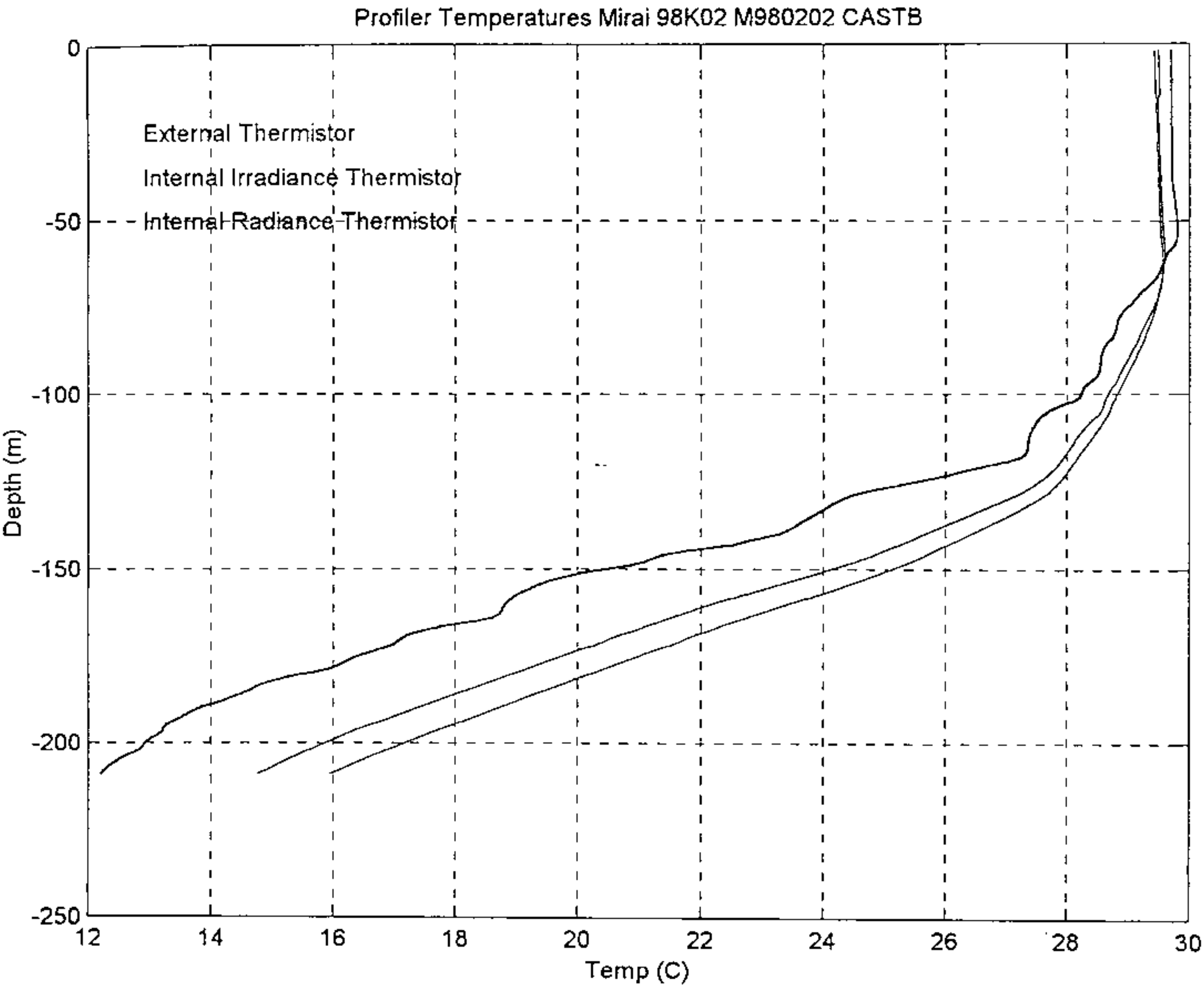


Profiler Temperatures Mirai 98k02 M980201 CASTC
External Thermistor
Internal Irradiance Thermistor
Internal Radiance Thermistor
Depth (m)
Temp (C)
0
-50
-100
-150
-200
-250
10
12
14
16
18
20
22
24
26
28
30


PAR Profile - Mirai 98k02 M980201 CASTC
Profiler PAR
Reference PAR(0.3m-) 5.14e+016
Surface PAR(0.0m-) 5.23e+016
Surface PAR(0.0m+) 5.54e+016
Kpar = 0.057/m
35.0%=-16m
20.0%=-28m
10.0%=-43m
5.0%=-56m
2.0%=-70m
1.0%=-81m
0.3%=-101m
0.01%=-176m
0.001%=-203m
0.0001%=-209m
depth (m)
0
-50
-100
-150
-200
-250
10^8
10^{10}
10^{12}
10^{14}
10^{16}
10^{18}
PAR (quanta/cm^2/sec)

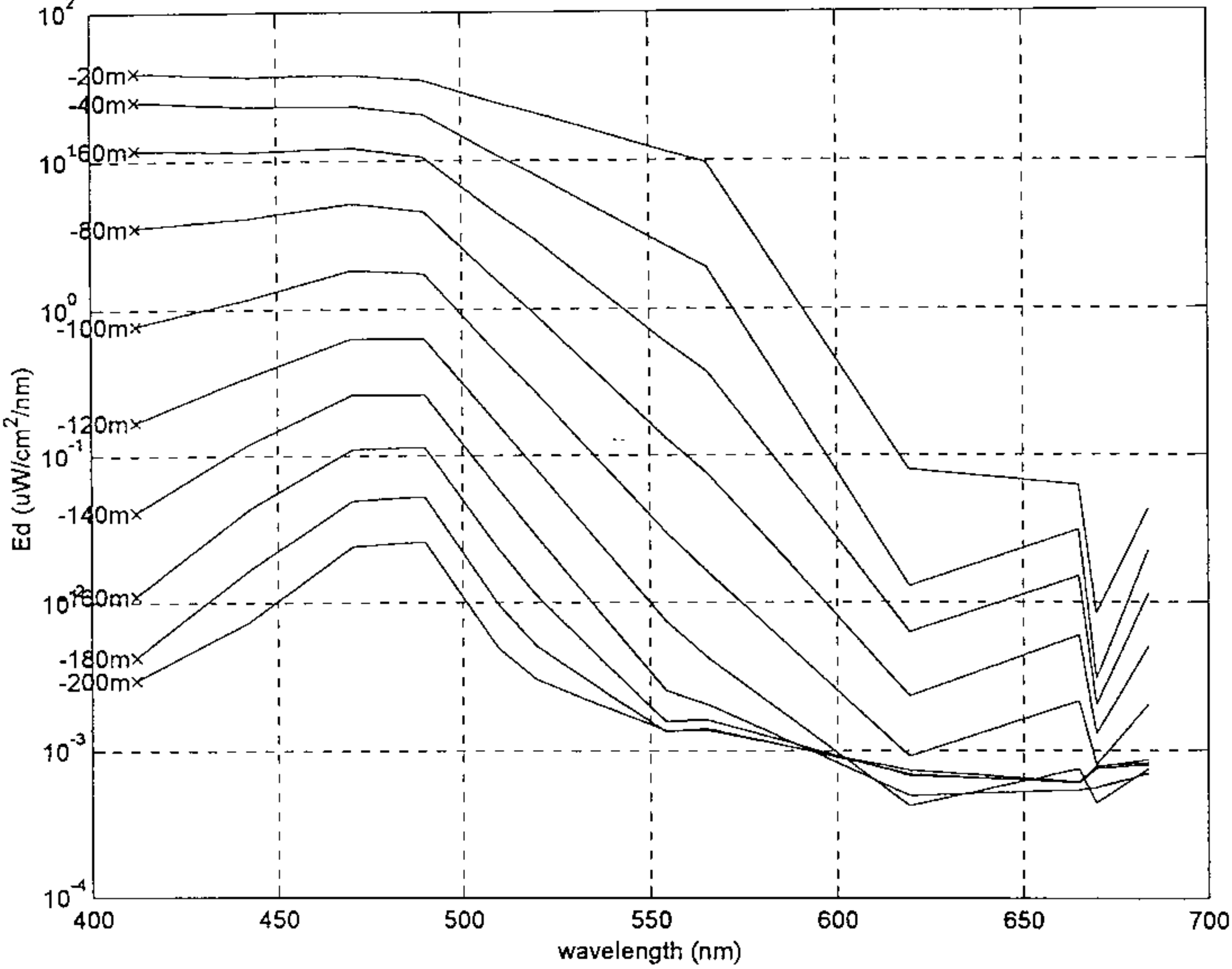


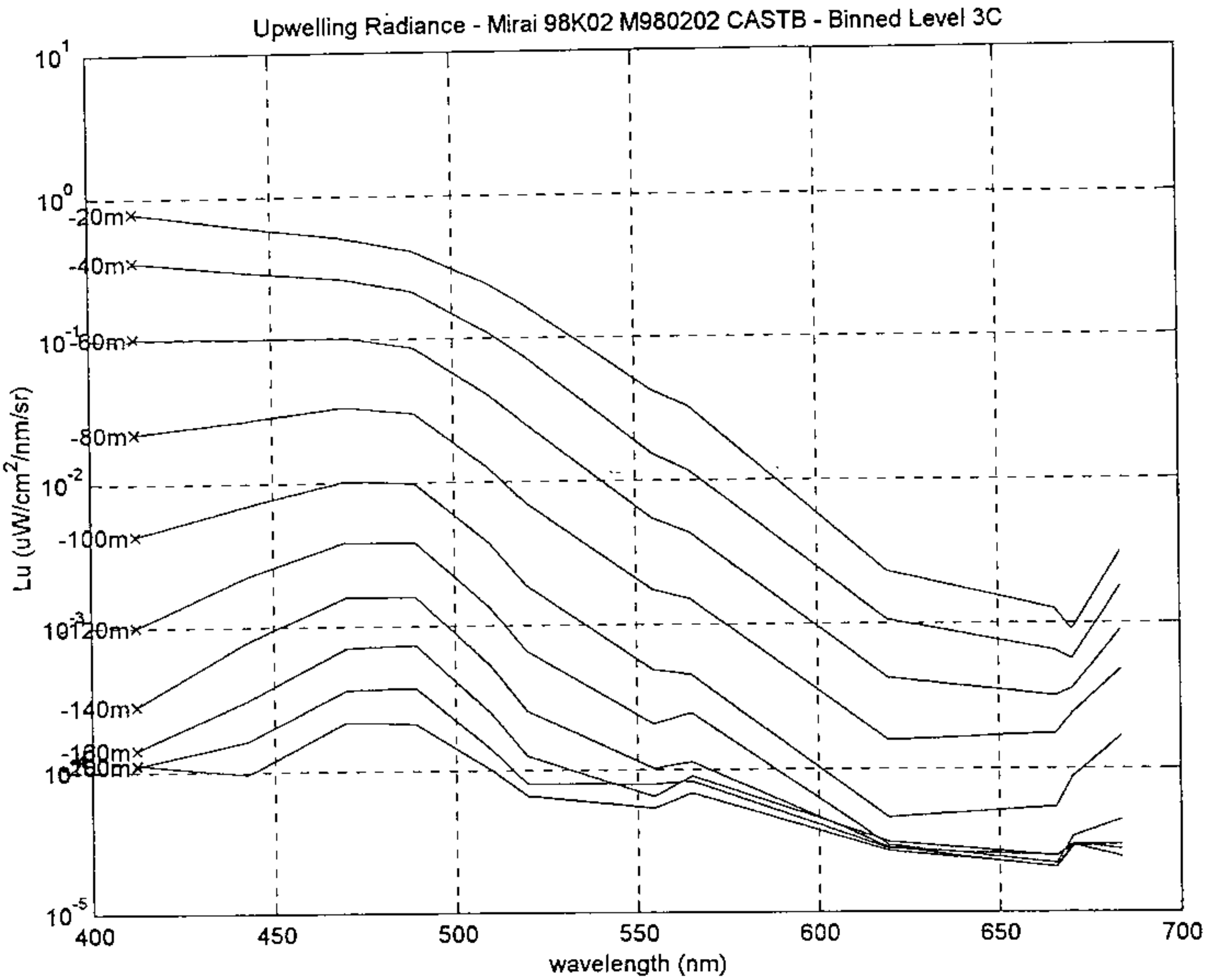
Normalized Water Leaving Radiances Mirai 98k02 M980201 CASTC
LWN algorithm CASE II
Lwn from PRO
Lw from PRO
radiance (uW/cm2/nm/sr)
wavelength (nm)
1.6
1.4
1.2
1
0.8
0.6
0.4
0.2
0
400
450
500
550
600
650
700



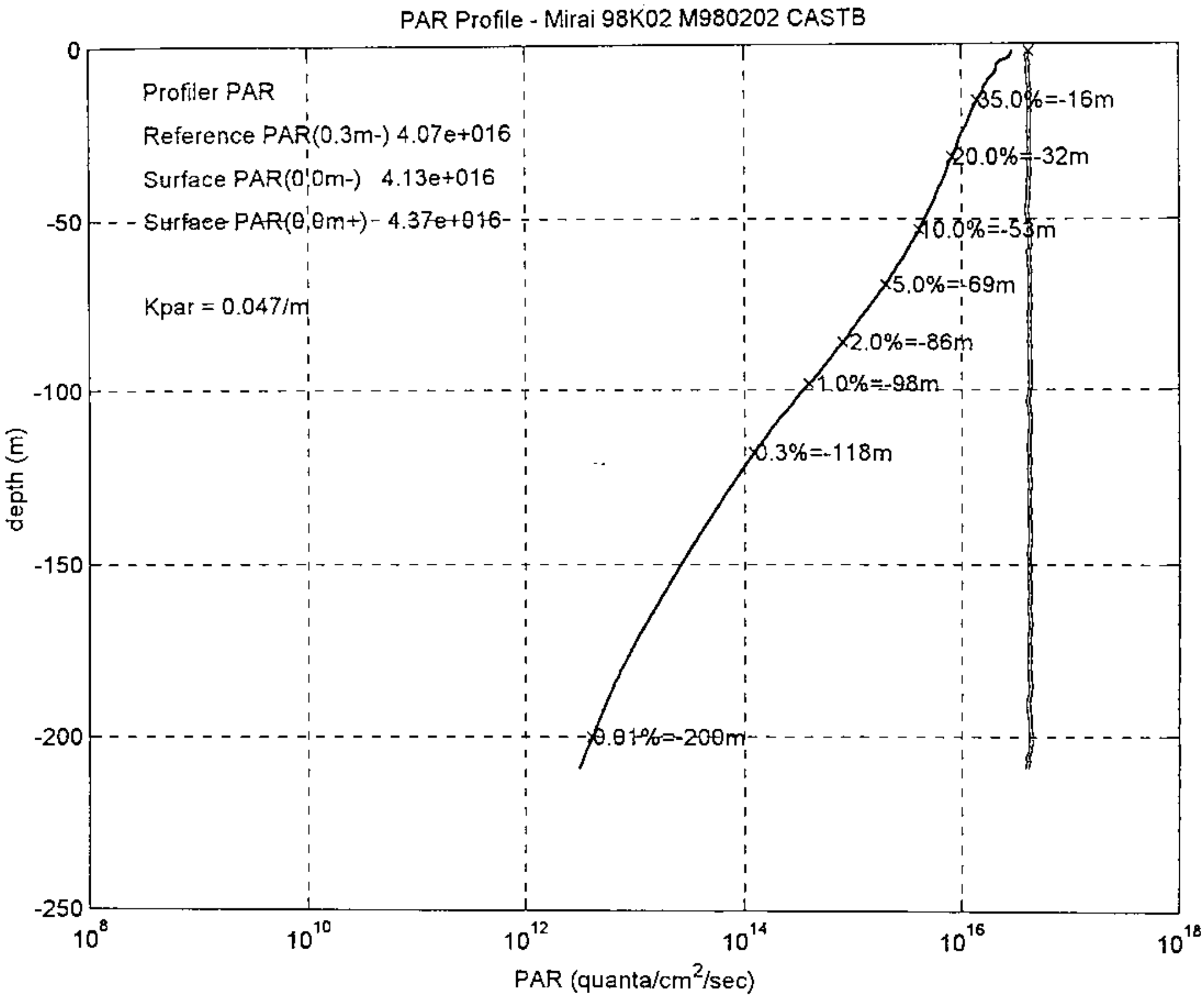
Profiler Temperatures Mirai 98K02 M980202 CASTB
External Thermistor
Internal Irradiance Thermistor
Internal Radiance Thermistor
Depth (m)
Temp (C)
0
-50
-100
-150
-200
-250
12
14
16
18
20
22
24
26
28
30

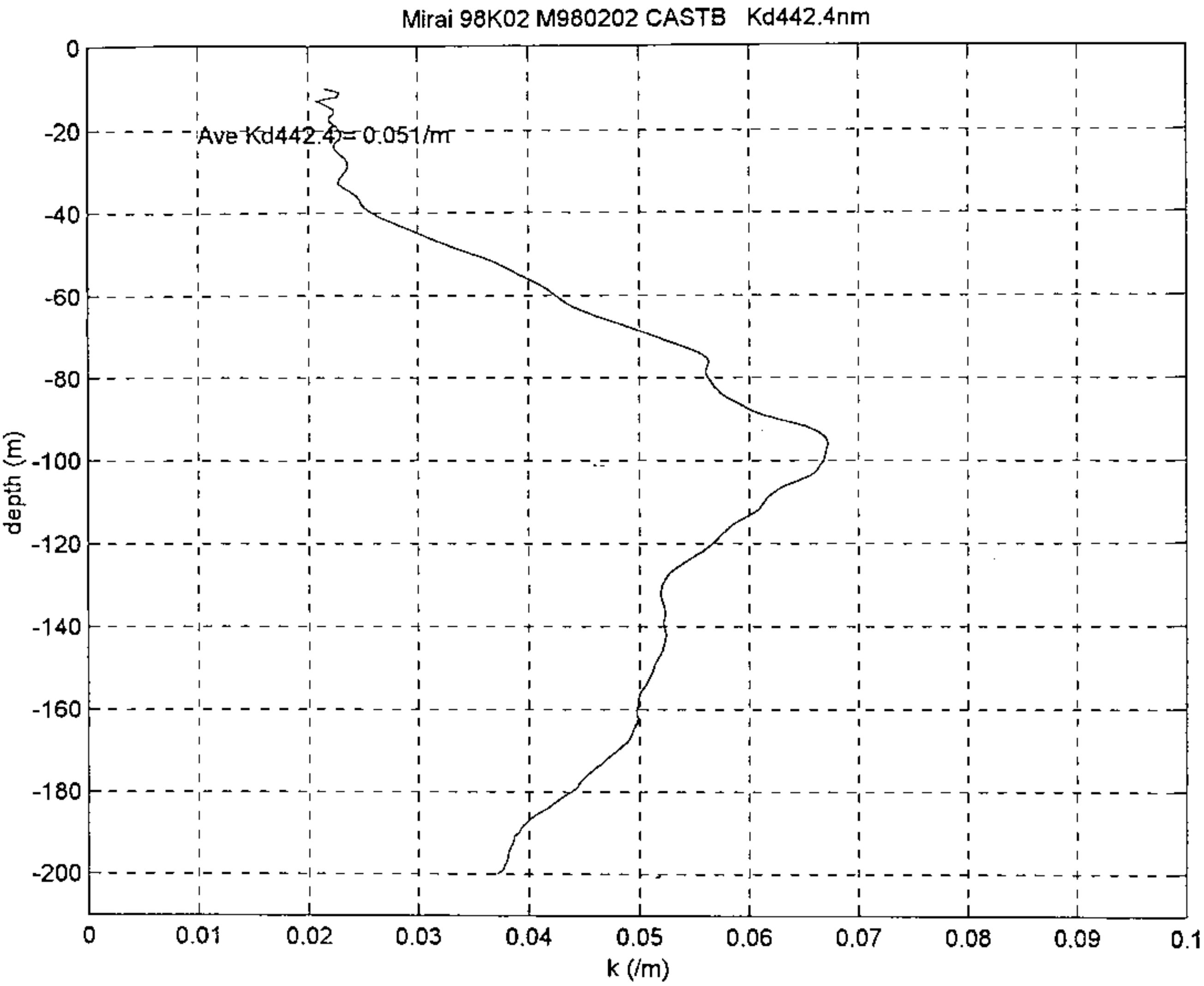
Downwelling Irradiance - Mirai 98K02 M980202 CASTB - Binned Level 3C



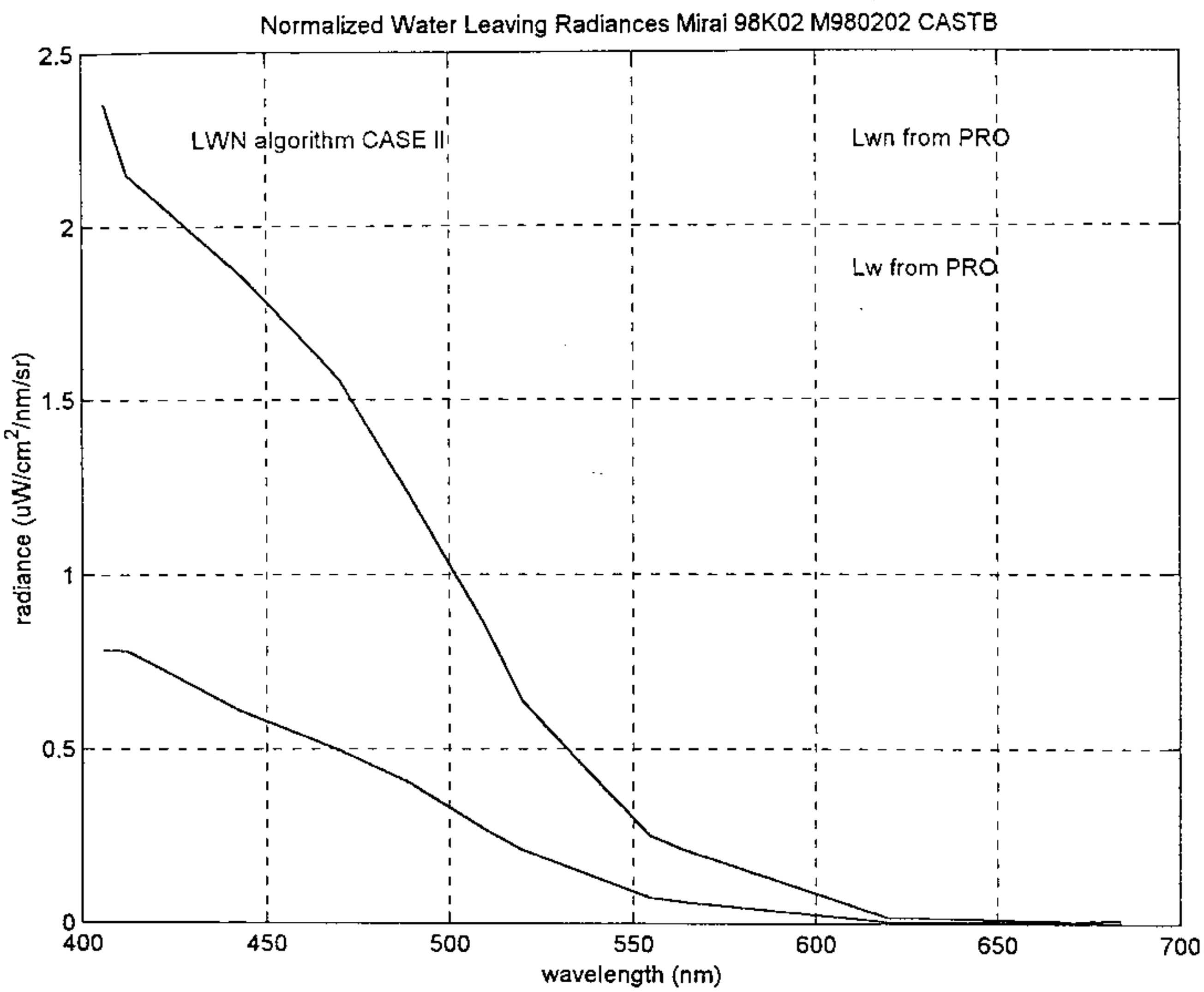


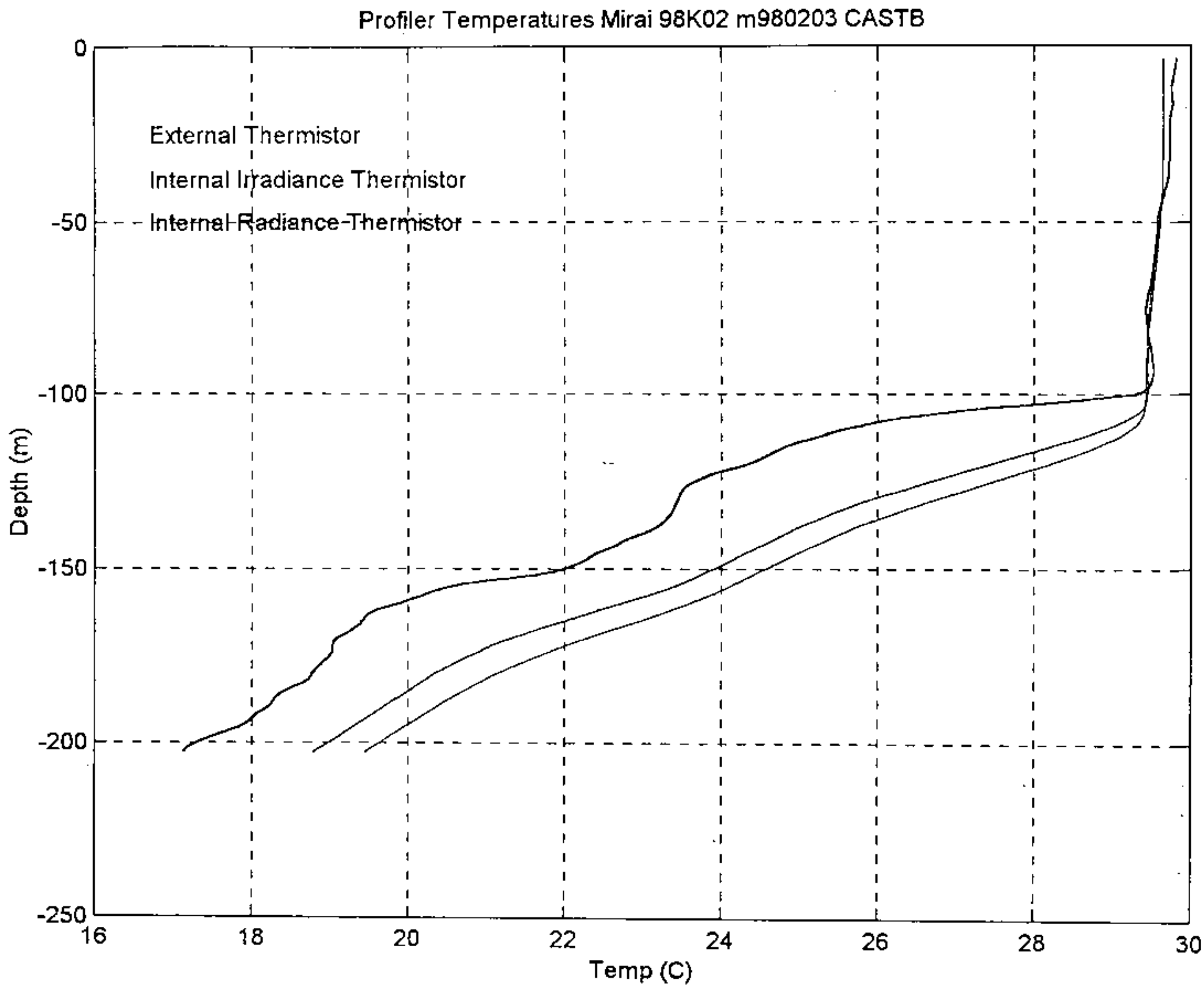
Upwelling Radiance - Mirai 98K02 M980202 CASTB - Binned Level 3C
Lu (uW/cm^2/nm/sr)
wavelength (nm)
10^1
10^0
10^-1
10^-2
10^-3
10^-4
10^-5
400
450
500
550
600
650
700
-20m
-40m
-60m
-80m
-100m
-120m
-140m
-160m
-200m

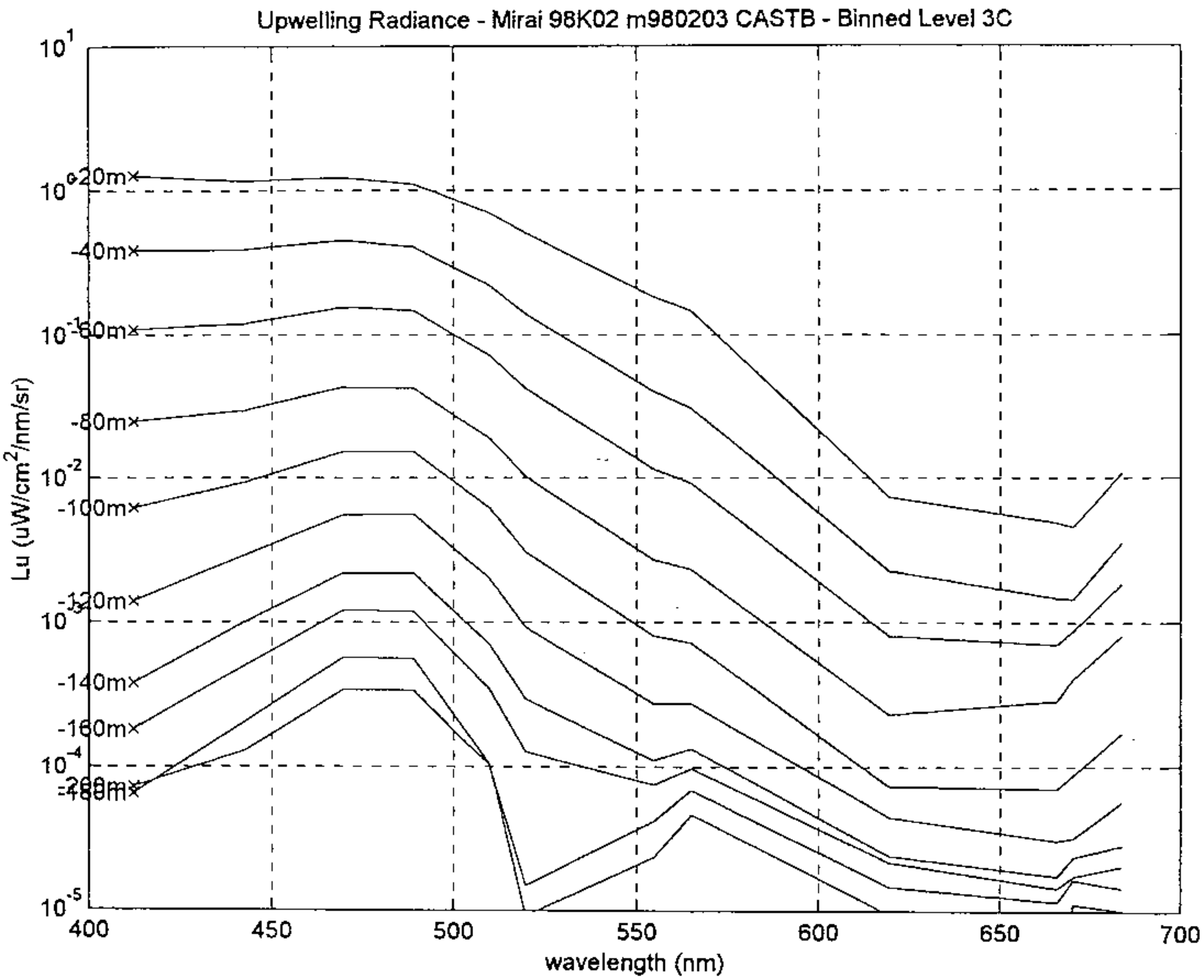

PAR Profile - Mirai 98K02 M980202 CASTB
Profiler PAR
Reference PAR(0.3m-) 4.07e+016
Surface PAR(0.0m-) 4.13e+016
Surface PAR(0.0m+) 4.37e+016
Kpar = 0.047/m
35.0%=-16m
20.0%=-32m
10.0%=-53m
5.0%=-69m
2.0%=-86m
1.0%=-98m
0.3%=-118m
0.01%=-200m
depth (m)
0
-50
-100
-150
-200
-250
10^8
10^{10}
10^{12}
10^{14}
10^{16}
10^{18}
PAR (quanta/cm^2/sec)



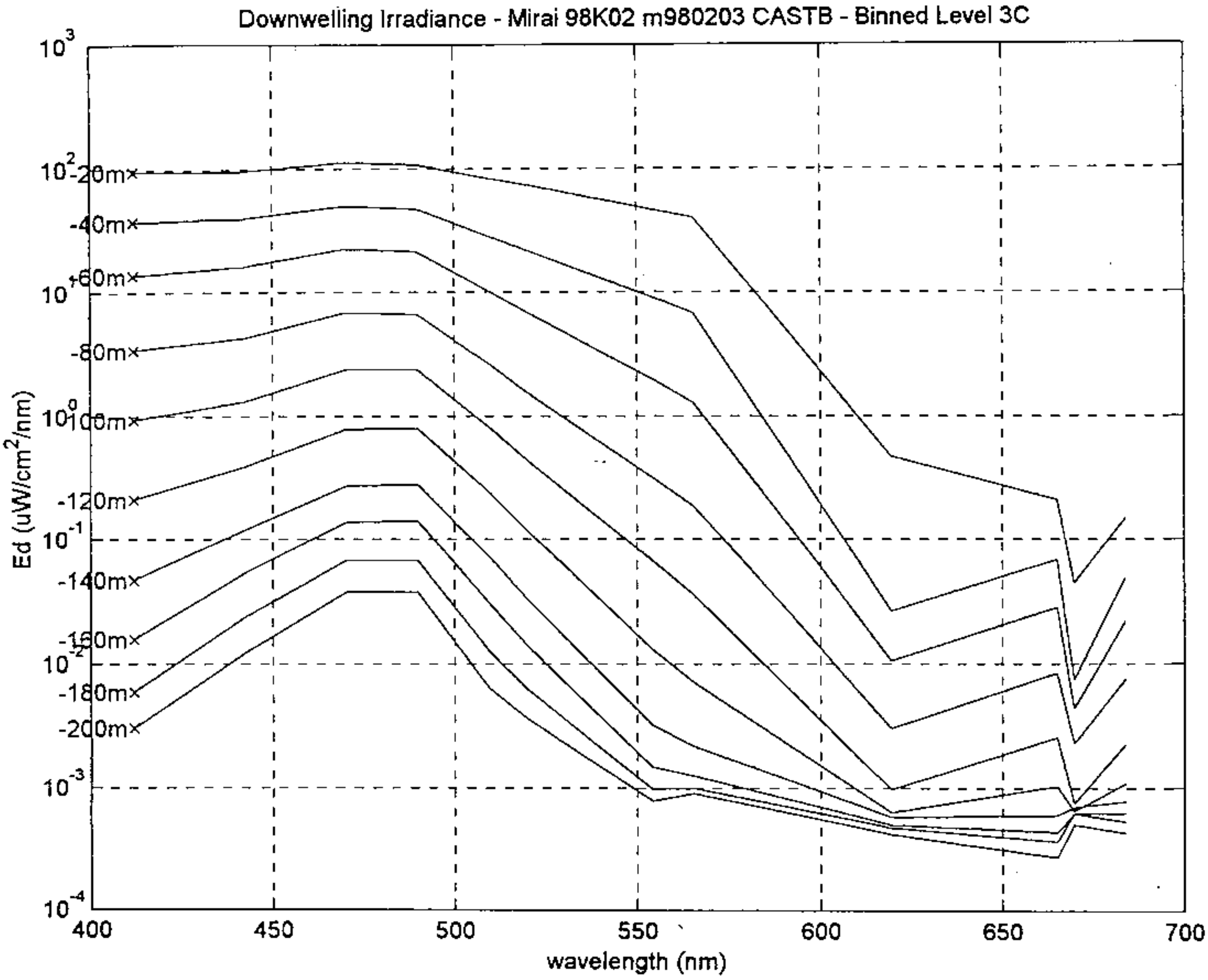
Mirai 98K02 M980202 CASTB Kd442.4nm
Ave Kd442.4) = 0.051/m
depth (m)
0
-20
-40
-60
-80
-100
-120
-140
-160
-180
-200
0
0.01
0.02
0.03
0.04
0.05
0.06
0.07
0.08
0.09
0.1
k (/m)


Normalized Water Leaving Radiances Mirai 98K02 M980202 CASTB
LWN algorithm CASE II
Lwn from PRO
Lw from PRO
radiance (uW/cm^2/nm/sr)
wavelength (nm)
2.5
2
1.5
1
0.5
0
400
450
500
550
600
650
700

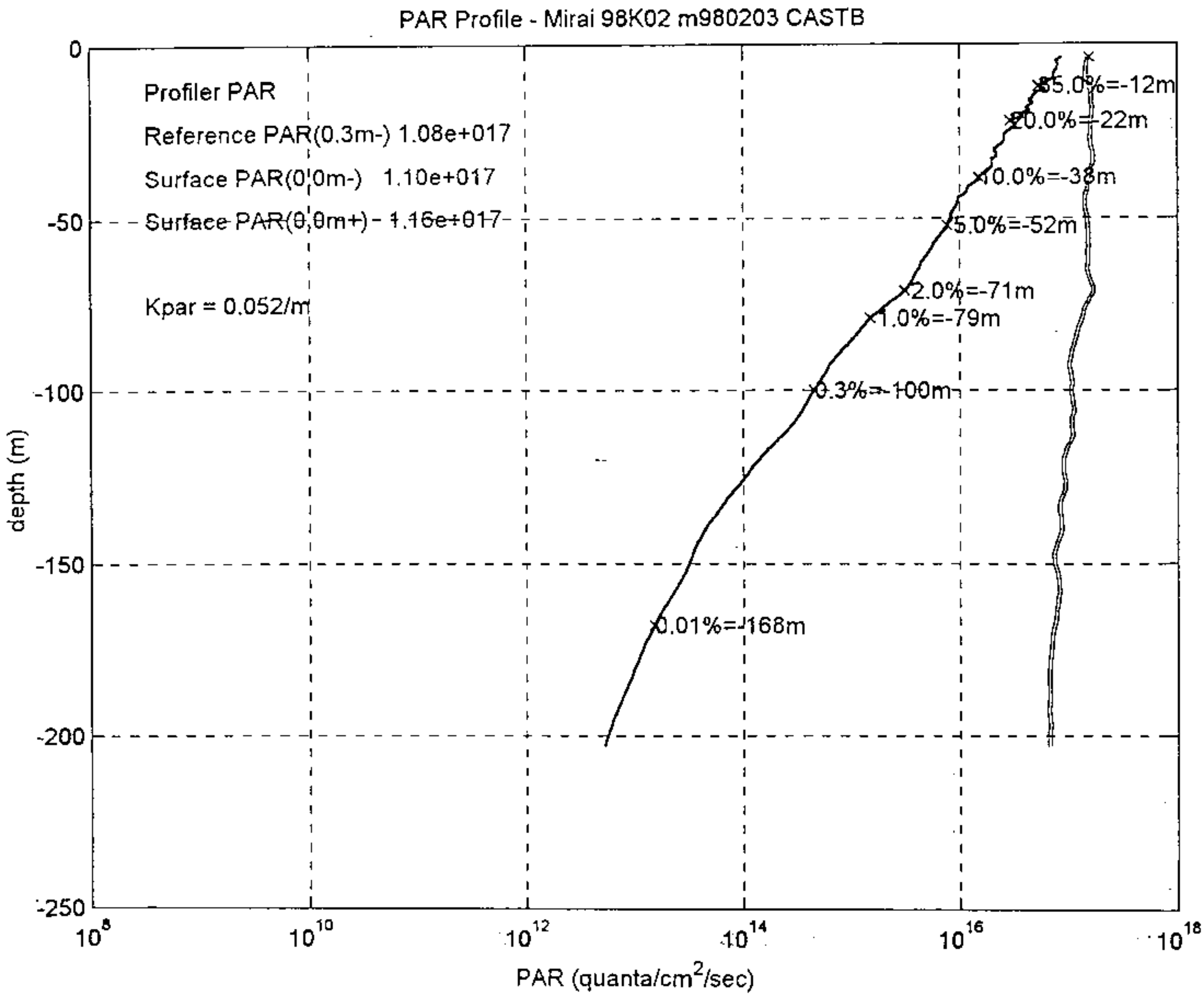

Profiler Temperatures Mirai 98K02 m980203 CASTB
External Thermistor
Internal Irradiance Thermistor
Internal Radiance Thermistor
Depth (m)
Temp (C)
0
-50
-100
-150
-200
-250
16
18
20
22
24
26
28
30



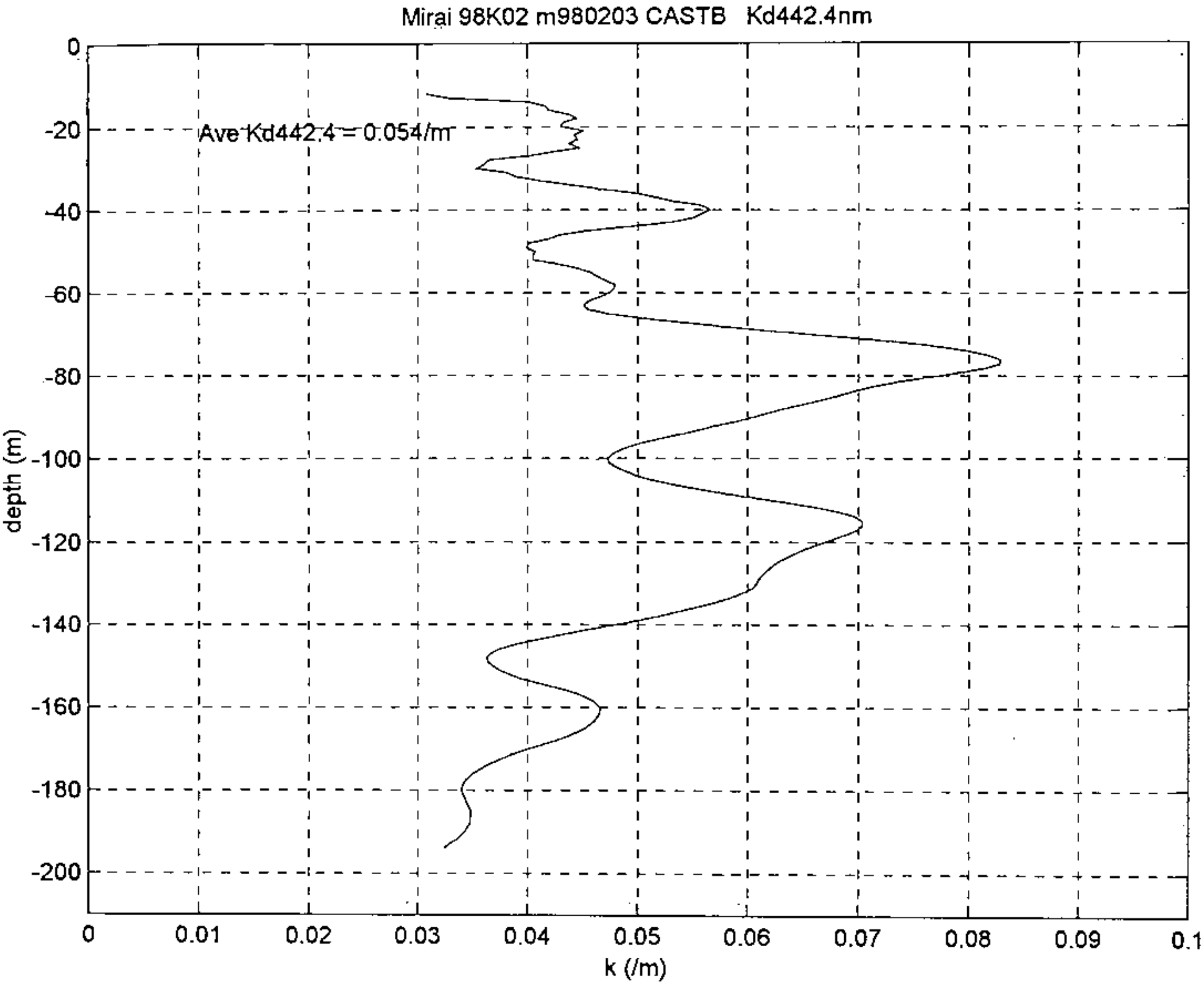
Upwelling Radiance - Mirai 98K02 m980203 CASTB - Binned Level 3C
Lu (uW/cm^2/nm/sr)
wavelength (nm)
-20m
-40m
-60m
-80m
-100m
-120m
-140m
-160m
-180m
-200m
400
450
500
550
600
650
700
10^1
10^0
10^-1
10^-2
10^-3
10^-4
10^-5



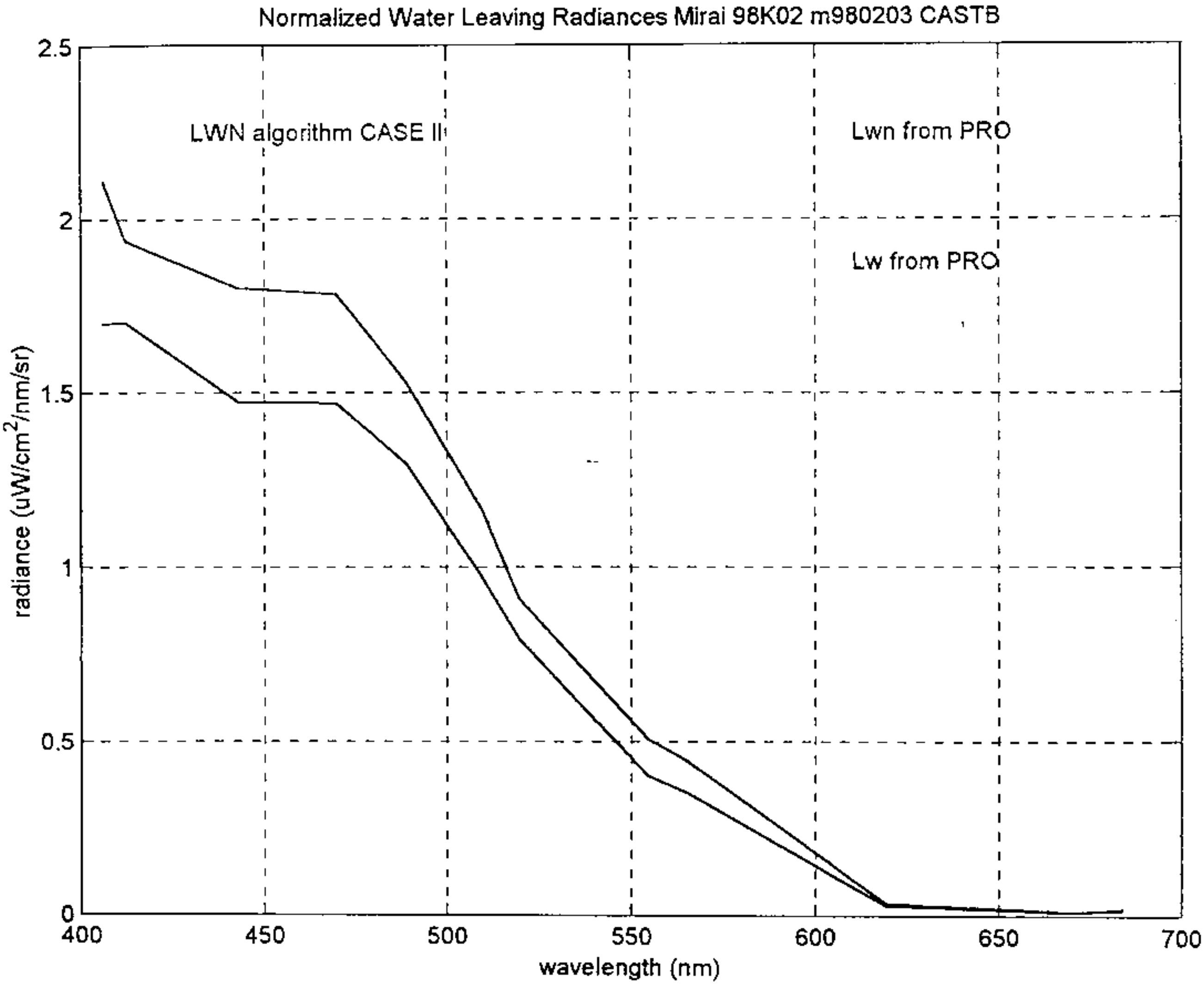
Downwelling Irradiance - Mirai 98K02 m980203 CASTB - Binned Level 3C
Ed (uW/cm2/nm)
wavelength (nm)
-20m×
-40m×
-60m×
-80m×
-100m×
-120m×
-140m×
-160m×
-180m×
-200m×

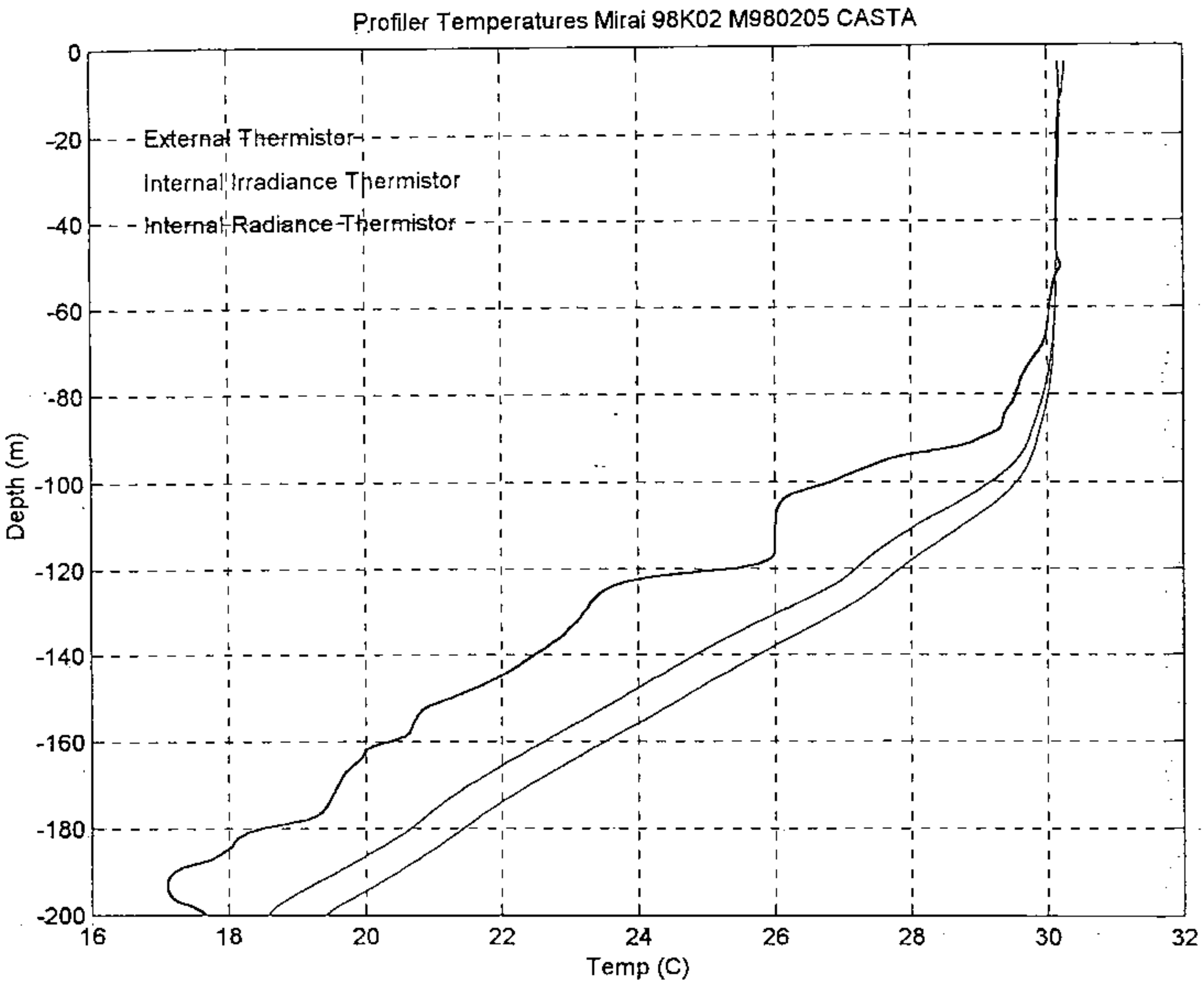


PAR Profile - Mirai 98K02 m980203 CASTB
Profiler PAR
Reference PAR(0.3m-) 1.08e+017
Surface PAR(0.0m-) 1.10e+017
Surface PAR(0.0m+) 1.16e+017
Kpar = 0.052/m
35.0%=-12m
20.0%=-22m
10.0%=-38m
5.0%=-52m
2.0%=-71m
1.0%=-79m
0.3%=-100m
0.01%=-168m
depth (m)
PAR (quanta/cm2/sec)

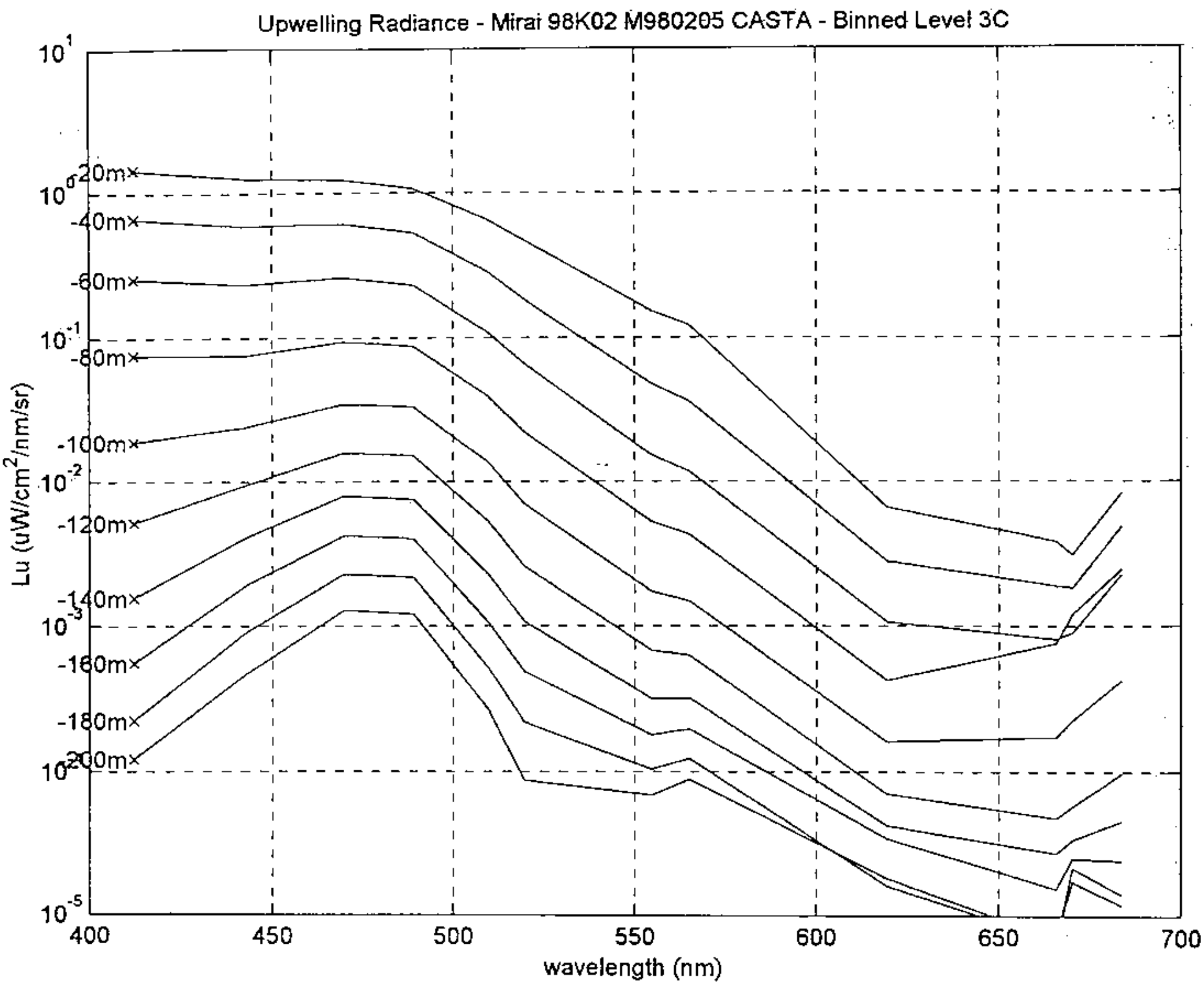


Mirai 98K02 m980203 CASTB Kd442.4nm
Ave Kd442.4 = 0.054/m
depth (m)
0
-20
-40
-60
-80
-100
-120
-140
-160
-180
-200
0
0.01
0.02
0.03
0.04
0.05
0.06
0.07
0.08
0.09
0.1
k (/m)

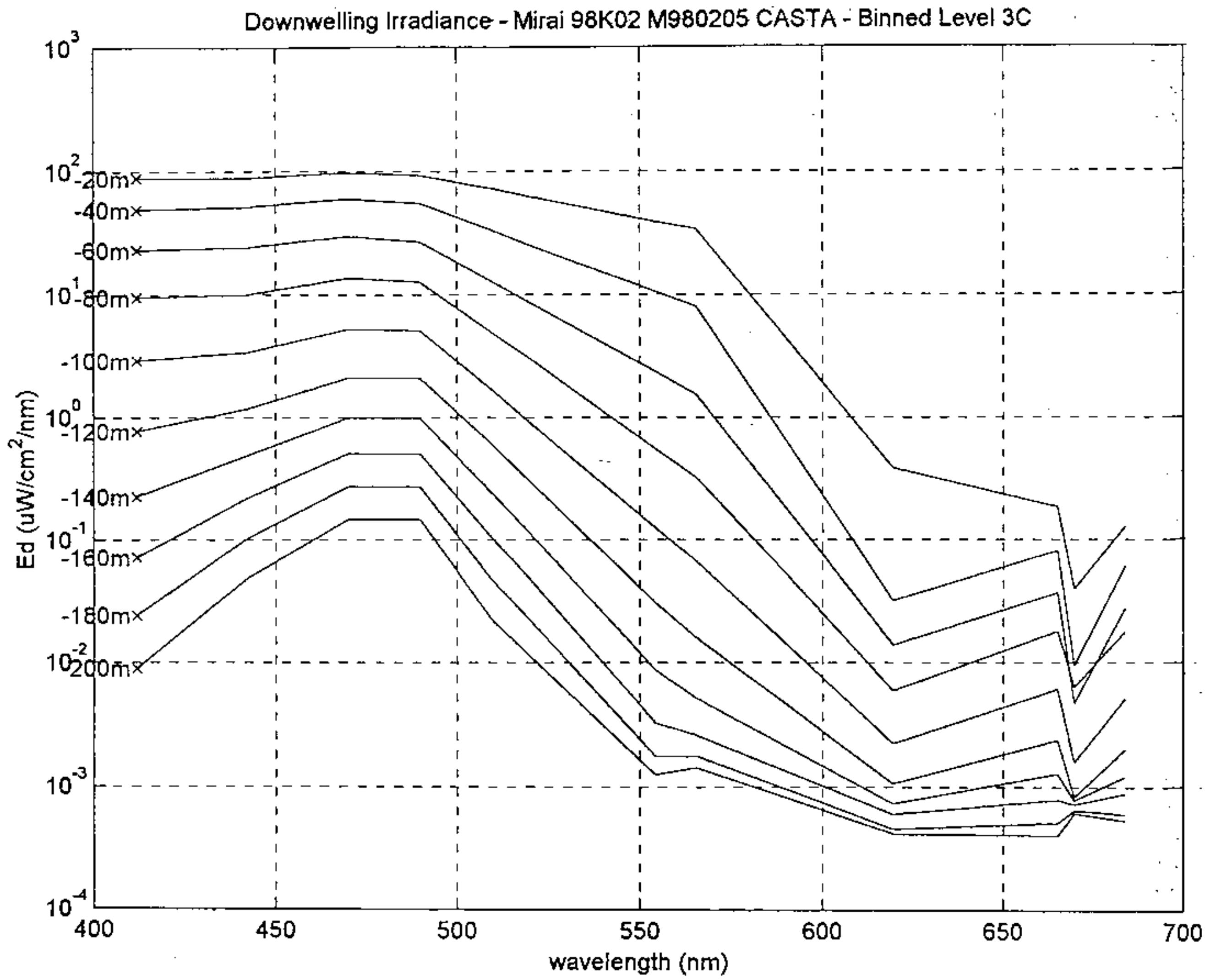

Normalized Water Leaving Radiances Mirai 98K02 m980203 CASTB
LWN algorithm CASE II
Lwn from PRO
Lw from PRO
radiance (uW/cm2/nm/sr)
wavelength (nm)
2.5
2
1.5
1
0.5
0
400
450
500
550
600
650
700



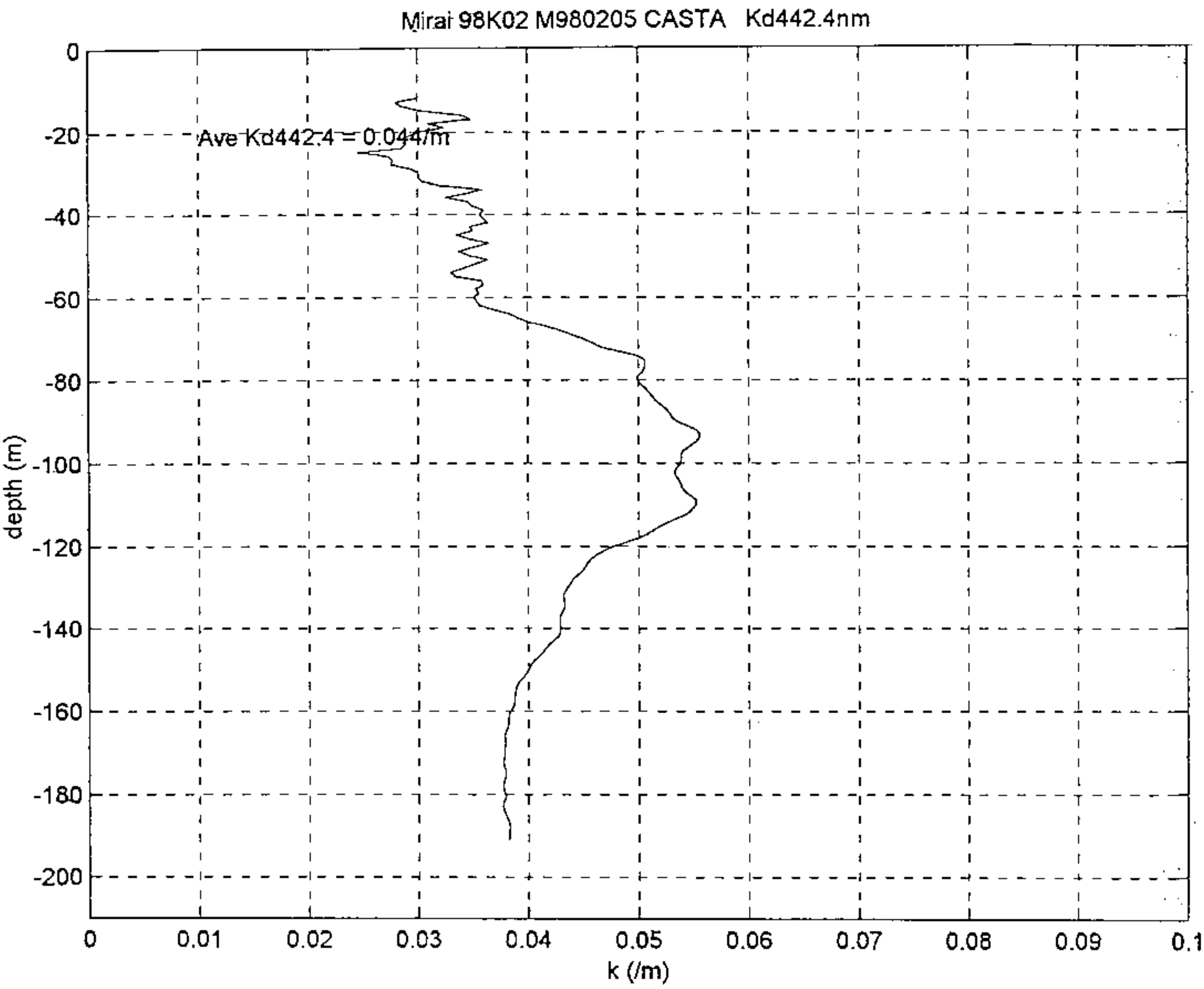
Profiler Temperatures Mirai 98K02 M980205 CASTA
External Thermistor
Internal Irradiance Thermistor
Internal Radiance Thermistor
Depth (m)
Temp (C)
0
-20
-40
-60
-80
-100
-120
-140
-160
-180
-200
16
18
20
22
24
26
28
30
32



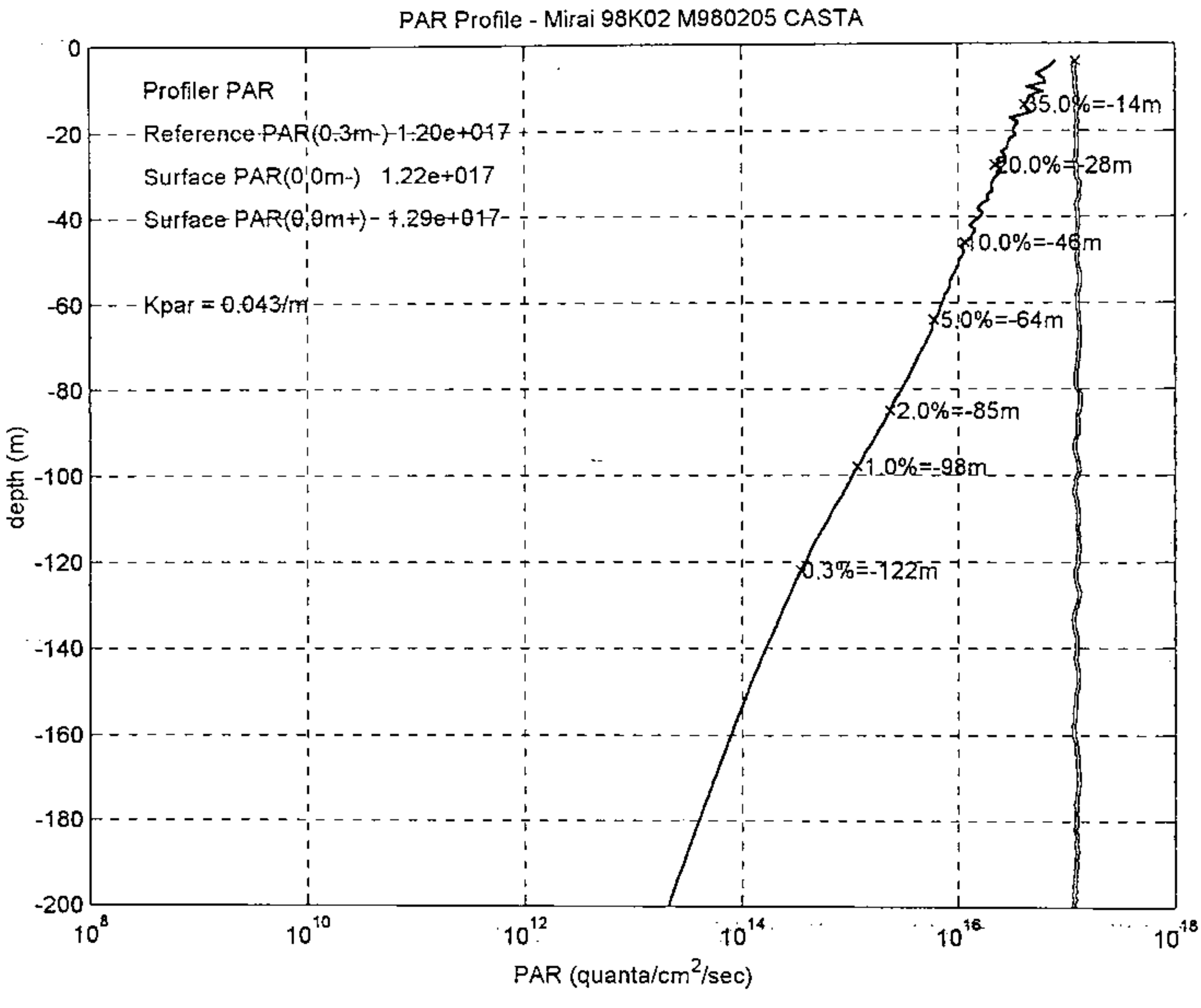
Upwelling Radiance - Mirai 98K02 M980205 CASTA - Binned Level 3C
Lu (uW/cm^2/nm/sr)
wavelength (nm)
-20m
-40m
-60m
-80m
-100m
-120m
-140m
-160m
-180m
-200m
400
450
500
550
600
650
700



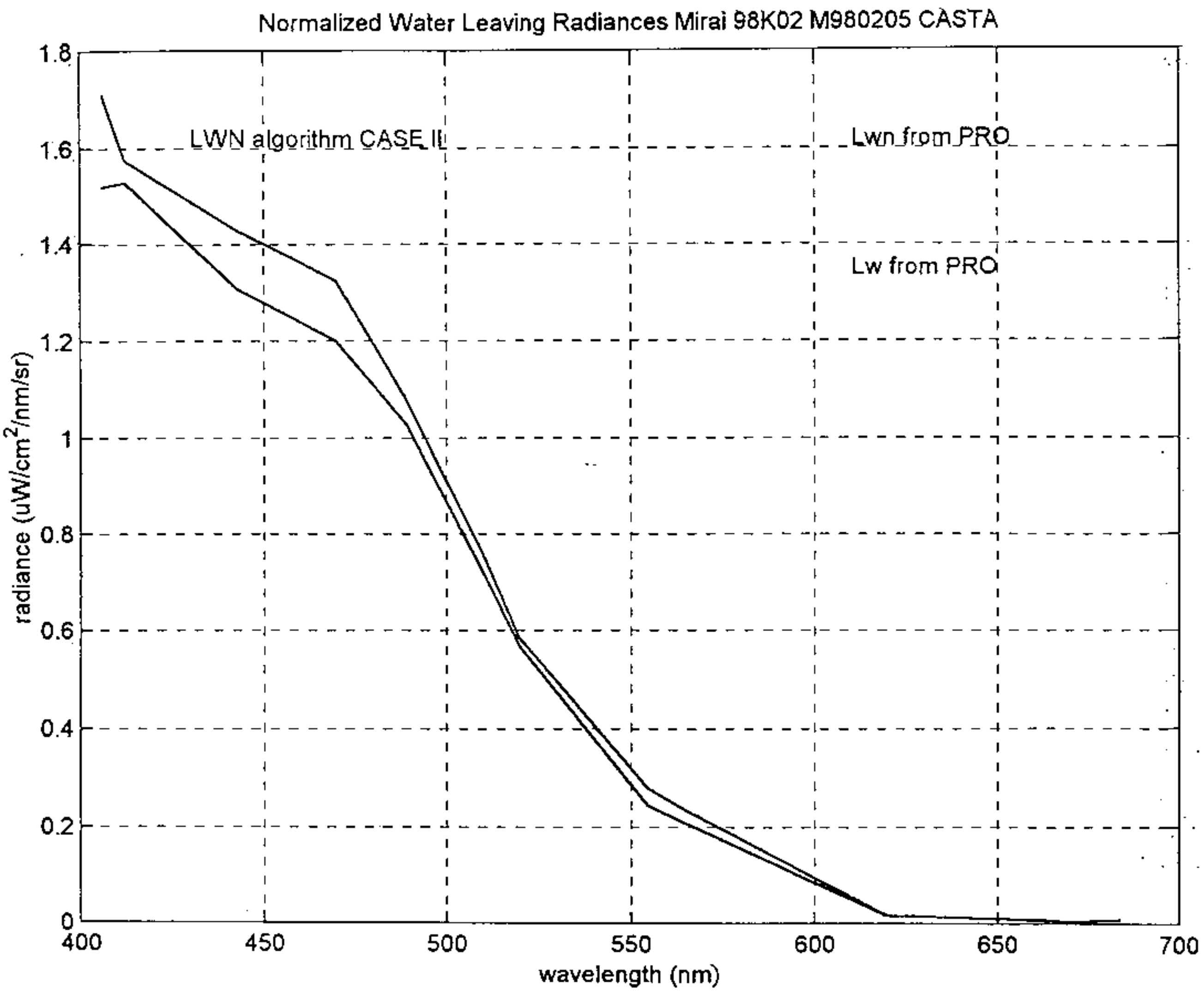
Downwelling Irradiance - Mirai 98K02 M980205 CASTA - Binned Level 3C
Ed (uW/cm2/nm)
wavelength (nm)
10^3
10^2
10^1
10^0
10^-1
10^-2
10^-3
10^-4
-20m
-40m
-60m
-80m
-100m
-120m
-140m
-160m
-180m
-200m
400
450
500
550
600
650
700



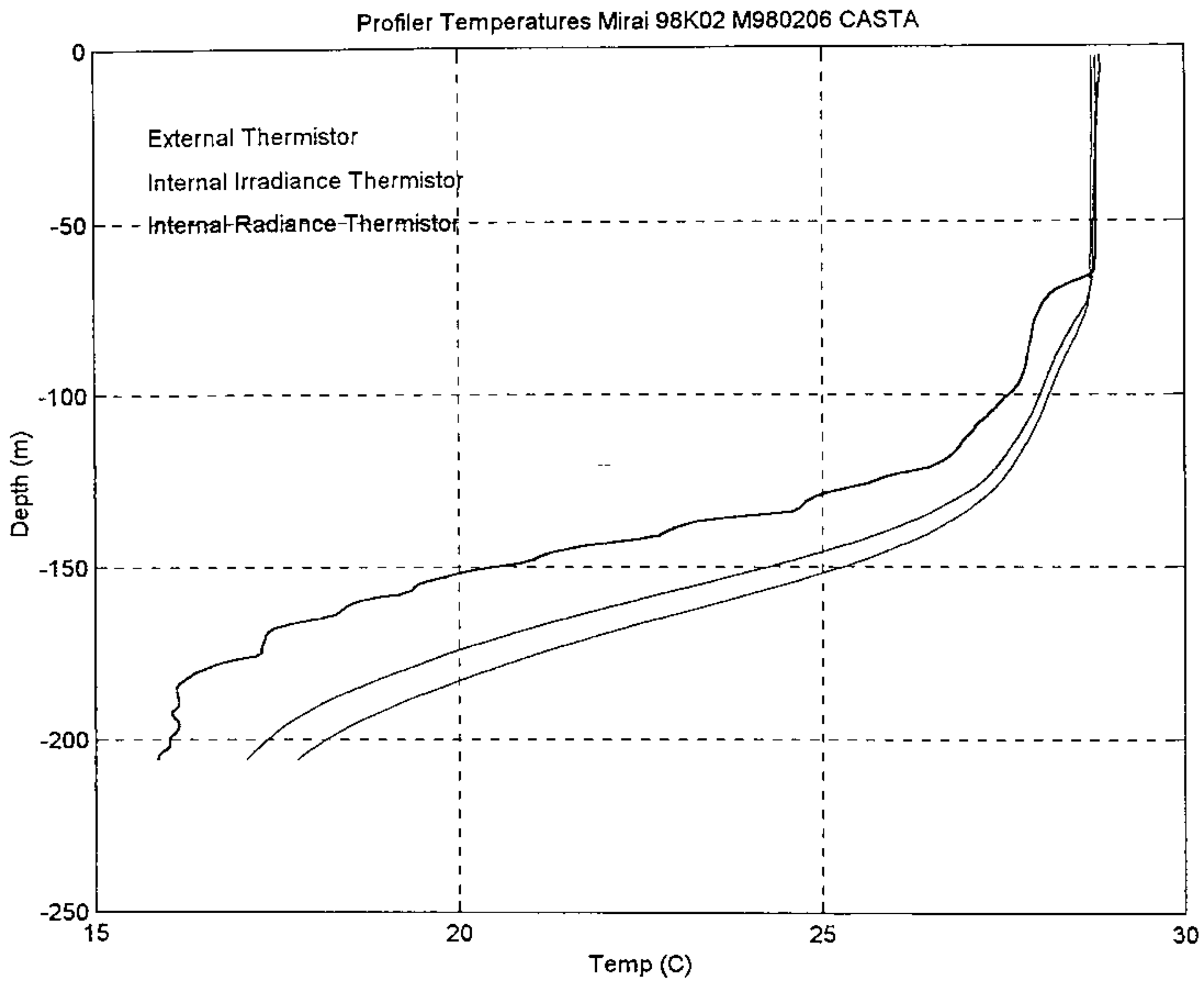
Mirai 98K02 M980205 CASTA Kd442.4nm
Ave Kd442.4 = 0.044/m
depth (m)
0
-20
-40
-60
-80
-100
-120
-140
-160
-180
-200
0
0.01
0.02
0.03
0.04
0.05
0.06
0.07
0.08
0.09
0.1
k (/m)



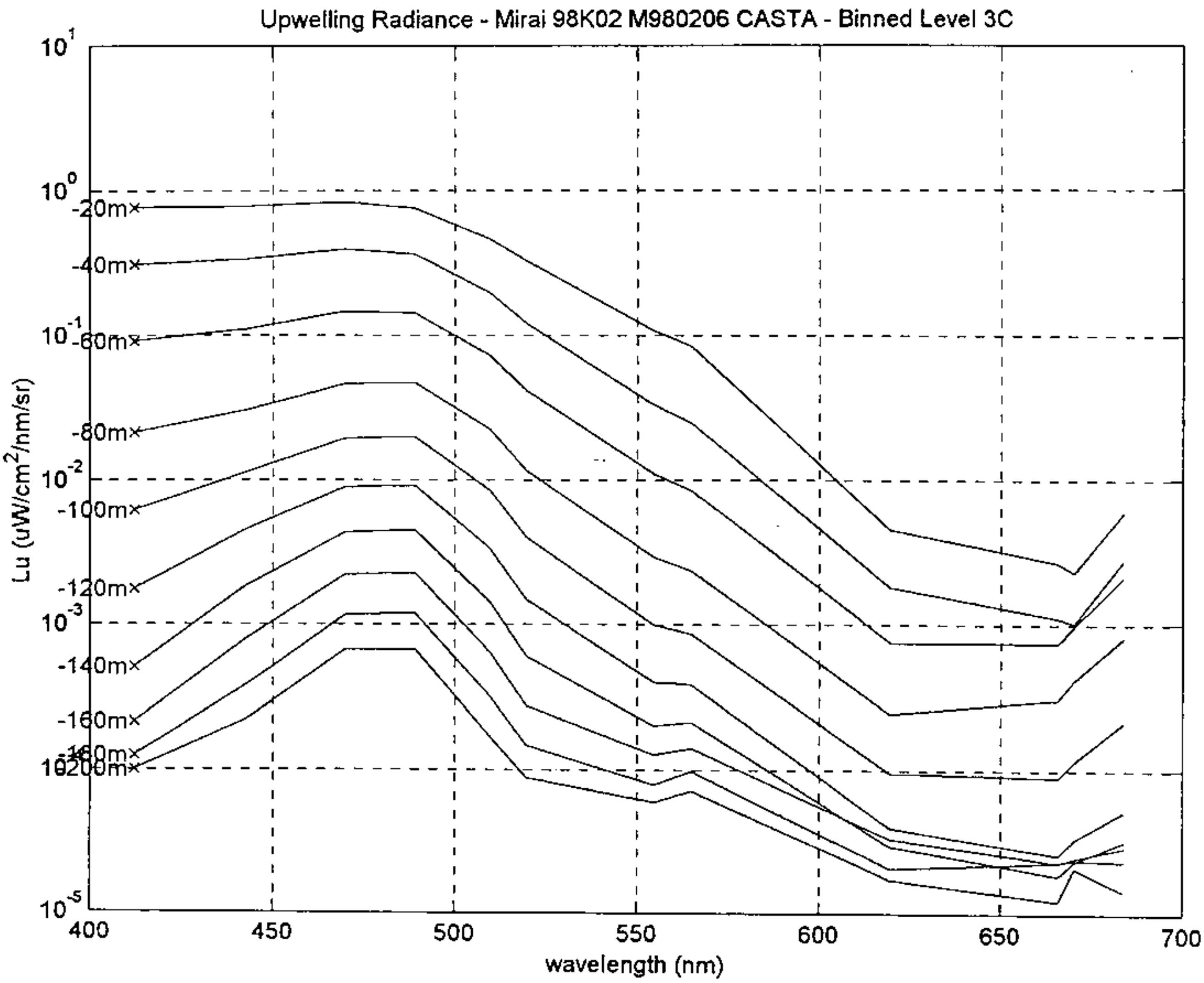
PAR Profile - Mirai 98K02 M980205 CASTA
Profiler PAR
Reference PAR(0.3m-) 1.20e+017
Surface PAR(0.0m-) 1.22e+017
Surface PAR(0.0m+) 1.29e+017
Kpar = 0.043/m
35.0%=-14m
20.0%=-28m
10.0%=-46m
5.0%=-64m
2.0%=-85m
1.0%=-98m
0.3%=-122m
depth (m)
PAR (quanta/cm2/sec)



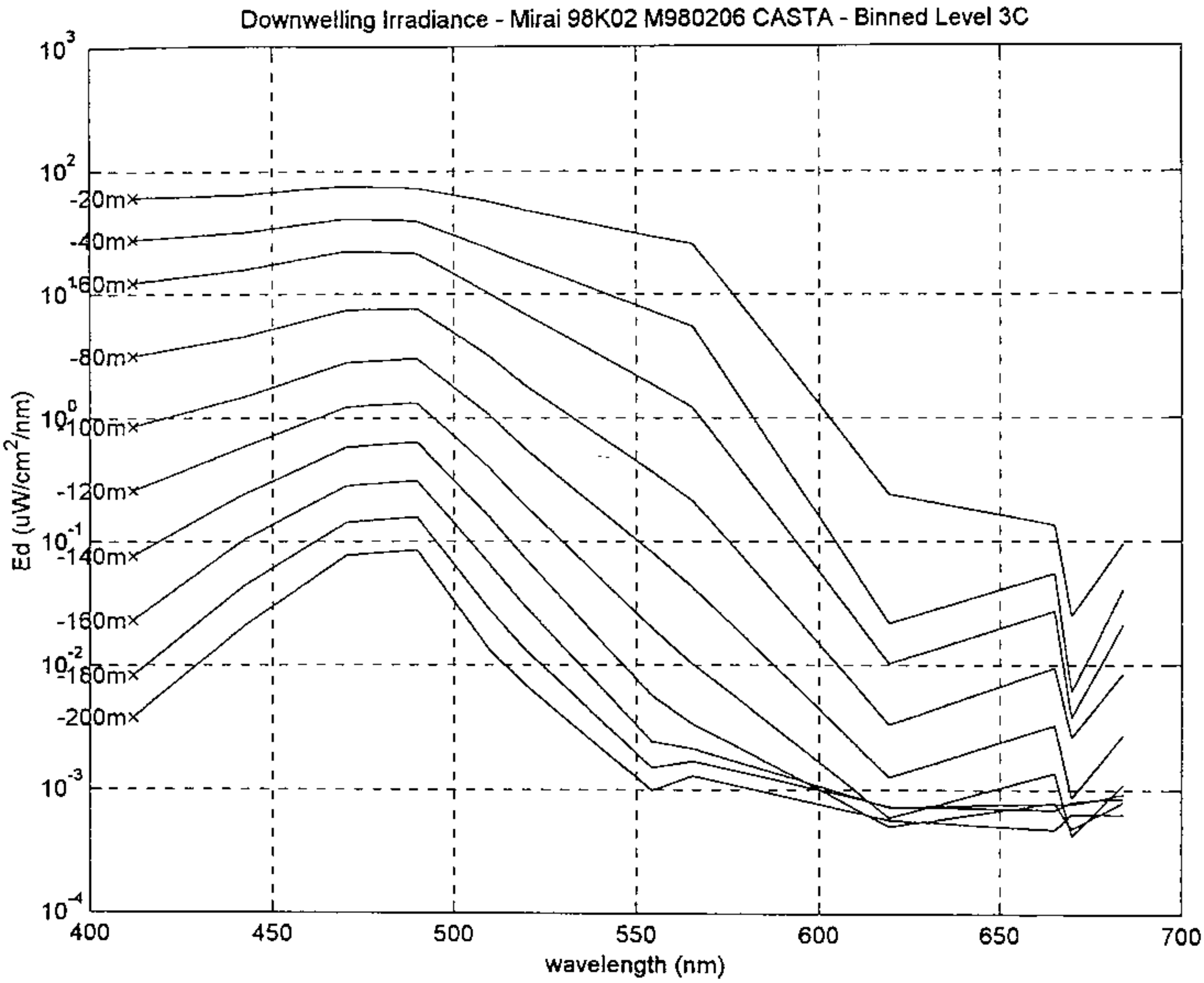
Normalized Water Leaving Radiances Mirai 98K02 M980205 CASTA
LWN algorithm CASE II
Lwn from PRO
Lw from PRO
radiance (uW/cm^2/nm/sr)
wavelength (nm)
0
0.2
0.4
0.6
0.8
1
1.2
1.4
1.6
1.8
400
450
500
550
600
650
700

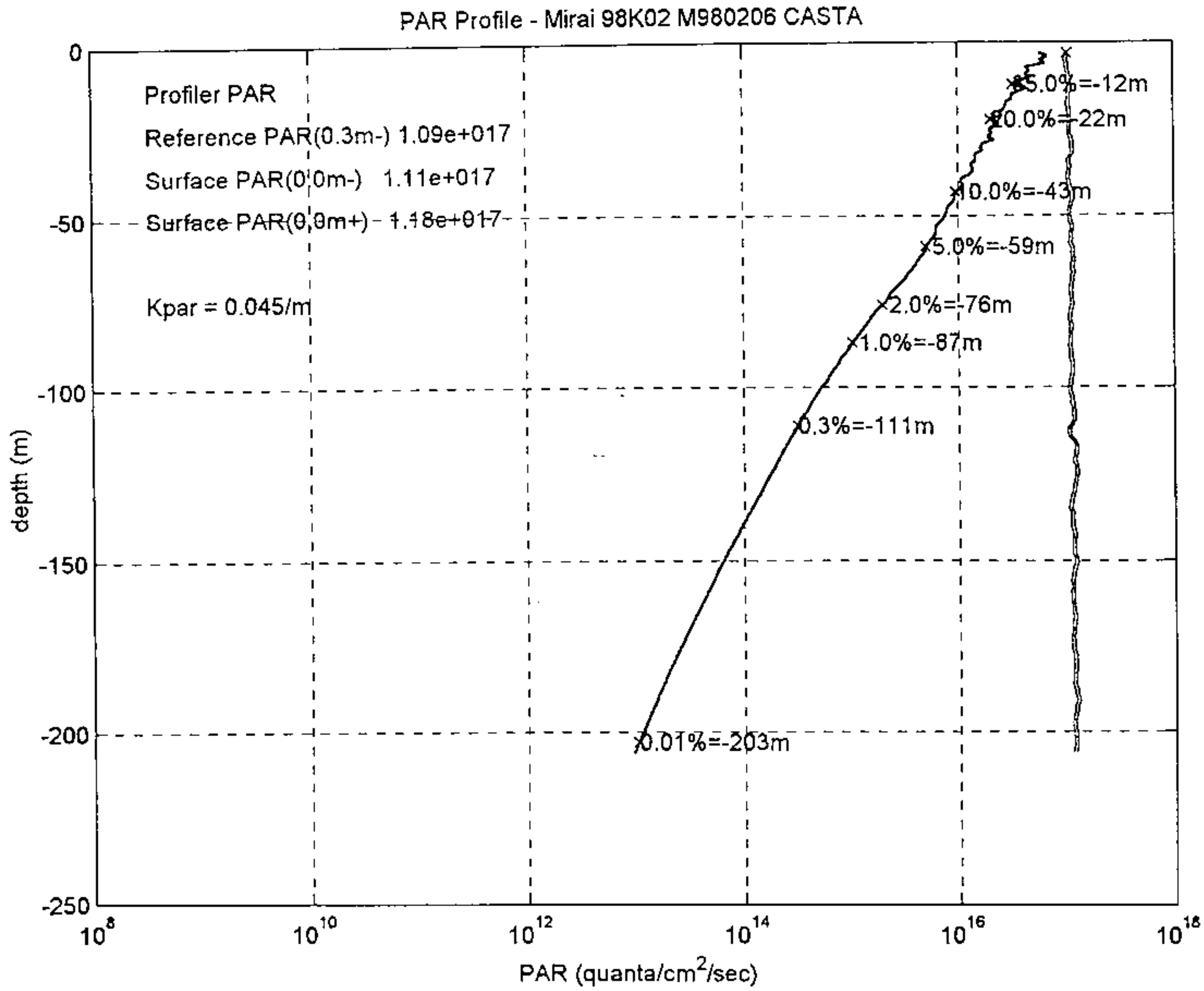


Profiler Temperatures Mirai 98K02 M980206 CASTA
External Thermistor
Internal Irradiance Thermistor
Internal Radiance Thermistor
Depth (m)
0
-50
-100
-150
-200
-250
15
20
25
30
Temp (C)

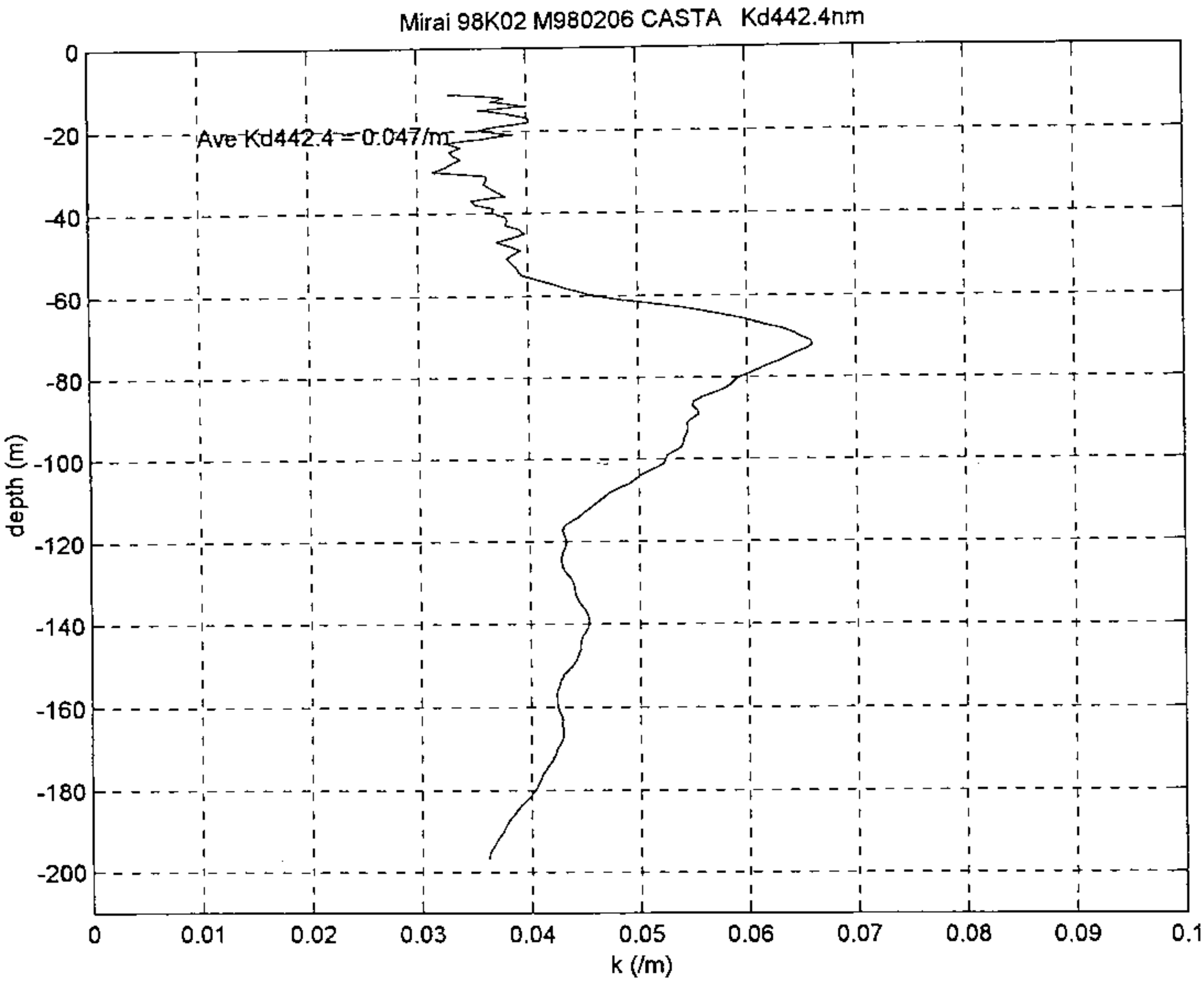


Upwelling Radiance - Mirai 98K02 M980206 CASTA - Binned Level 3C
10^1
10^0
10^{-1}
10^{-2}
10^{-3}
10^{-5}
-20m×
-40m×
-60m×
-80m×
-100m×
-120m×
-140m×
-160m×
-180m×
-200m×
Lu (uW/cm^2/nm/sr)
400
450
500
550
600
650
700
wavelength (nm)

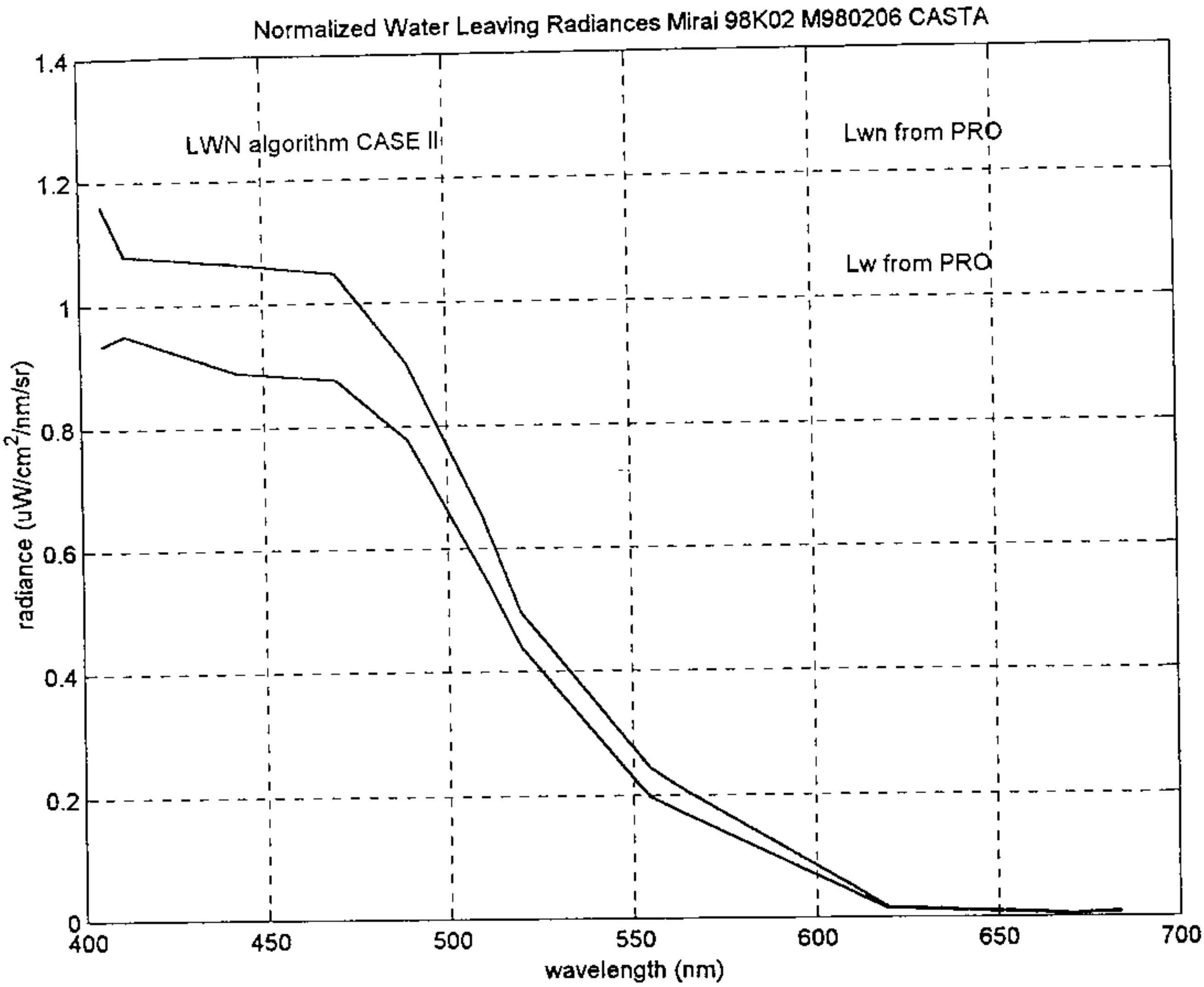

Downwelling Irradiance - Mirai 98K02 M980206 CASTA - Binned Level 3C
Ed (uW/cm^2/nm)
wavelength (nm)
-20m
-40m
-60m
-80m
-100m
-120m
-140m
-160m
-180m
-200m
10^3
10^2
10^1
10^0
10^-1
10^-2
10^-3
10^-4
400
450
500
550
600
650
700



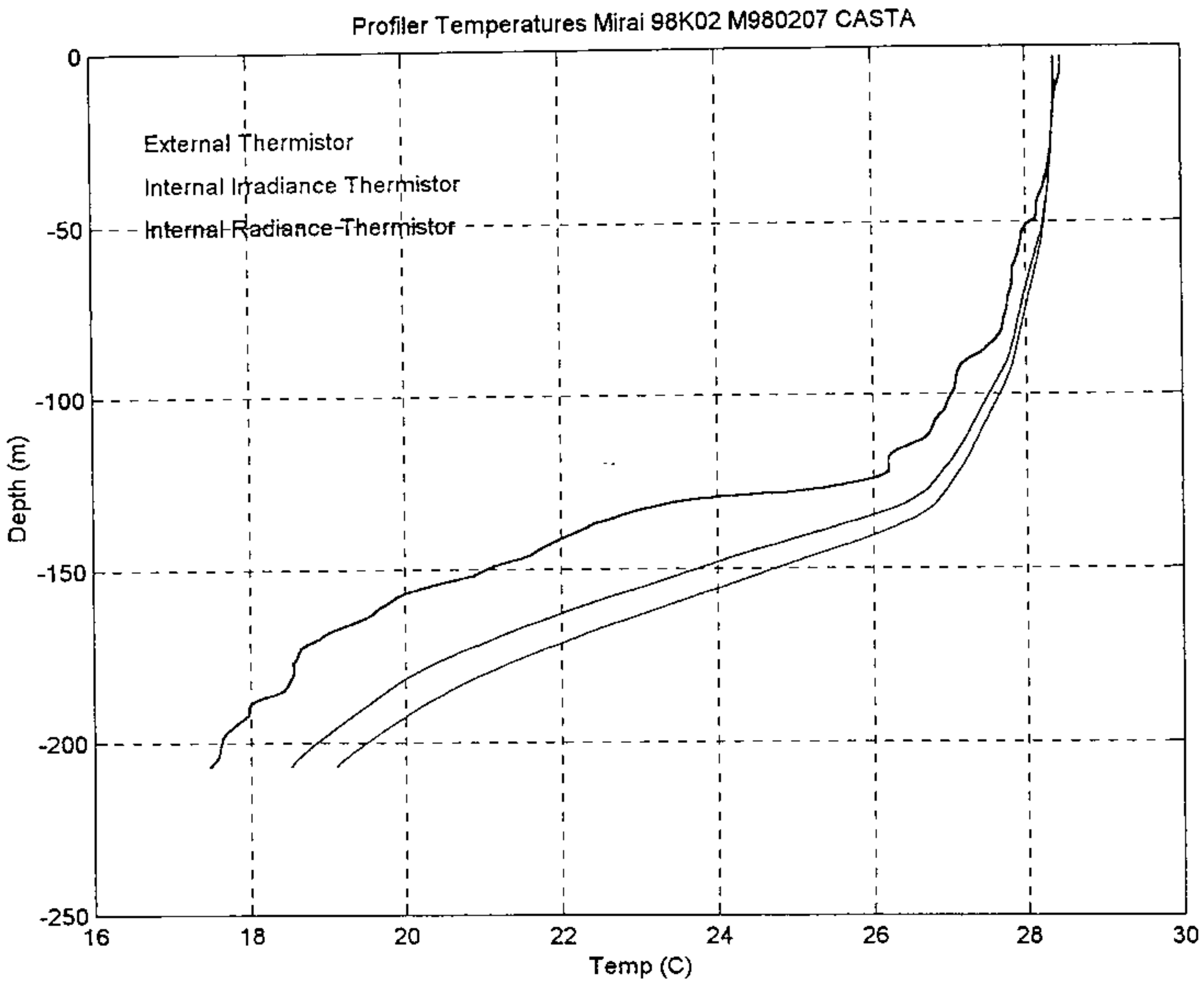
PAR Profile - Mirai 98K02 M980206 CASTA
Profiler PAR
Reference PAR(0.3m-) 1.09e+017
Surface PAR(0.0m-) 1.11e+017
Surface PAR(0.0m+) 1.18e+017
Kpar = 0.045/m
25.0%=-12m
20.0%=-22m
10.0%=-43m
5.0%=-59m
2.0%=-76m
1.0%=-87m
0.3%=-111m
0.01%=-203m
0
-50
-100
-150
-200
-250
depth (m)
10^8
10^{10}
10^{12}
10^{14}
10^{16}
10^{18}
PAR (quanta/cm^2/sec)



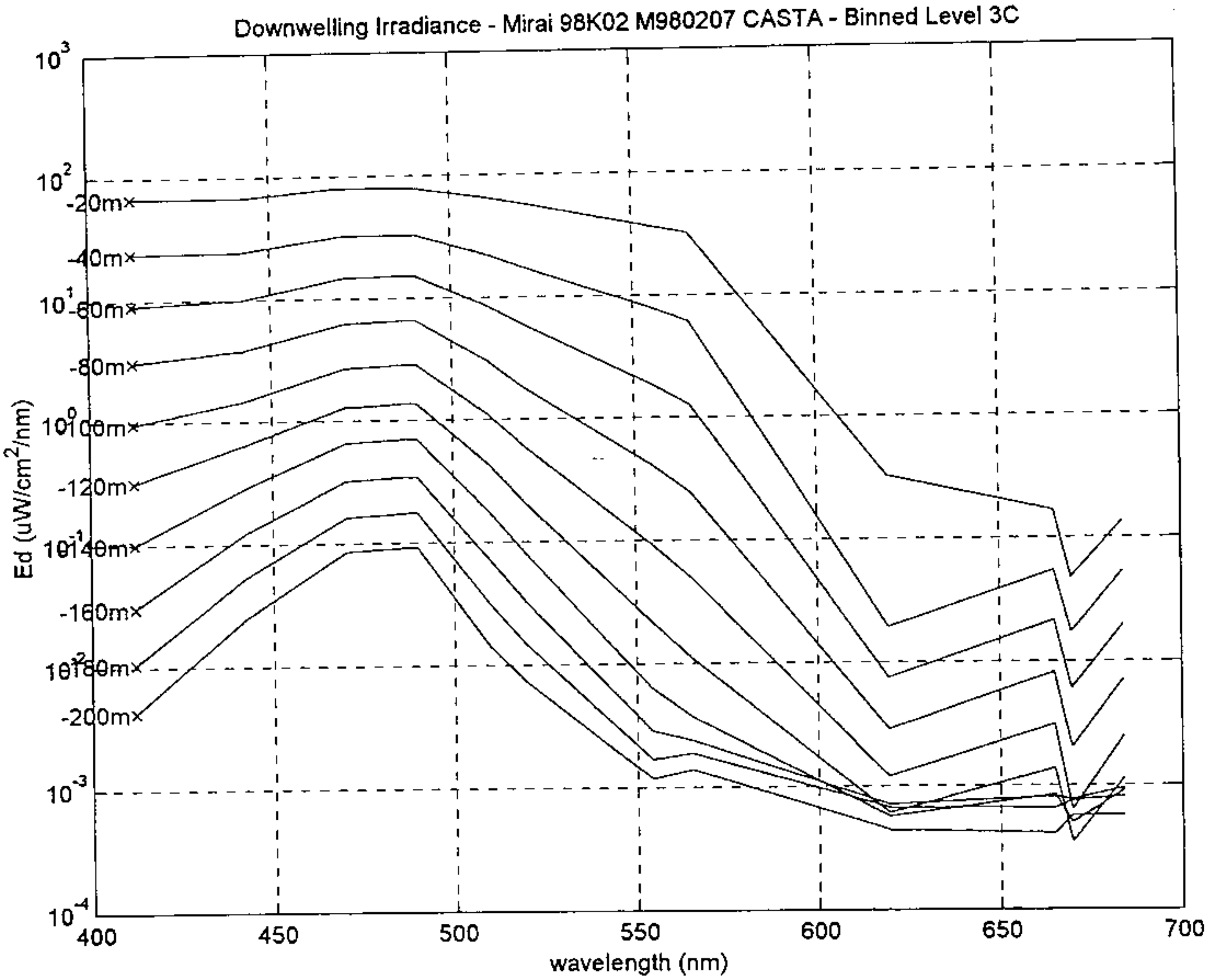
Mirai 98K02 M980206 CASTA Kd442.4nm
Ave Kd442.4 = 0.047/m
depth (m)
0
-20
-40
-60
-80
-100
-120
-140
-160
-180
-200
0
0.01
0.02
0.03
0.04
0.05
0.06
0.07
0.08
0.09
0.1
k (/m)

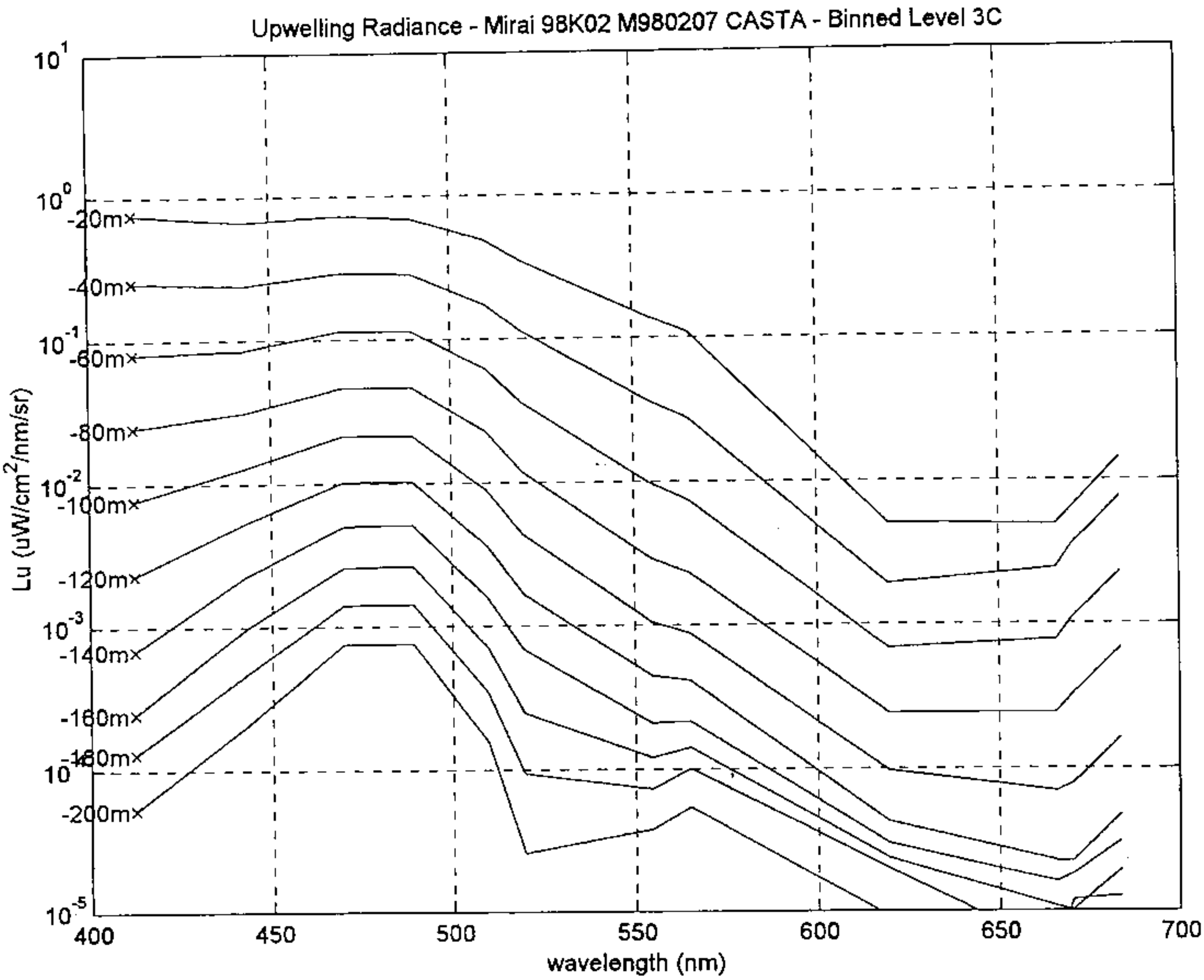


Normalized Water Leaving Radiances Mirai 98K02 M980206 CASTA
LWN algorithm CASE II
Lwn from PRO
Lw from PRO
radiance (uW/cm2/nm/sr)
wavelength (nm)
1.4
1.2
1
0.8
0.6
0.4
0.2
0
400
450
500
550
600
650
700

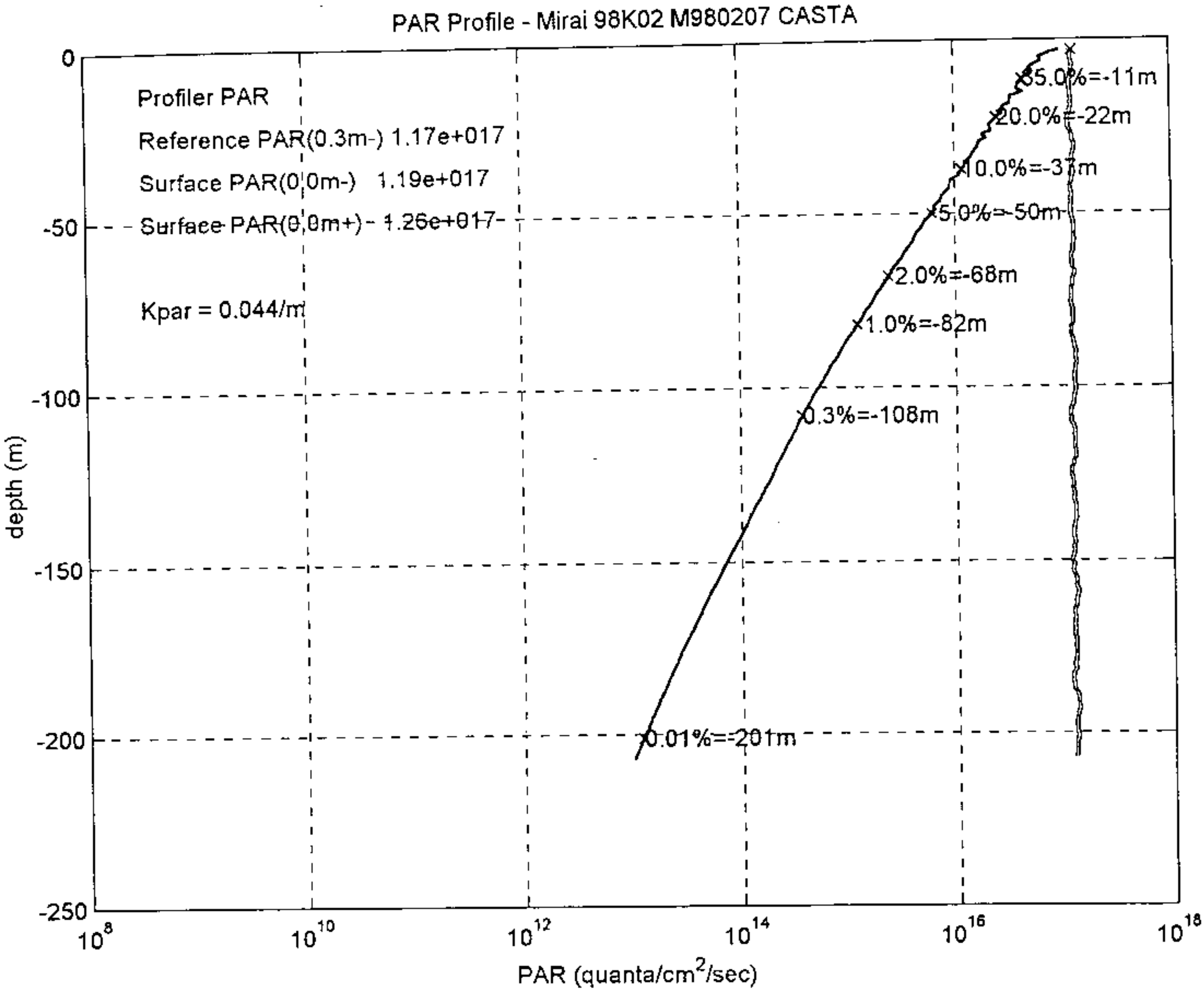


Profiler Temperatures Mirai 98K02 M980207 CASTA
External Thermistor
Internal Irradiance Thermistor
Internal Radiance Thermistor
Depth (m)
0
-50
-100
-150
-200
-250
16
18
20
22
24
26
28
30
Temp (C)

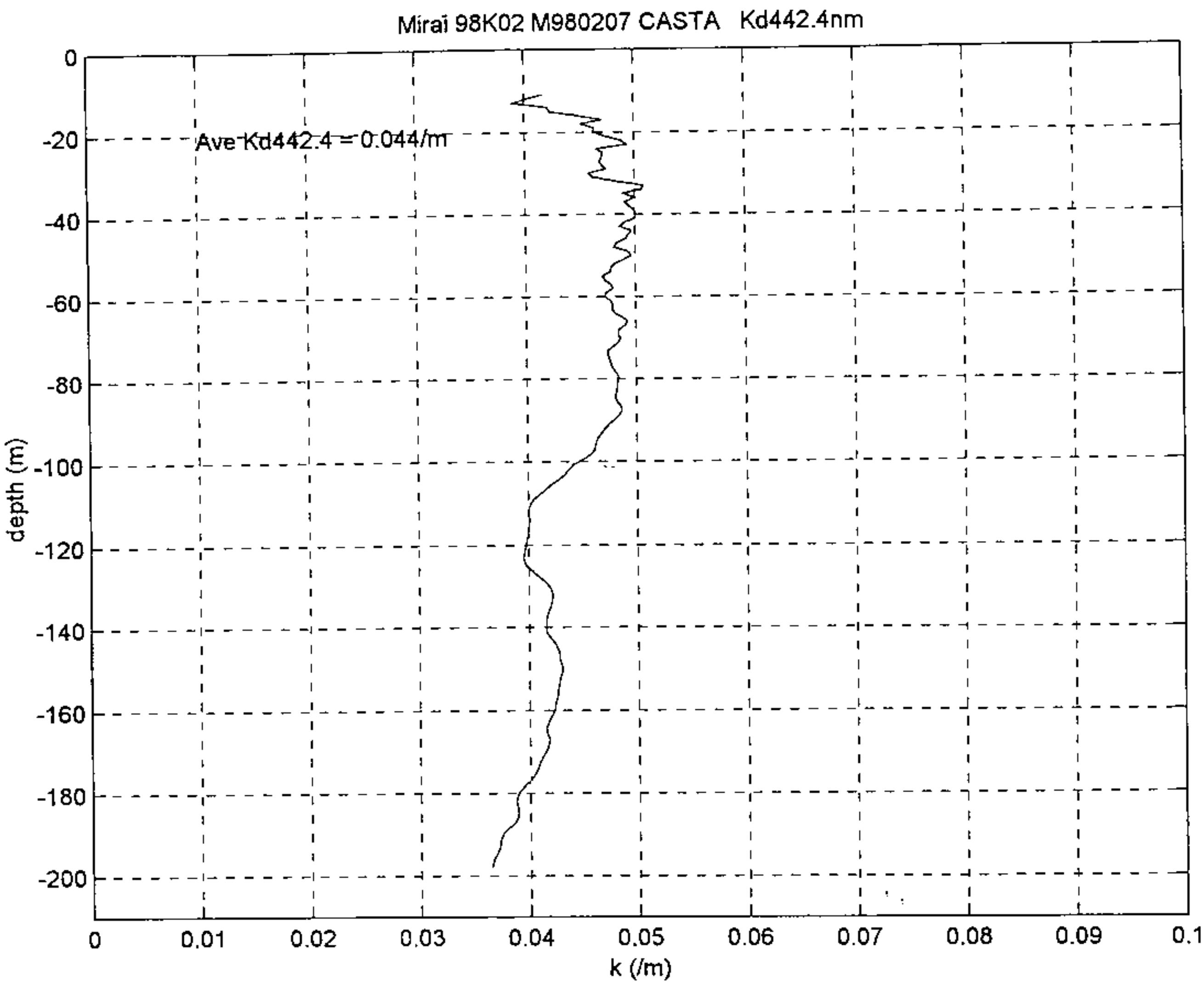

Downwelling Irradiance - Mirai 98K02 M980207 CASTA - Binned Level 3C
10^3
10^2
10^1
10^0
10^-1
10^-2
10^-3
10^-4
-20m×
-40m×
-60m×
-80m×
-100m×
-120m×
-140m×
-160m×
-180m×
-200m×
Ed (uW/cm^2/nm)
400
450
500
550
600
650
700
wavelength (nm)



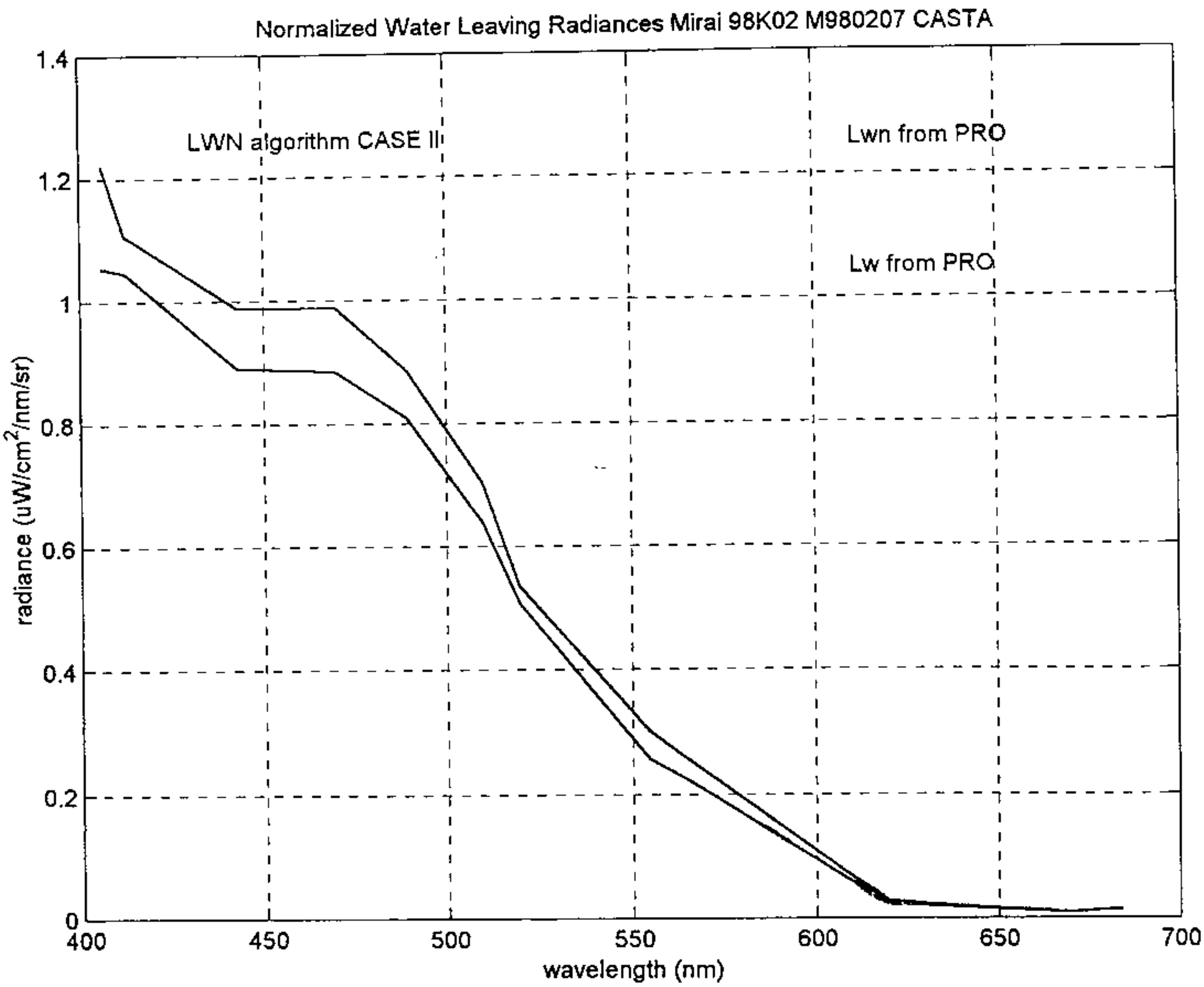
Upwelling Radiance - Mirai 98K02 M980207 CASTA - Binned Level 3C
Lu (uW/cm^2/nm/sr)
wavelength (nm)
10^1
10^0
10^-1
10^-2
10^-3
10^-5
400
450
500
550
600
650
700
-20m×
-40m×
-60m×
-80m×
-100m×
-120m×
-140m×
-160m×
-180m×
-200m×



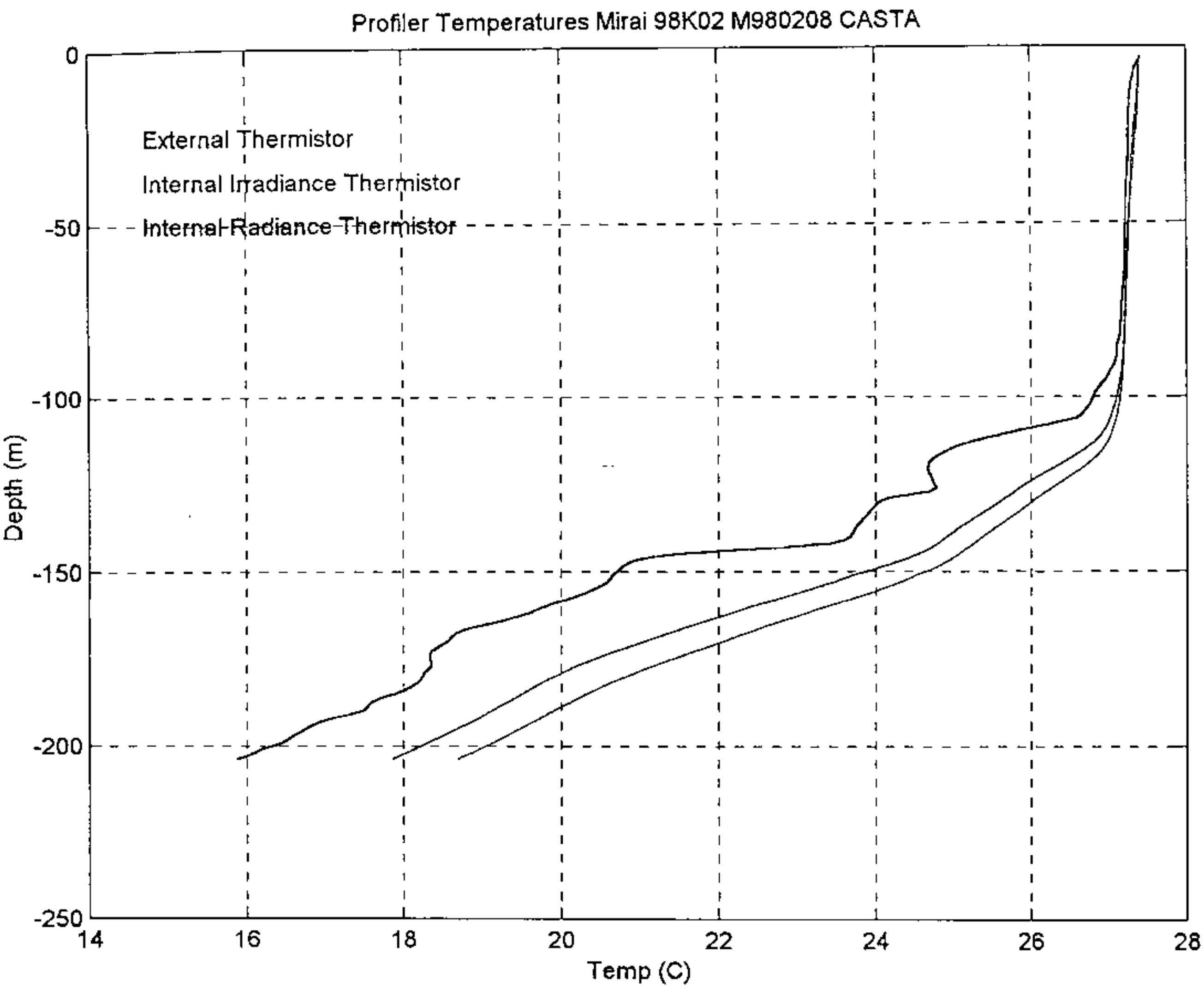
PAR Profile - Mirai 98K02 M980207 CASTA
Profiler PAR
Reference PAR(0.3m-) 1.17e+017
Surface PAR(0.0m-) 1.19e+017
Surface PAR(0.0m+) 1.26e+017
Kpar = 0.044/m
35.0%=-11m
20.0%=-22m
10.0%=-37m
5.0%=-50m
2.0%=-68m
1.0%=-82m
0.3%=-108m
0.01%=-201m
depth (m)
0
-50
-100
-150
-200
-250
10^8
10^10
10^12
10^14
10^16
10^18
PAR (quanta/cm^2/sec)

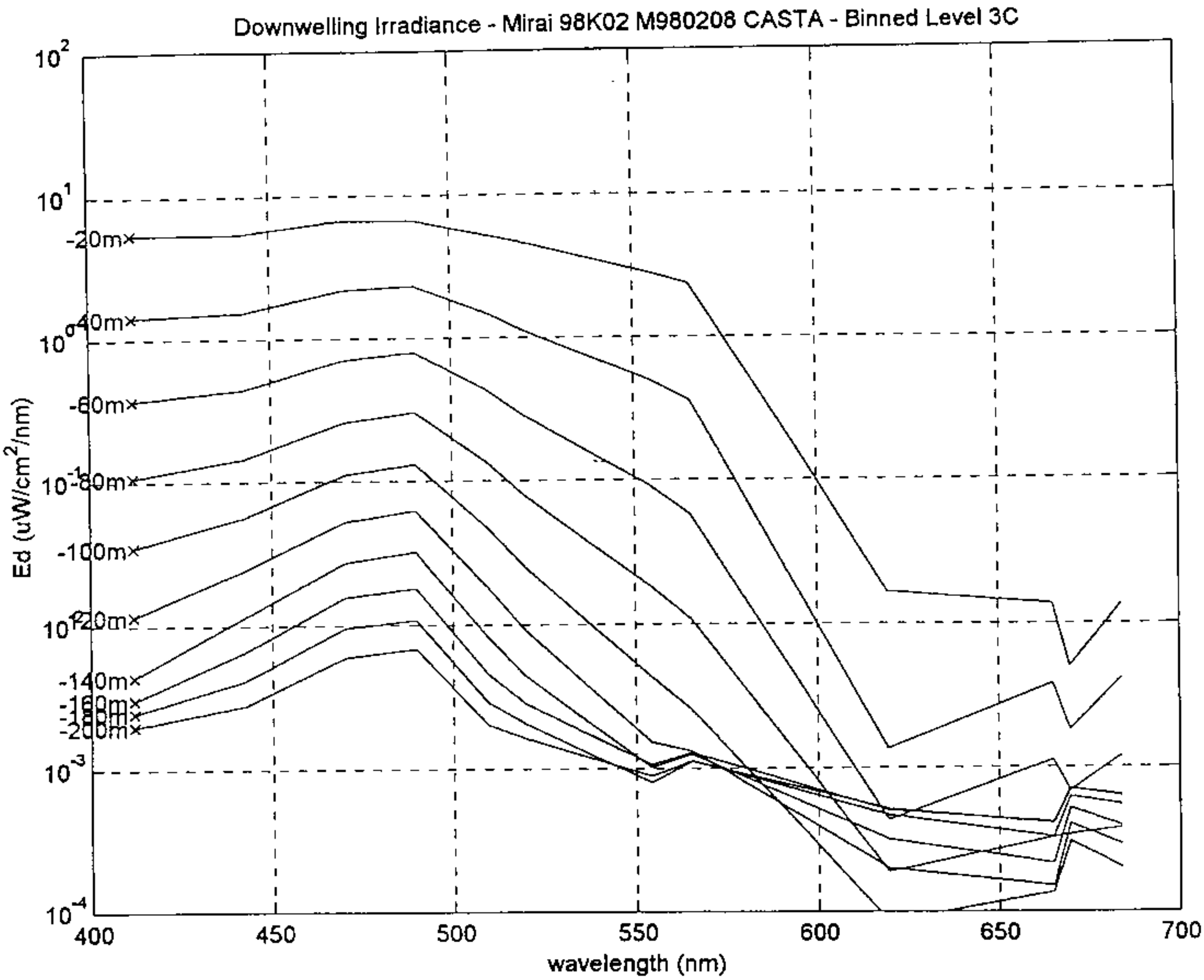


Mirai 98K02 M980207 CASTA Kd442.4nm
Ave Kd442.4 = 0.044/m
depth (m)
k (/m)
0
-20
-40
-60
-80
-100
-120
-140
-160
-180
-200
0
0.01
0.02
0.03
0.04
0.05
0.06
0.07
0.08
0.09
0.1

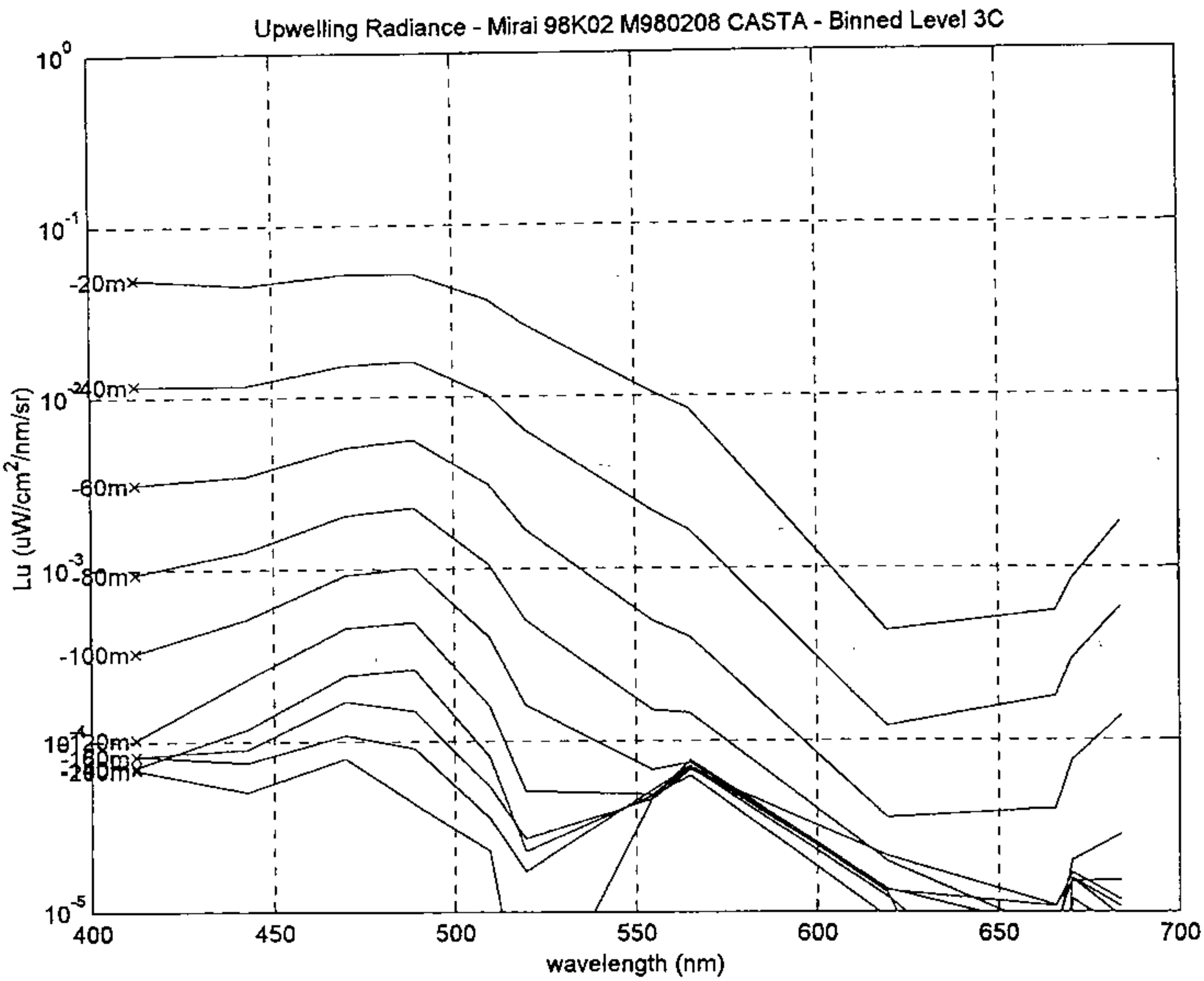


Normalized Water Leaving Radiances Mirai 98K02 M980207 CASTA
LWN algorithm CASE II
Lwn from PRO
Lw from PRO
radiance (uW/cm^2/nm/sr)
wavelength (nm)
1.4
1.2
1
0.8
0.6
0.4
0.2
0
400
450
500
550
600
650
700

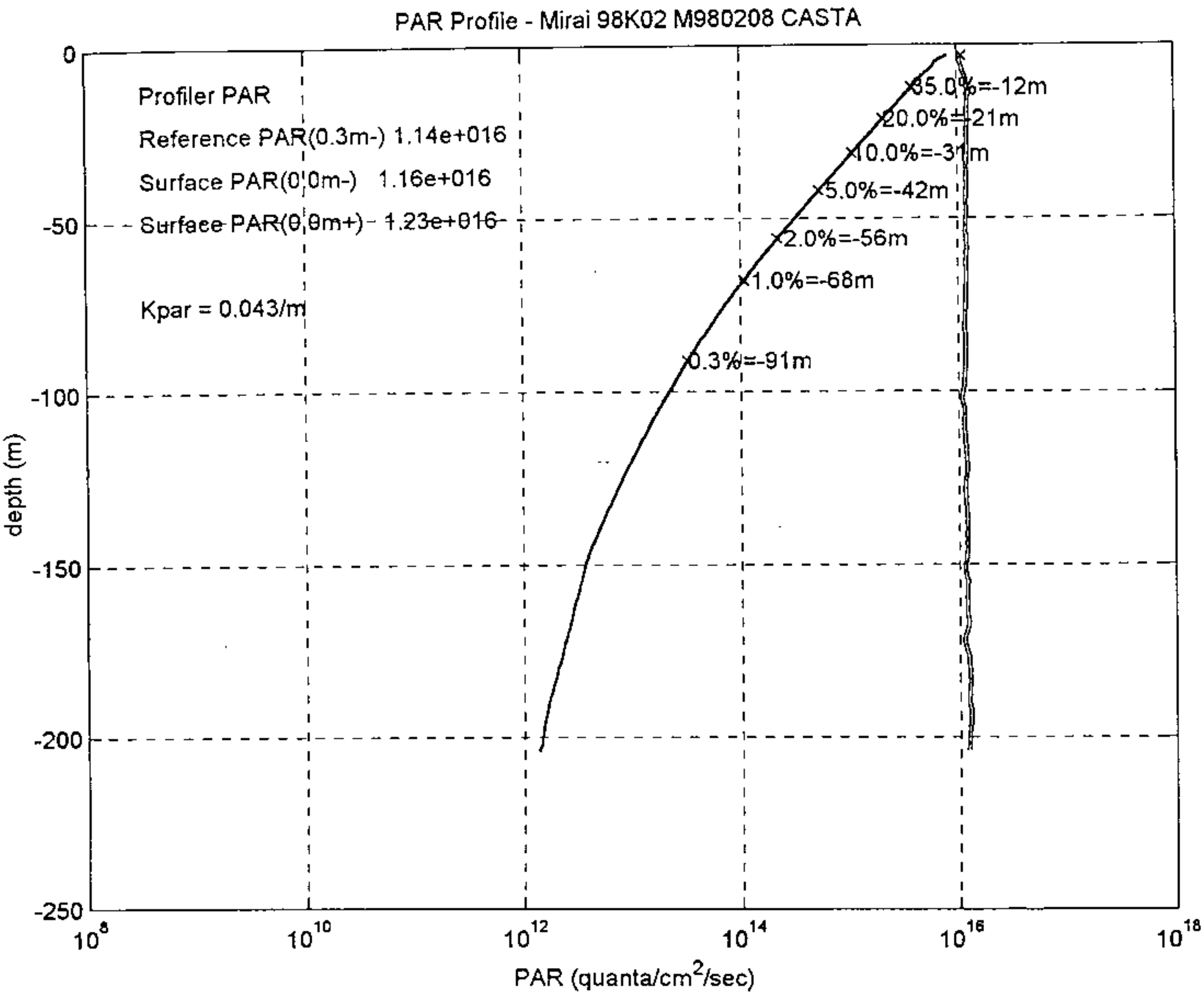

Profiler Temperatures Mirai 98K02 M980208 CASTA
External Thermistor
Internal Irradiance Thermistor
Internal Radiance Thermistor
Depth (m)
0
-50
-100
-150
-200
-250
14
16
18
20
22
24
26
28
Temp (C)



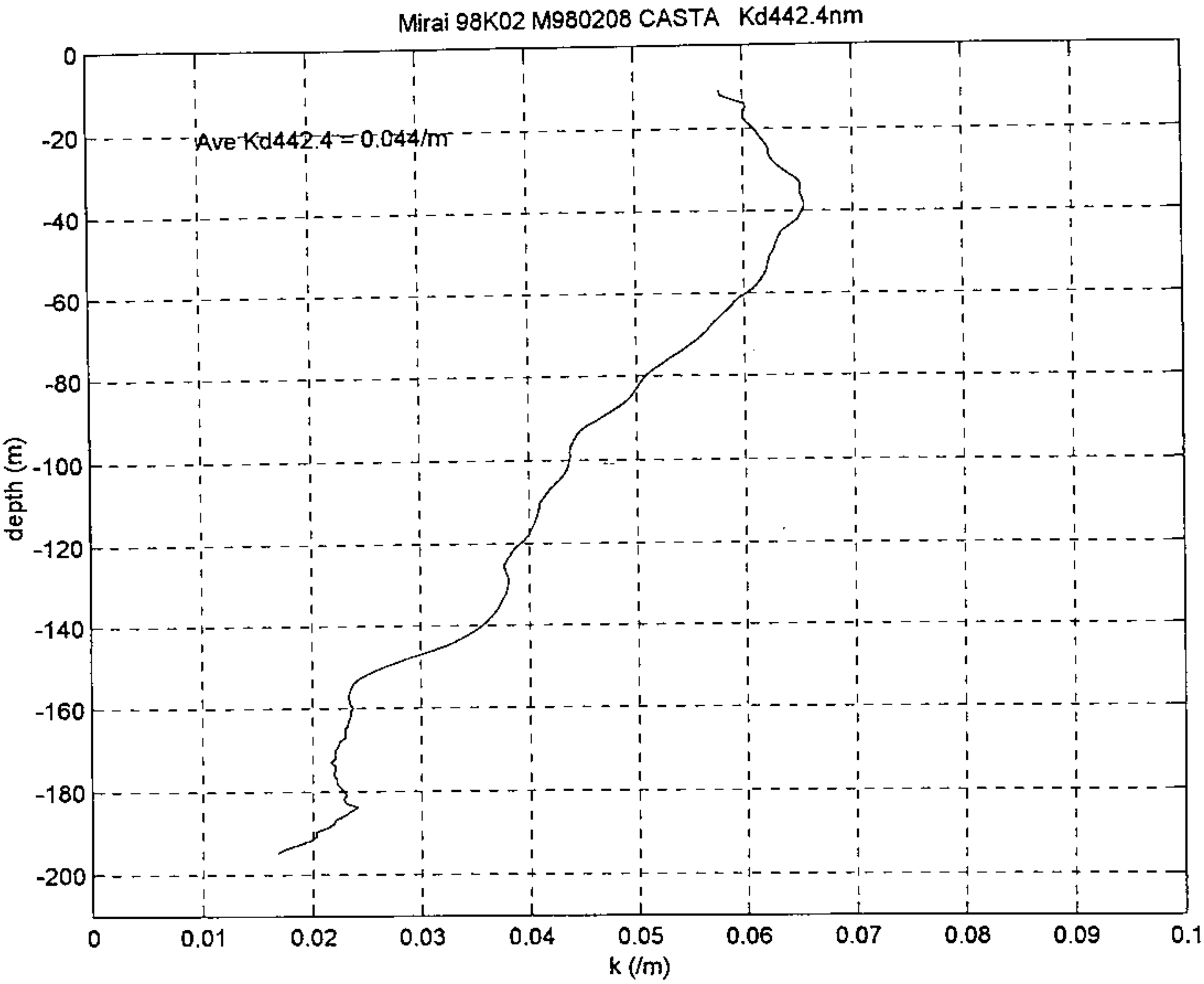
Downwelling Irradiance - Mirai 98K02 M980208 CASTA - Binned Level 3C
Ed (uW/cm^2/nm)
wavelength (nm)
-20m
-40m
-60m
-80m
-100m
-120m
-140m
-160m
-180m
-200m
400
450
500
550
600
650
700

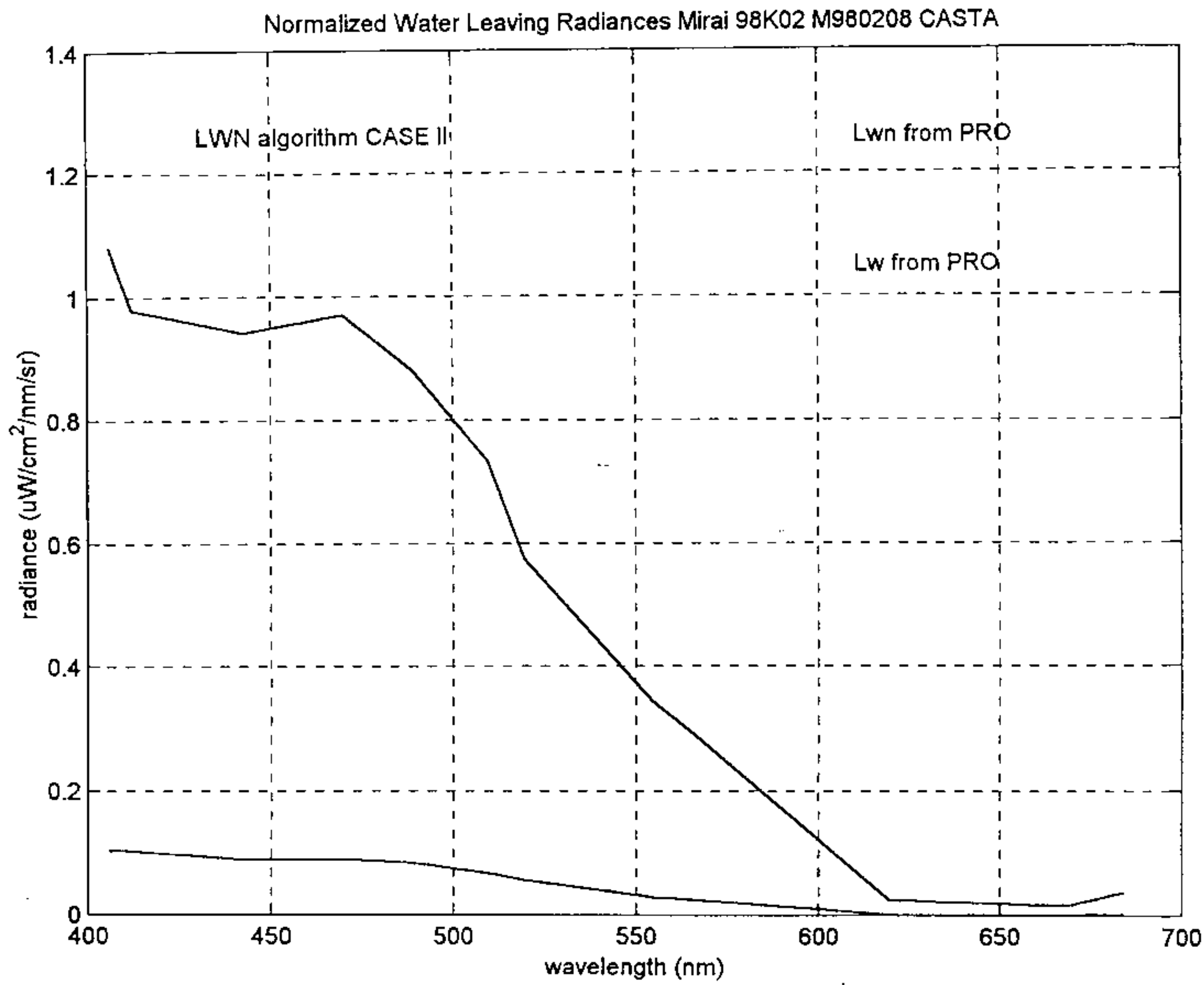


Upwelling Radiance - Mirai 98K02 M980208 CASTA - Binned Level 3C
Lu (uW/cm²/nm/sr)
wavelength (nm)
-20m
-40m
-60m
-80m
-100m
-120m
-160m
-200m
10⁰
10⁻¹
10⁻²
10⁻³
10⁻⁴
10⁻⁵
400
450
500
550
600
650
700

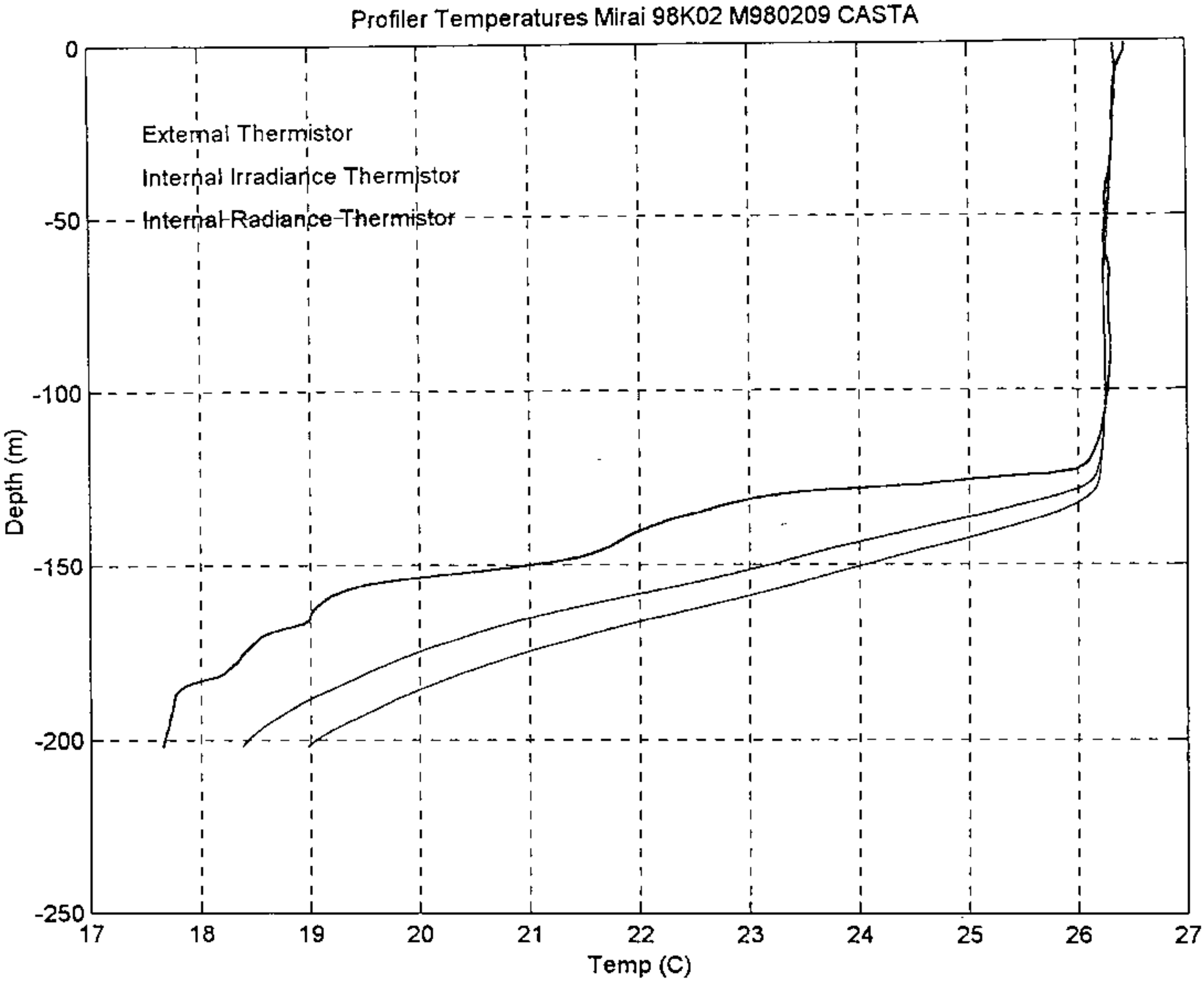


PAR Profile - Mirai 98K02 M980208 CASTA
Profiler PAR
Reference PAR(0.3m-) 1.14e+016
Surface PAR(0.0m-) 1.16e+016
Surface PAR(0.0m+) 1.23e+016
Kpar = 0.043/m
35.0%=-12m
20.0%=-21m
10.0%=-31m
5.0%=-42m
2.0%=-56m
1.0%=-68m
0.3%=-91m
depth (m)
0
-50
-100
-150
-200
-250
10^8
10^{10}
10^{12}
10^{14}
10^{16}
10^{18}
PAR (quanta/cm^2/sec)

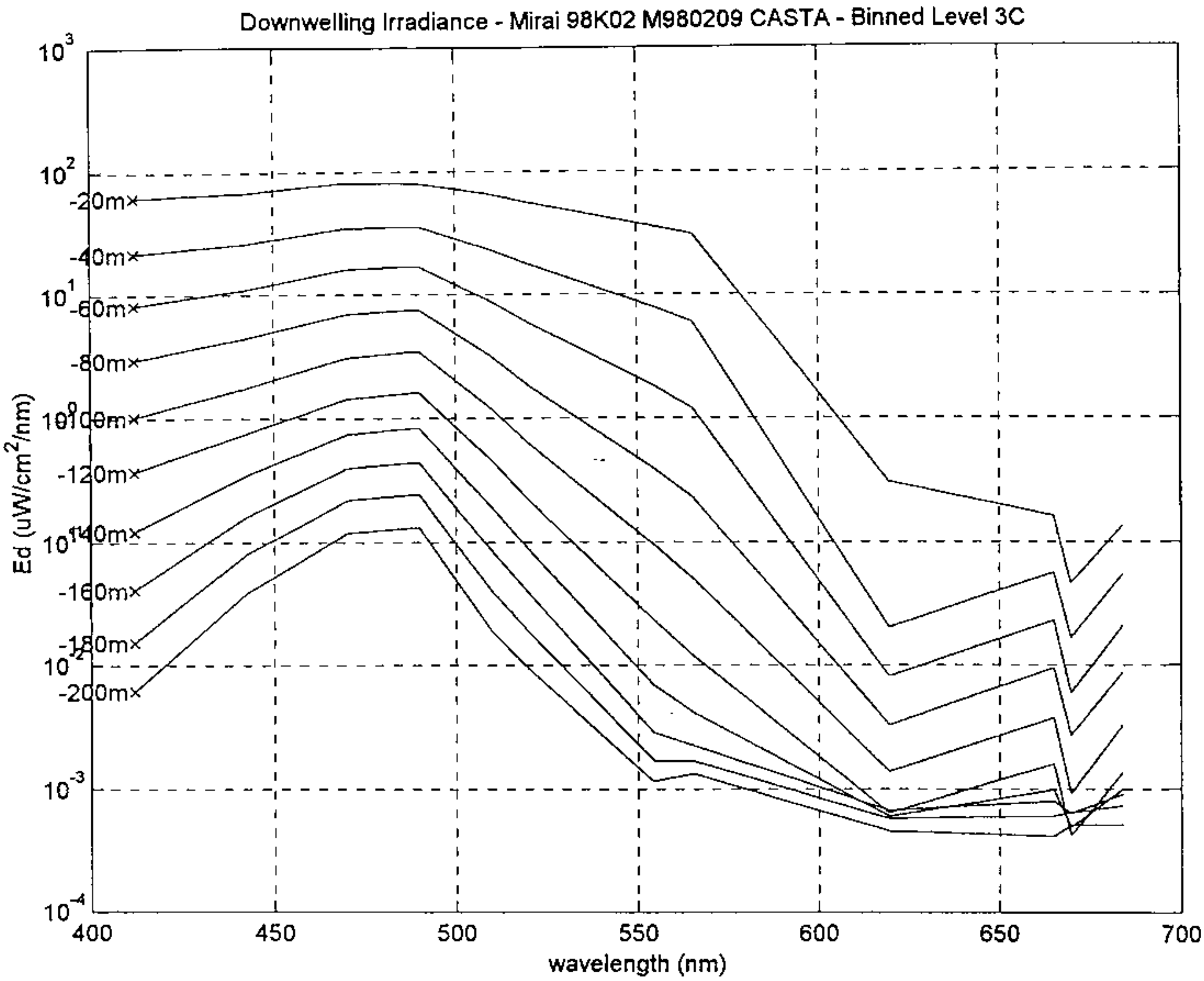

Mirai 98K02 M980208 CASTA Kd442.4nm
Ave Kd442.4 = 0.044/m
depth (m)
0
-20
-40
-60
-80
-100
-120
-140
-160
-180
-200
0
0.01
0.02
0.03
0.04
0.05
0.06
0.07
0.08
0.09
0.1
k (/m)



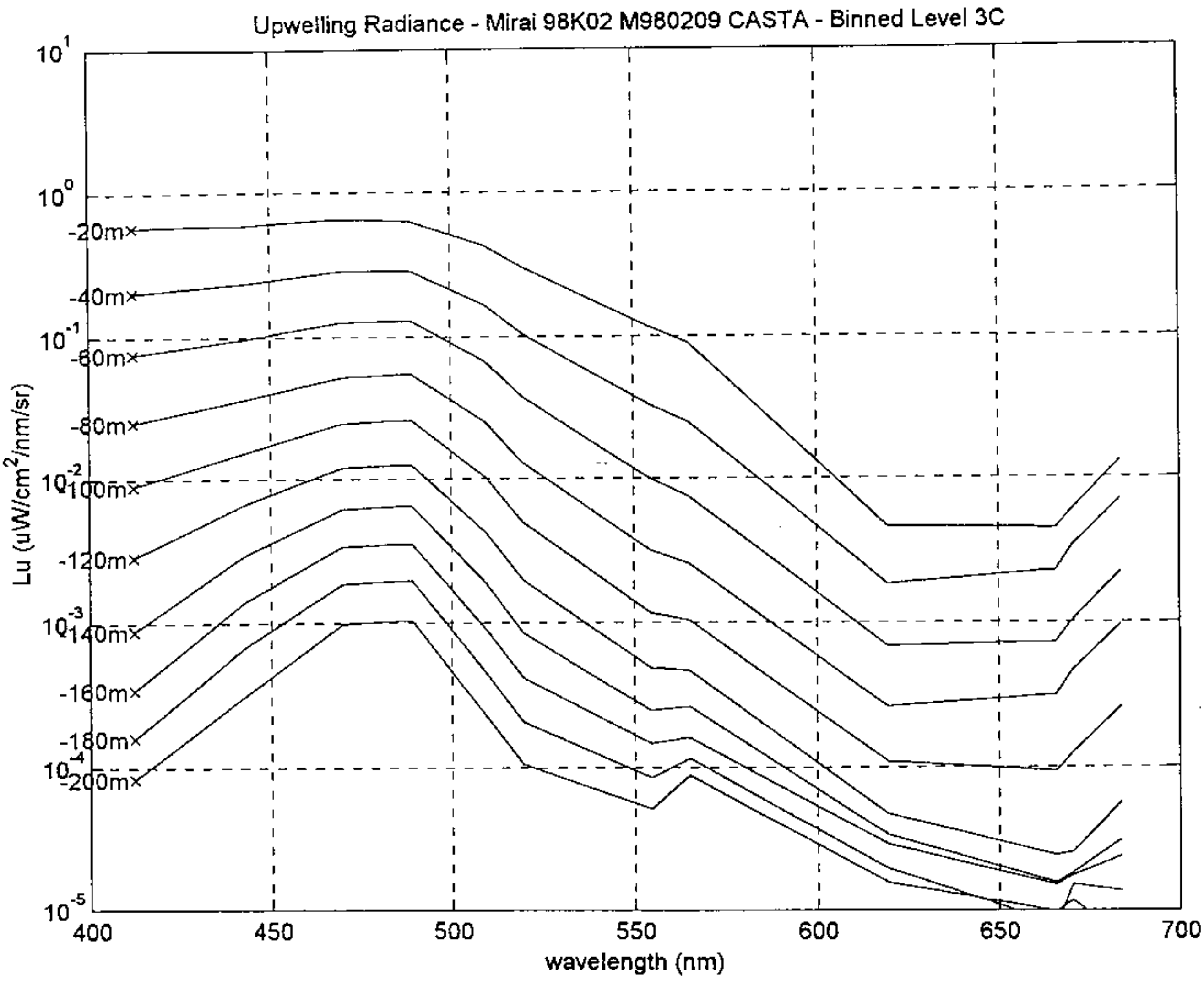
Normalized Water Leaving Radiances Mirai 98K02 M980208 CASTA
LWN algorithm CASE II
Lwn from PRO
Lw from PRO
1.4
1.2
1
0.8
0.6
0.4
0.2
0
radiance (uW/cm2/nm/sr)
400
450
500
550
600
650
700
wavelength (nm)



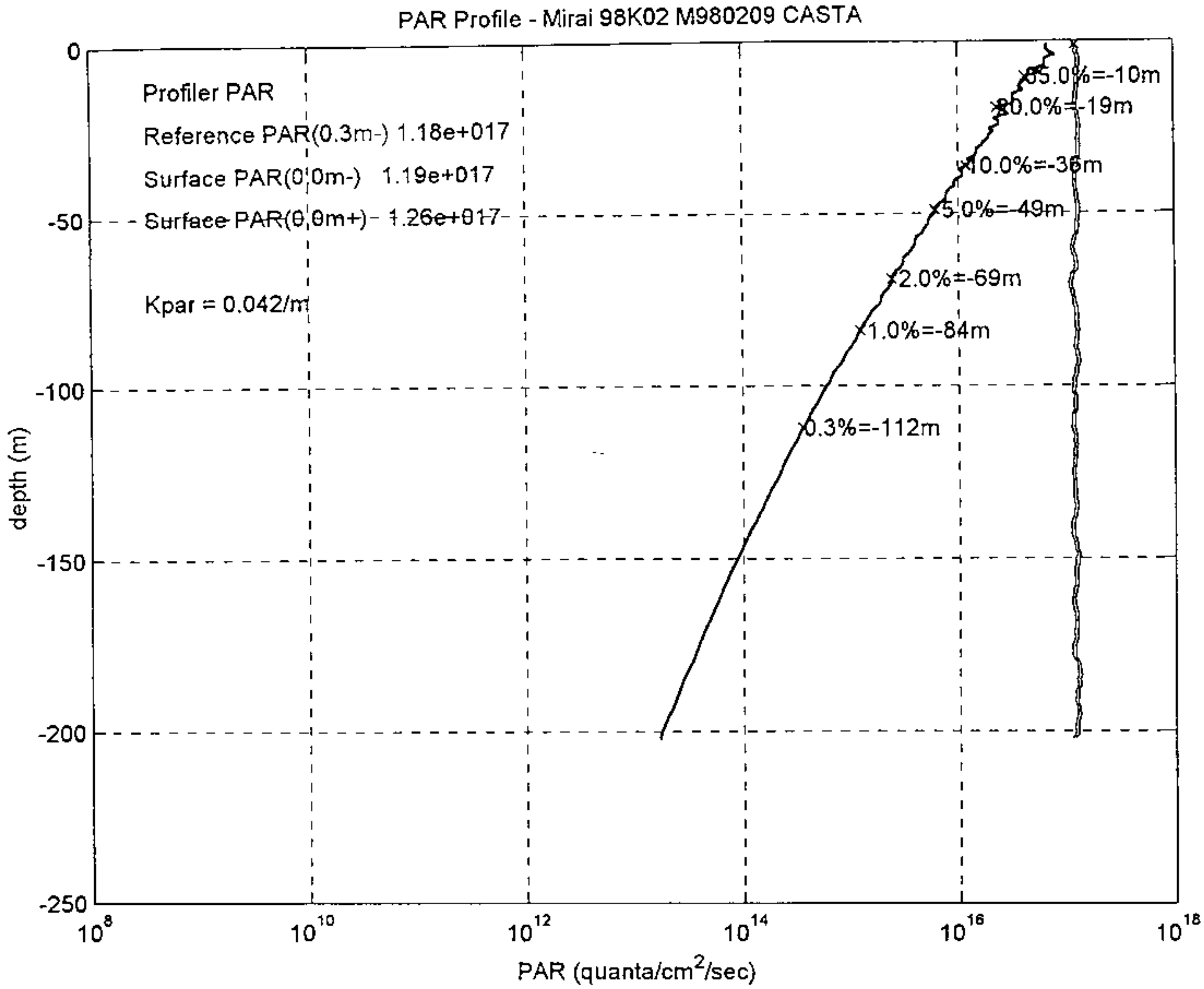
Profiler Temperatures Mirai 98K02 M980209 CASTA
External Thermistor
Internal Irradiance Thermistor
Internal Radiance Thermistor
0
-50
-100
-150
-200
-250
Depth (m)
17
18
19
20
21
22
23
24
25
26
27
Temp (C)

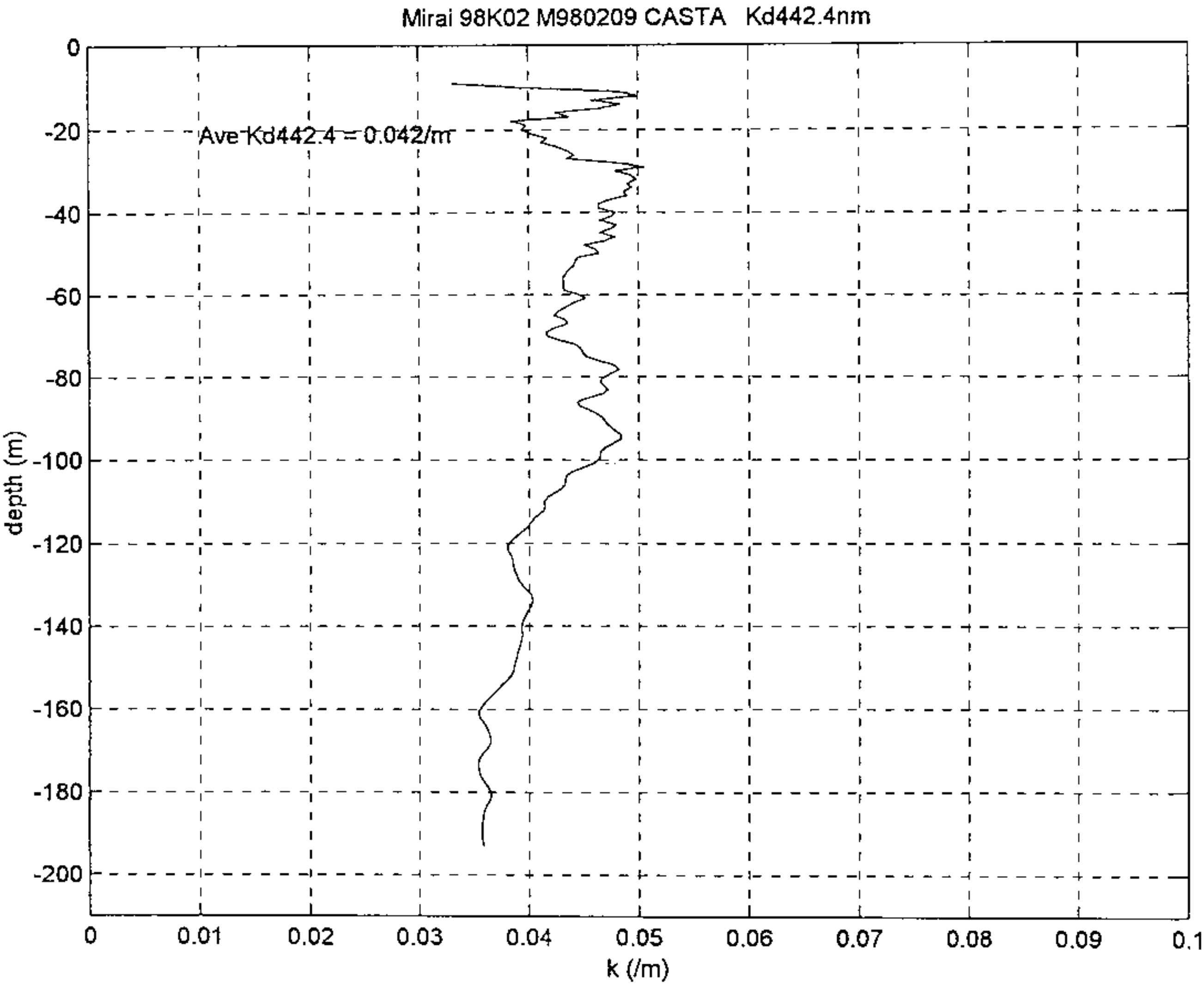


Downwelling Irradiance - Mirai 98K02 M980209 CASTA - Binned Level 3C
Ed (uW/cm^2/nm)
wavelength (nm)
-20m
-40m
-60m
-80m
-100m
-120m
-140m
-160m
-180m
-200m

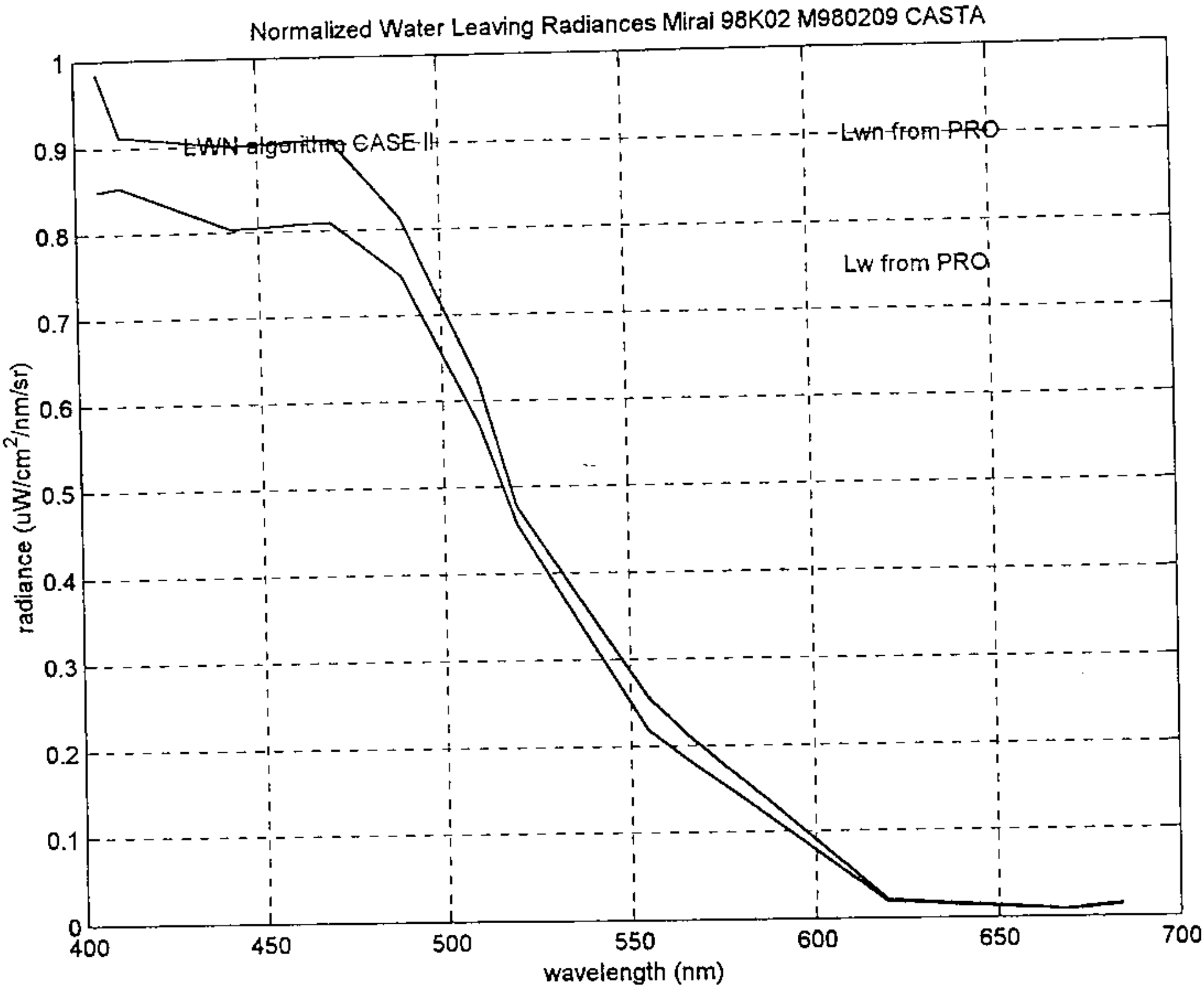


Upwelling Radiance - Mirai 98K02 M980209 CASTA - Binned Level 3C
Lu (uW/cm^2/nm/sr)
wavelength (nm)
10^1
10^0
10^-1
10^-2
10^-3
10^-4
10^-5
400
450
500
550
600
650
700
-20m×
-40m×
-60m×
-80m×
-100m×
-120m×
-140m×
-160m×
-180m×
-200m×

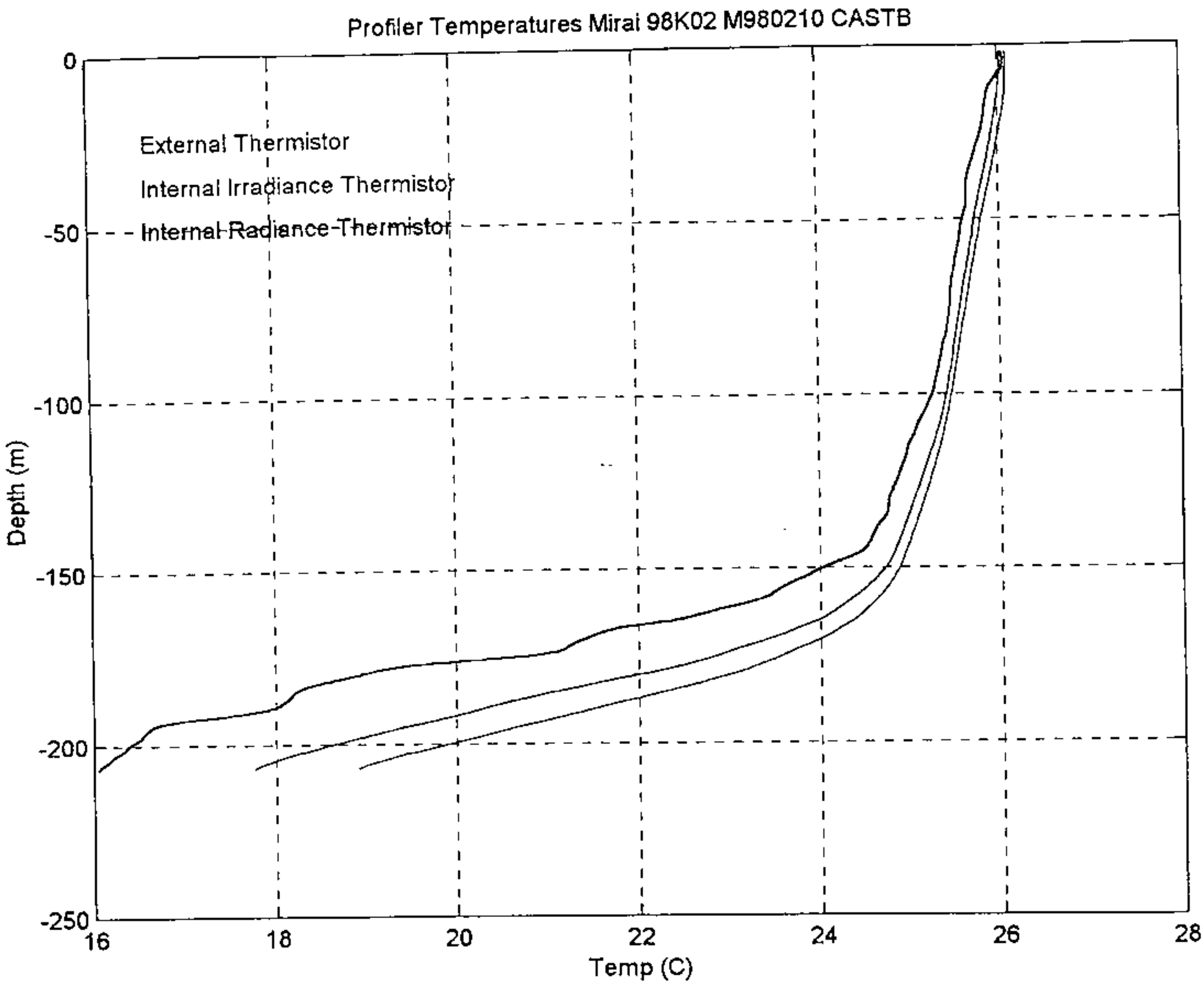

PAR Profile - Mirai 98K02 M980209 CASTA
Profiler PAR
Reference PAR(0.3m-) 1.18e+017
Surface PAR(0.0m-) 1.19e+017
Surface PAR(0.0m+) 1.26e+017
Kpar = 0.042/m
35.0%=-10m
20.0%=-19m
10.0%=-36m
5.0%=-49m
2.0%=-69m
1.0%=-84m
0.3%=-112m
depth (m)
PAR (quanta/cm2/sec)

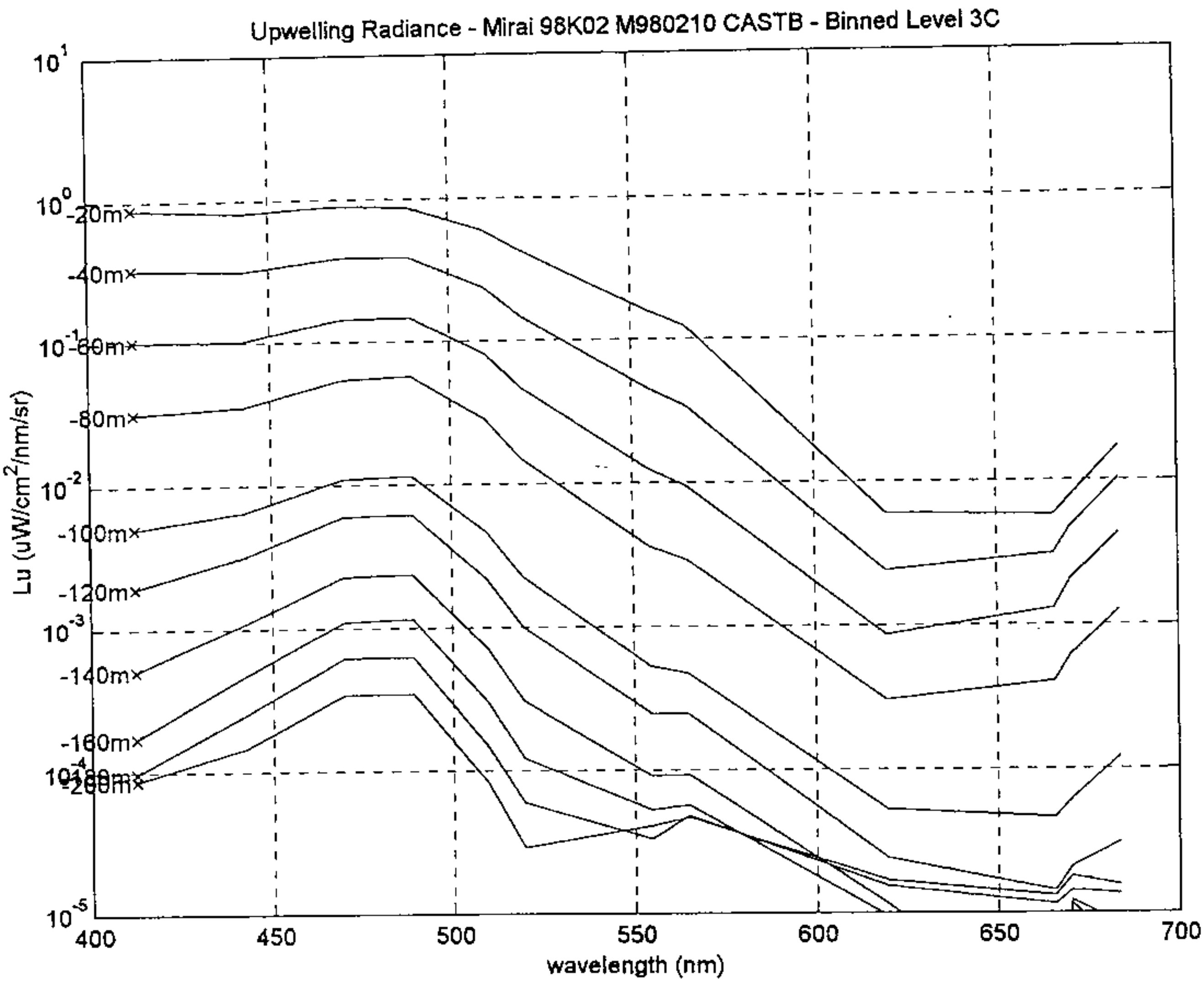


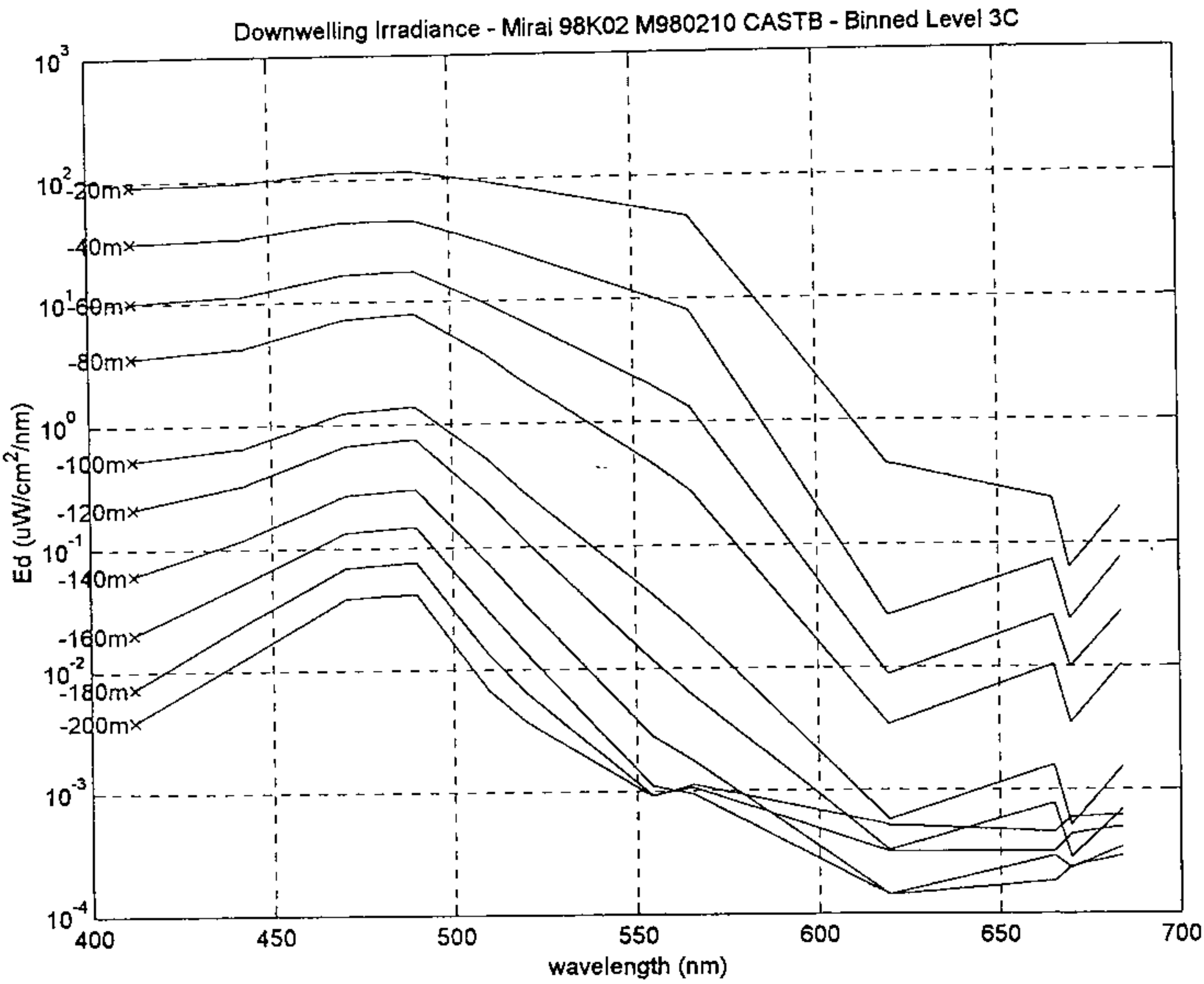
Mirai 98K02 M980209 CASTA Kd442.4nm
Ave Kd442.4 = 0.042/m
depth (m)
k (/m)
0
-20
-40
-60
-80
-100
-120
-140
-160
-180
-200
0
0.01
0.02
0.03
0.04
0.05
0.06
0.07
0.08
0.09
0.1

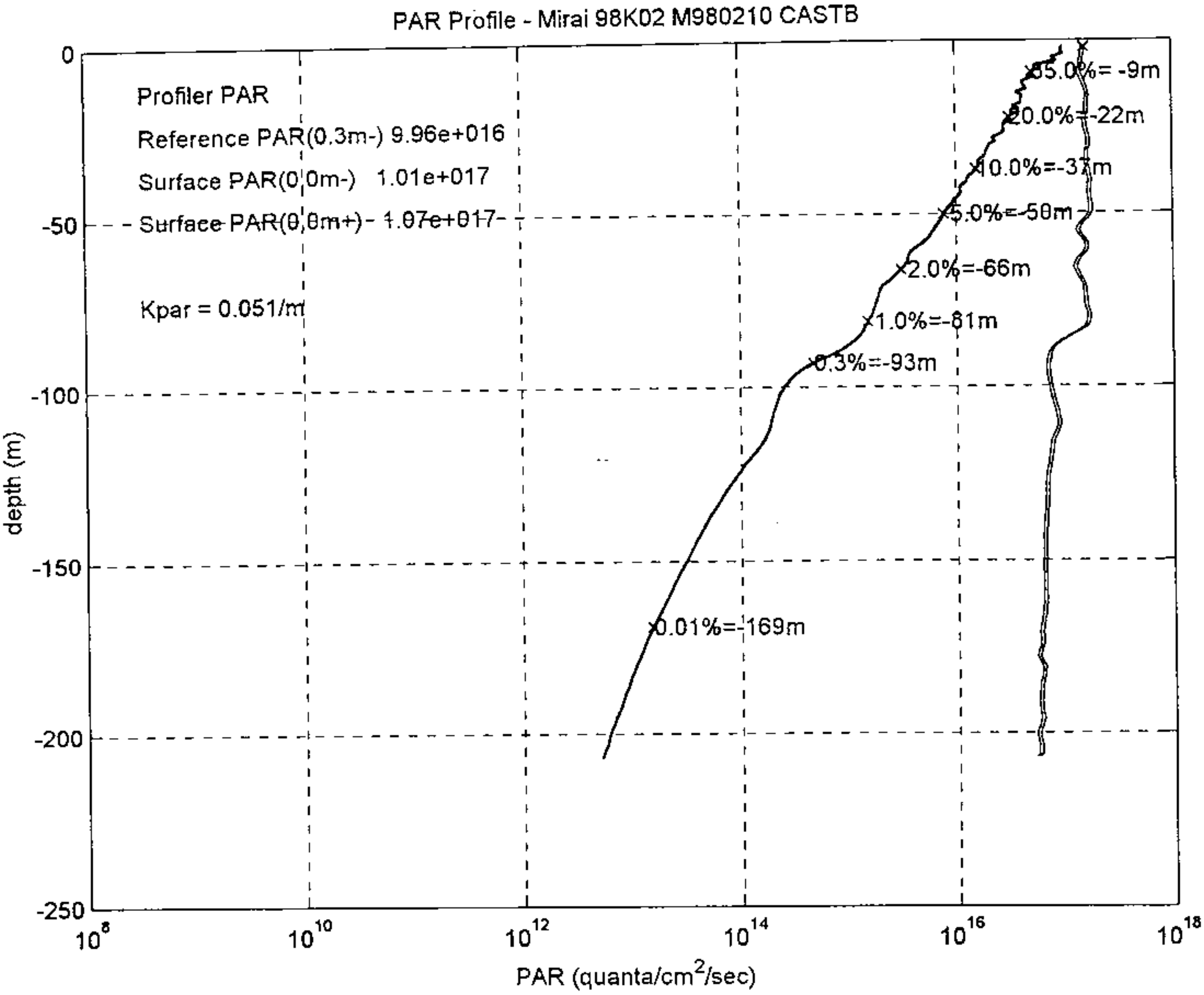


Normalized Water Leaving Radiances Mirai 98K02 M980209 CASTA
LWN algorithm CASE II
Lwn from PRO
Lw from PRO
radiance (uW/cm^2/nm/sr)
wavelength (nm)
1
0.9
0.8
0.7
0.6
0.5
0.4
0.3
0.2
0.1
0
400
450
500
550
600
650
700

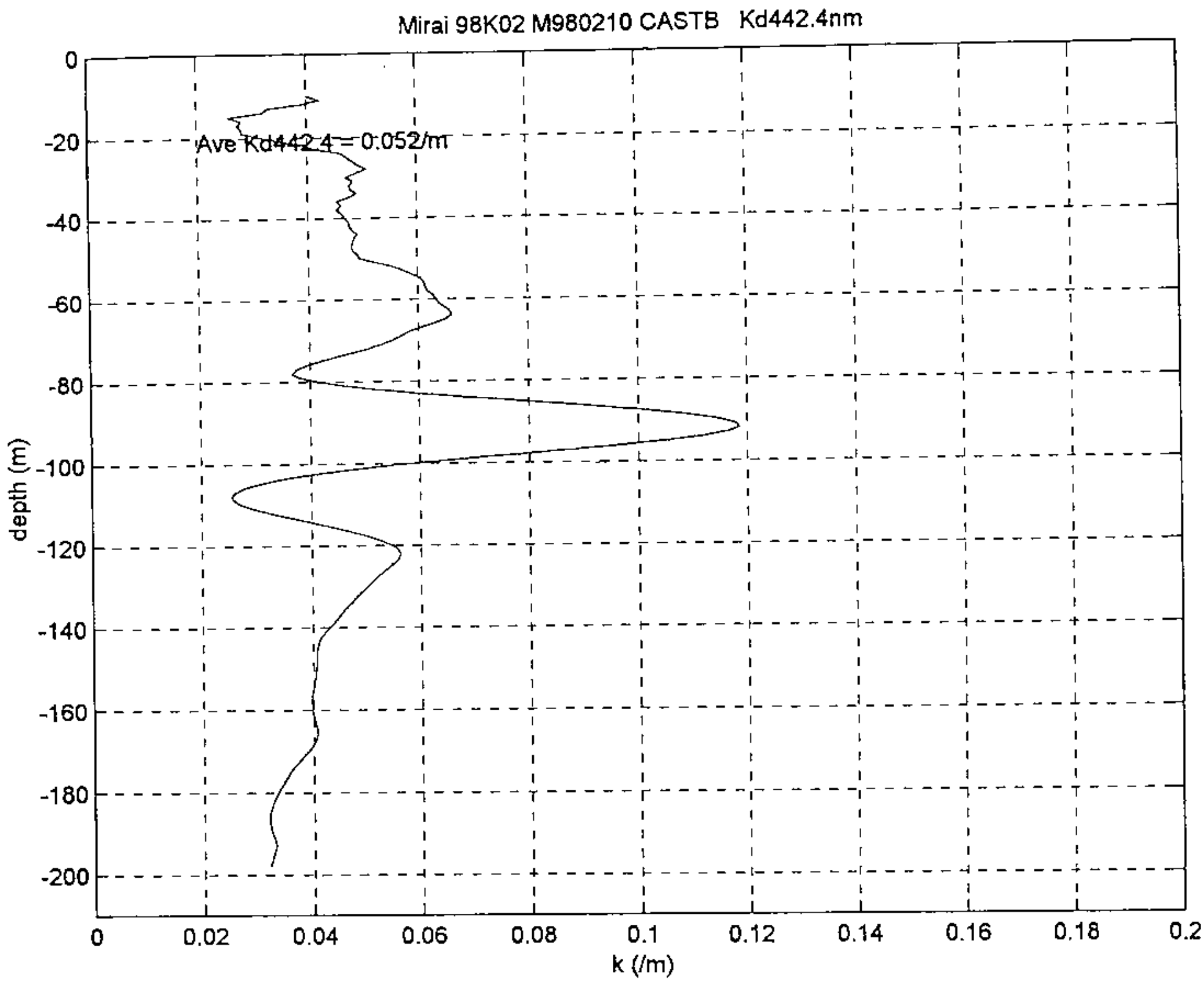

Profiler Temperatures Mirai 98K02 M980210 CASTB
External Thermistor
Internal Irradiance Thermistor
Internal Radiance Thermistor
0
-50
-100
-150
-200
-250
Depth (m)
16
18
20
22
24
26
28
Temp (C)

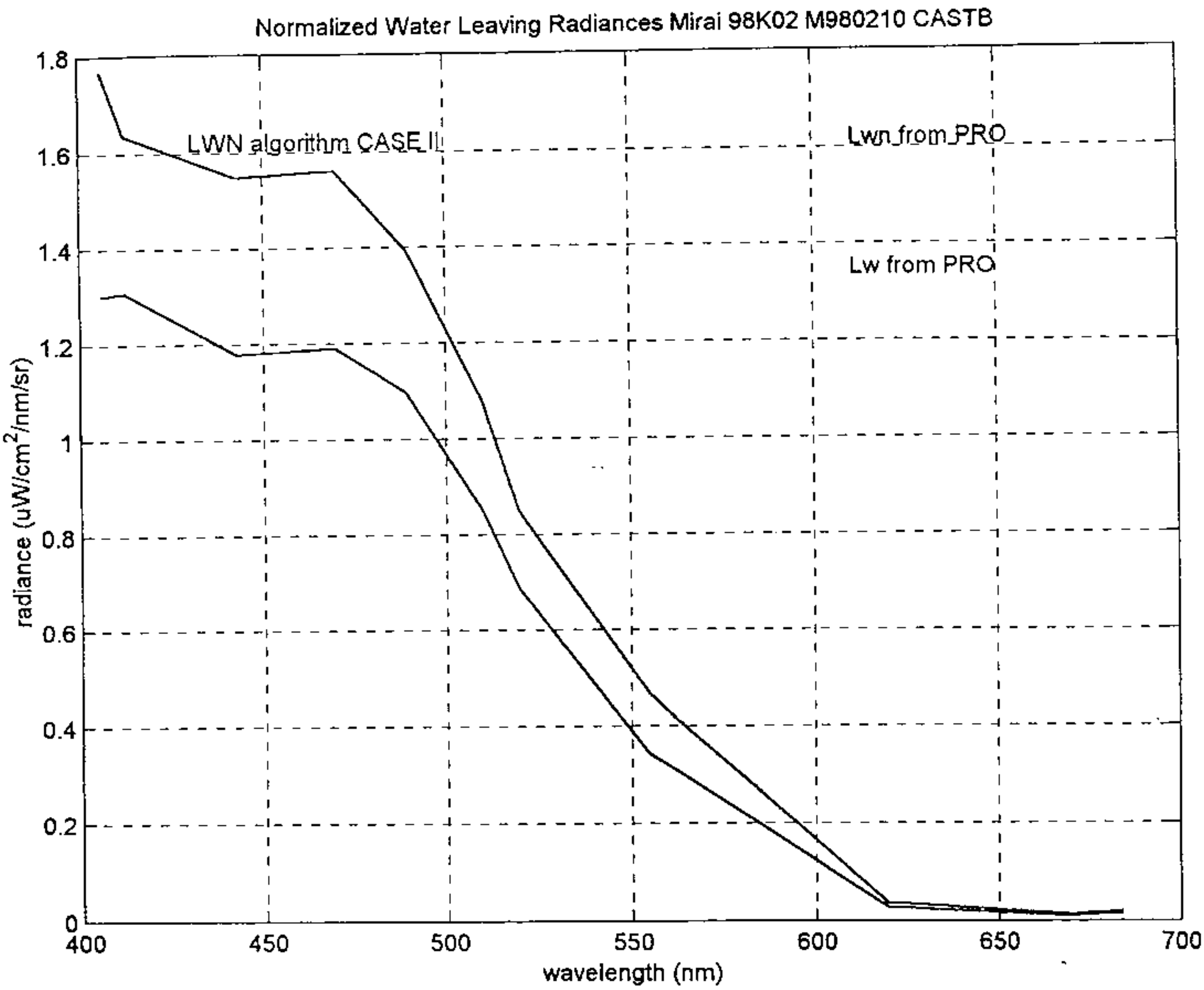

Upwelling Radiance - Mirai 98K02 M980210 CASTB - Binned Level 3C
Lu (uW/cm^2/nm/sr)
wavelength (nm)
-20m
-40m
-60m
-80m
-100m
-120m
-140m
-160m
-180m
-200m
10^1
10^0
10^-1
10^-2
10^-3
10^-4
10^-5
400
450
500
550
600
650
700


Downwelling Irradiance - Mirai 98K02 M980210 CASTB - Binned Level 3C
Ed (uW/cm^2/nm)
wavelength (nm)
10^3
10^2
10^1
10^0
10^-1
10^-2
10^-3
10^-4
400
450
500
550
600
650
700
-20m
-40m
-60m
-80m
-100m
-120m
-140m
-160m
-180m
-200m

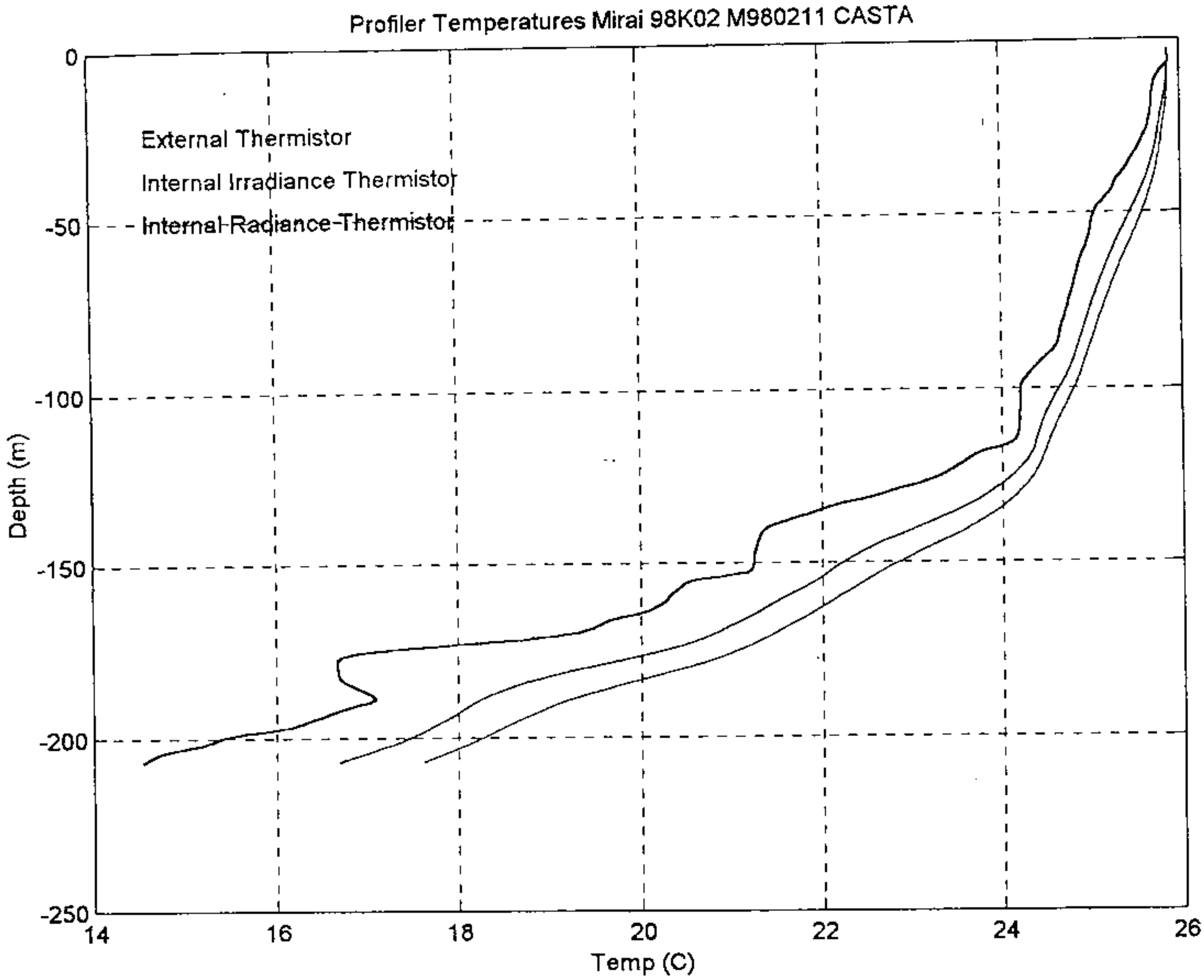


PAR Profile - Mirai 98K02 M980210 CASTB
Profiler PAR
Reference PAR(0.3m-) 9.96e+016
Surface PAR(0.0m-) 1.01e+017
Surface PAR(0.0m+) 1.07e+017
Kpar = 0.051/m
35.0%= -9m
20.0%=-22m
10.0%=-37m
5.0%=-50m
2.0%=-66m
1.0%=-81m
0.3%=-93m
0.01%=-169m
0
-50
-100
-150
-200
-250
depth (m)
10^8
10^10
10^12
10^14
10^16
10^18
PAR (quanta/cm^2/sec)

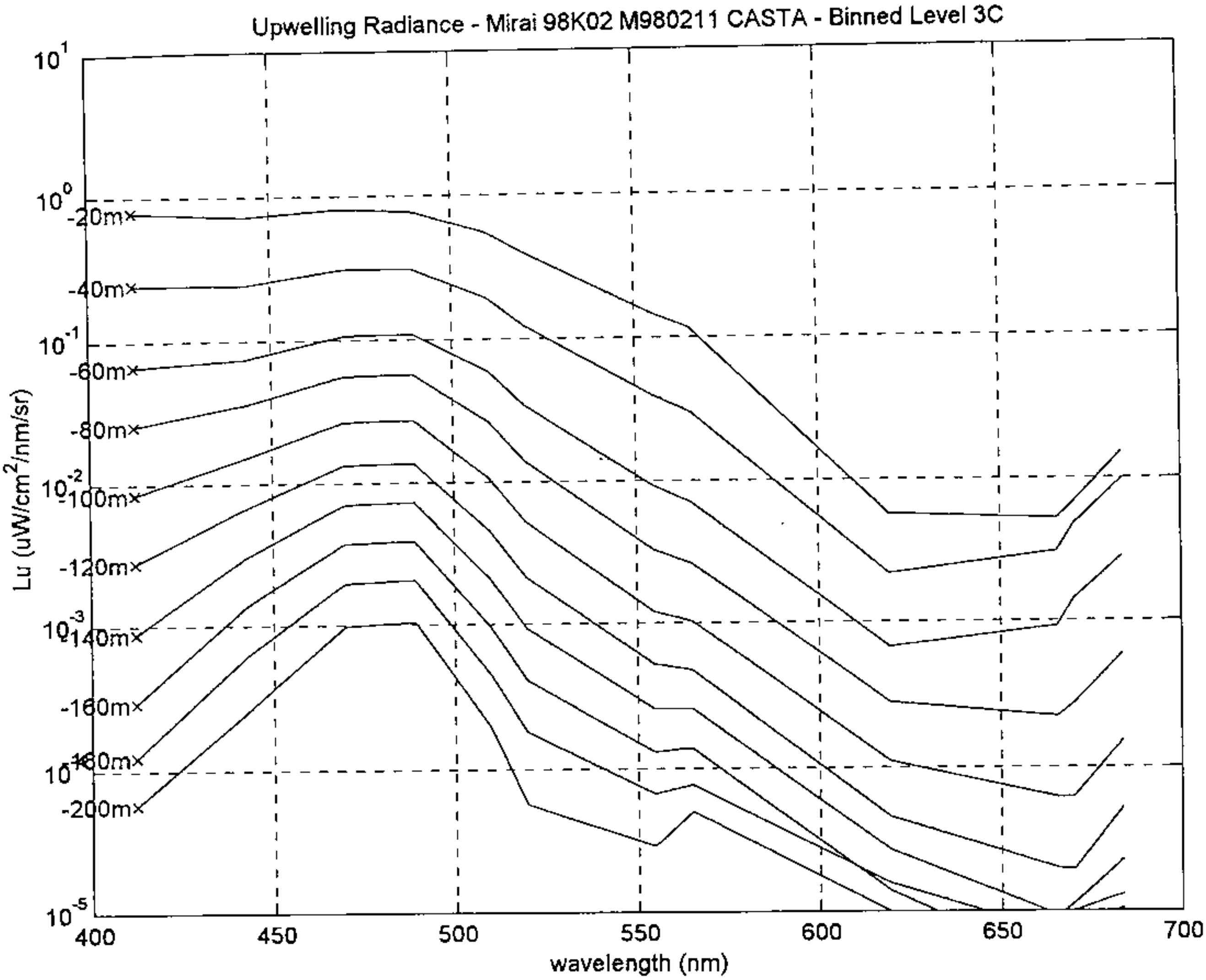

Mirai 98K02 M980210 CASTB Kd442.4nm
Ave Kd442.4 = 0.052/m
depth (m)
k (/m)
0
-20
-40
-60
-80
-100
-120
-140
-160
-180
-200
0
0.02
0.04
0.06
0.08
0.1
0.12
0.14
0.16
0.18
0.2



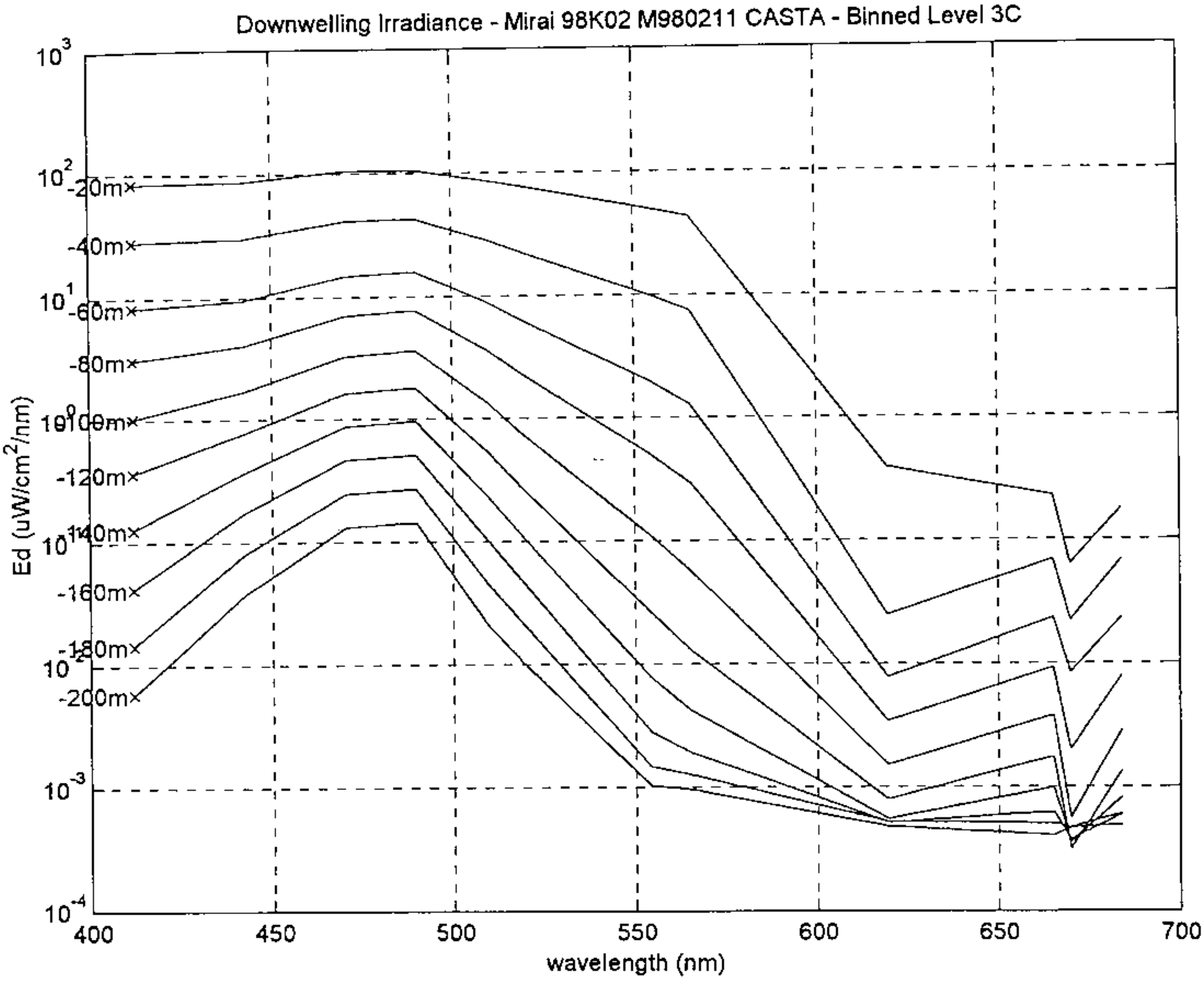
Normalized Water Leaving Radiances Mirai 98K02 M980210 CASTB
LWN algorithm CASE II
Lwn from PRO
Lw from PRO
radiance (uW/cm2/nm/sr)
wavelength (nm)
1.8
1.6
1.4
1.2
1
0.8
0.6
0.4
0.2
0
400
450
500
550
600
650
700



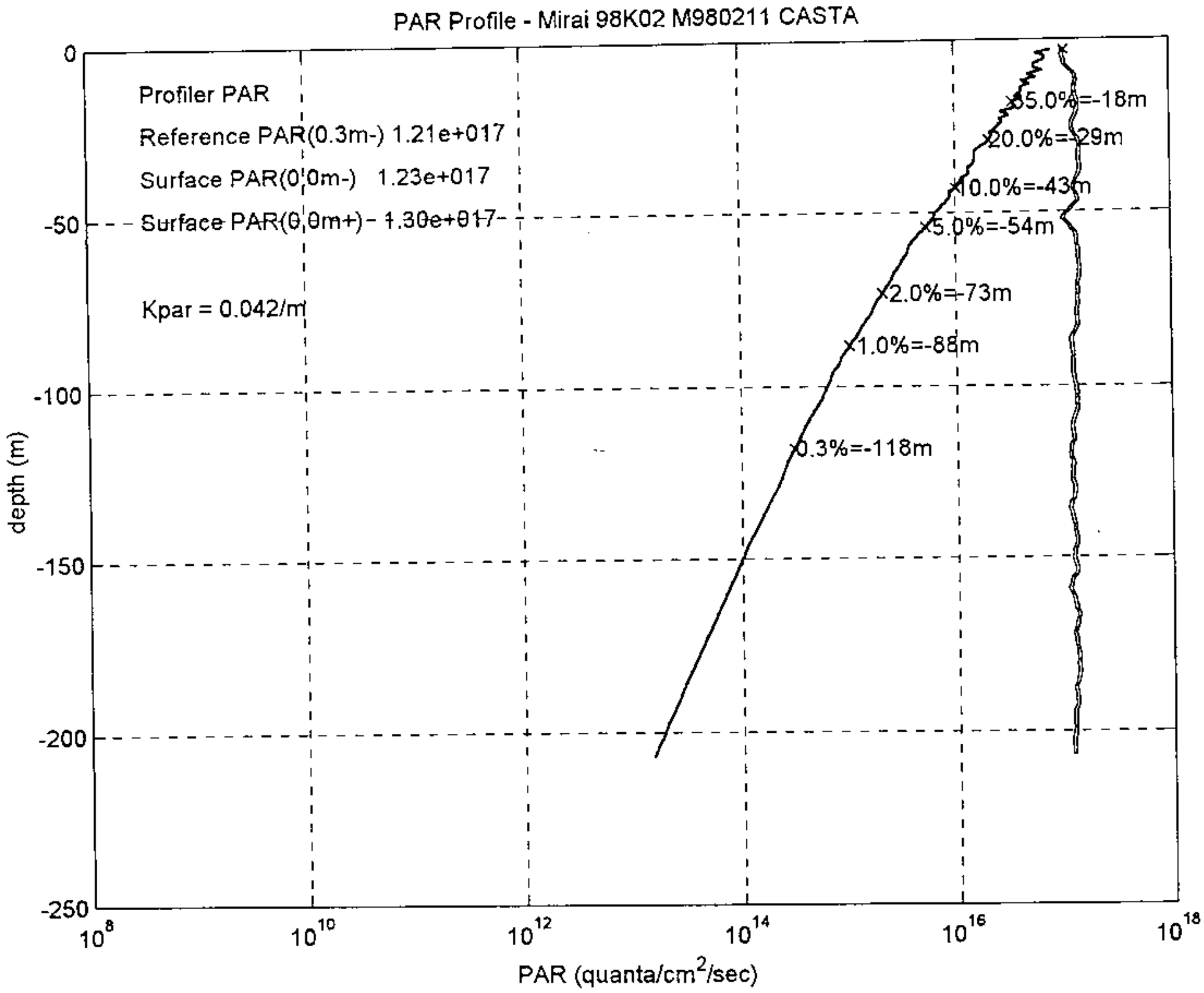
Profiler Temperatures Mirai 98K02 M980211 CASTA
External Thermistor
Internal Irradiance Thermistor
Internal Radiance Thermistor
0
-50
-100
-150
-200
-250
Depth (m)
14
16
18
20
22
24
26
Temp (C)



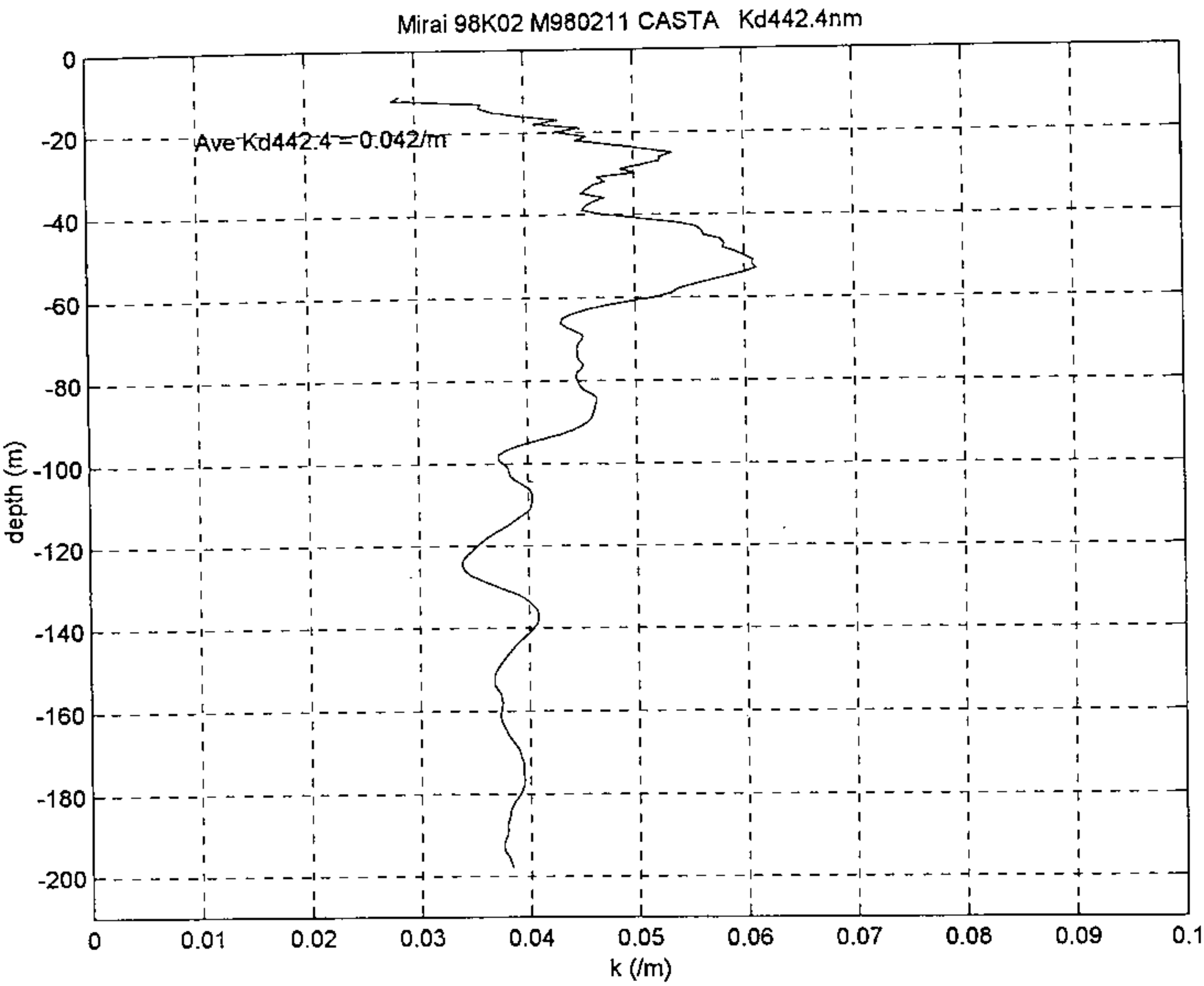
Upwelling Radiance - Mirai 98K02 M980211 CASTA - Binned Level 3C
Lu (uW/cm2/nm/sr)
wavelength (nm)
10^1
10^0
10^-1
10^-2
10^-3
10^-4
10^-5
400
450
500
550
600
650
700
-20m
-40m
-60m
-80m
-100m
-120m
-140m
-160m
-180m
-200m

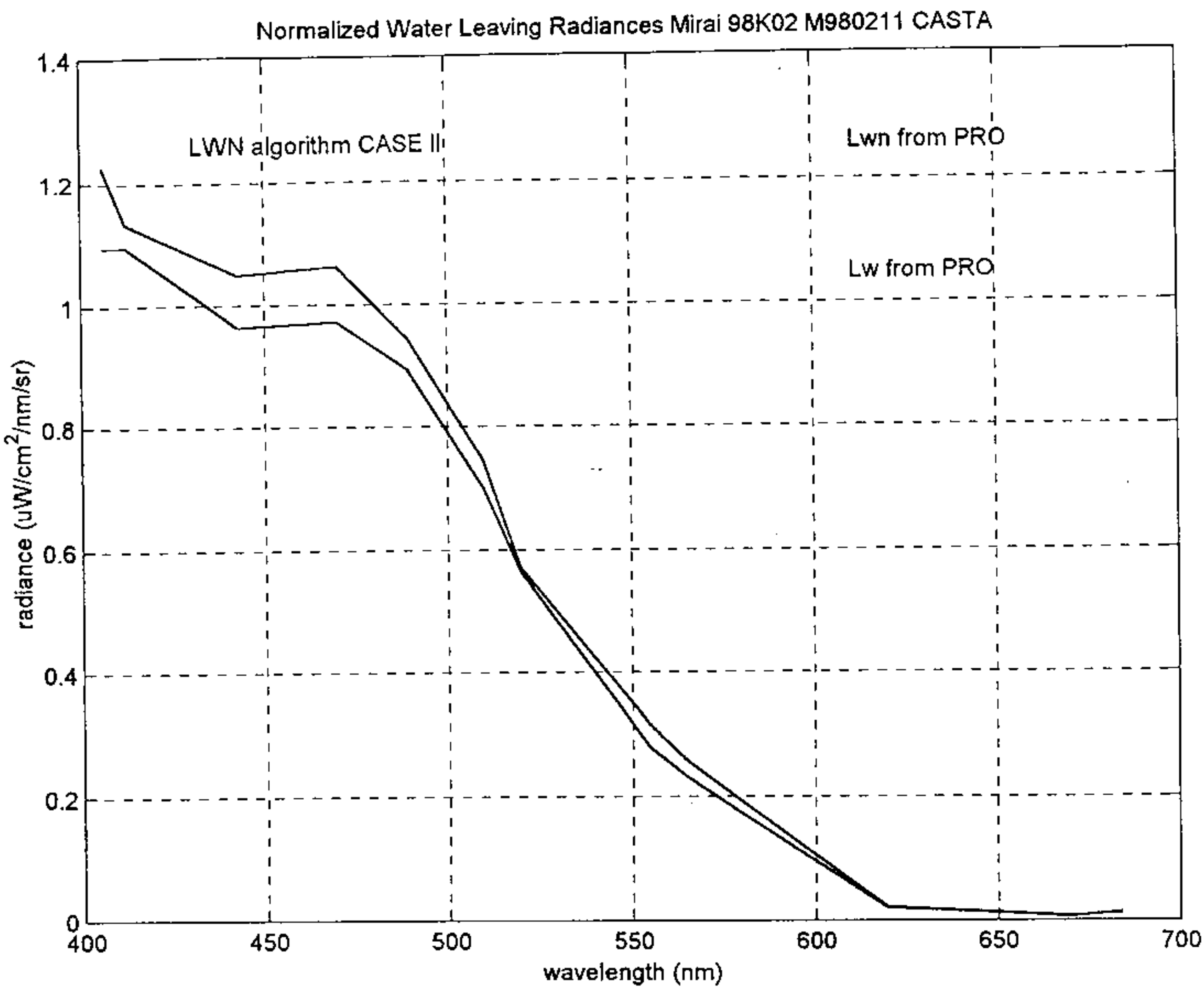


Downwelling Irradiance - Mirai 98K02 M980211 CASTA - Binned Level 3C
Ed (uW/cm^2/nm)
wavelength (nm)
10^3
10^2
10^1
10^0
10^-1
10^-2
10^-3
10^-4
400
450
500
550
600
650
700
-20m×
-40m×
-60m×
-80m×
-100m×
-120m×
-140m×
-160m×
-180m×
-200m×

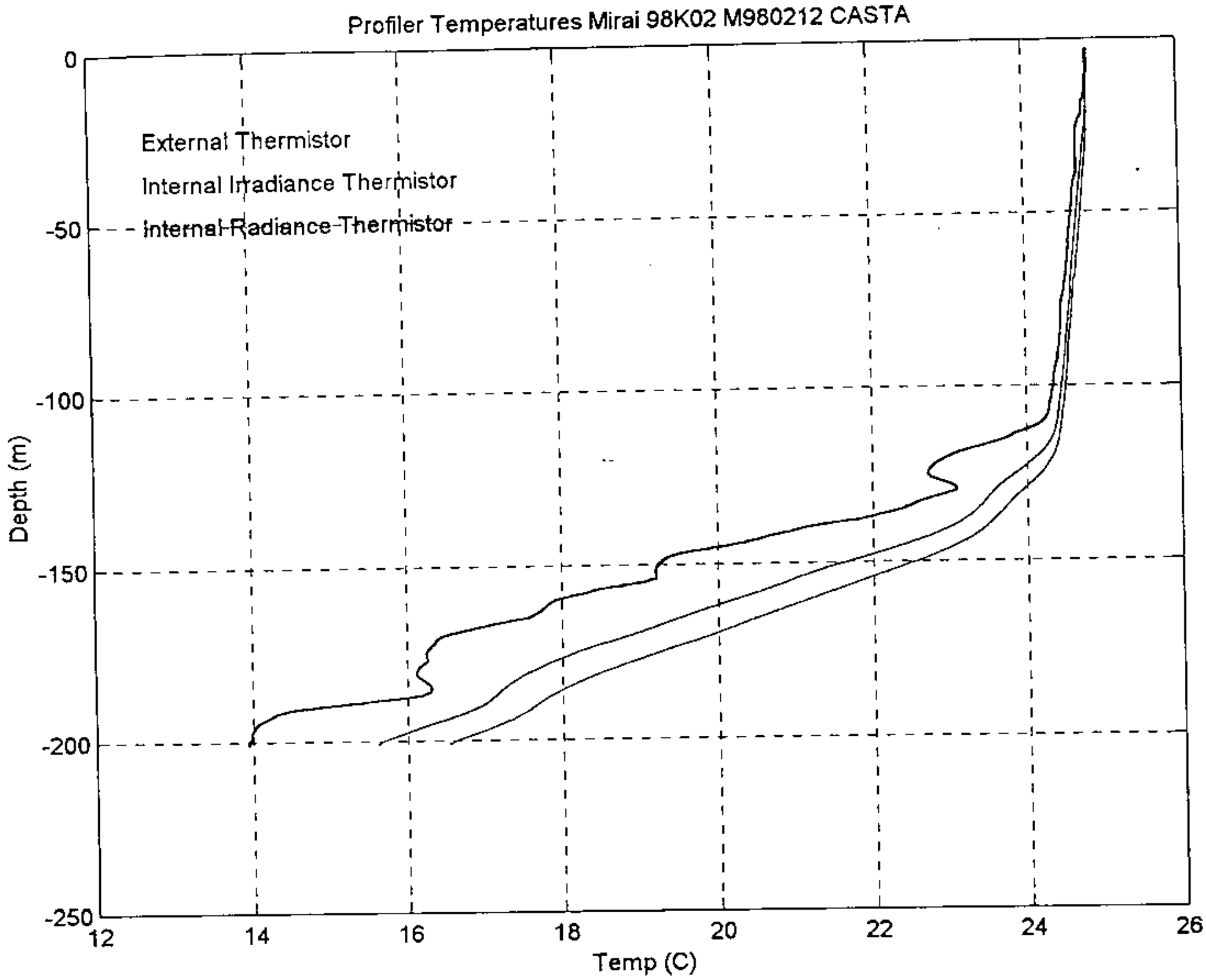


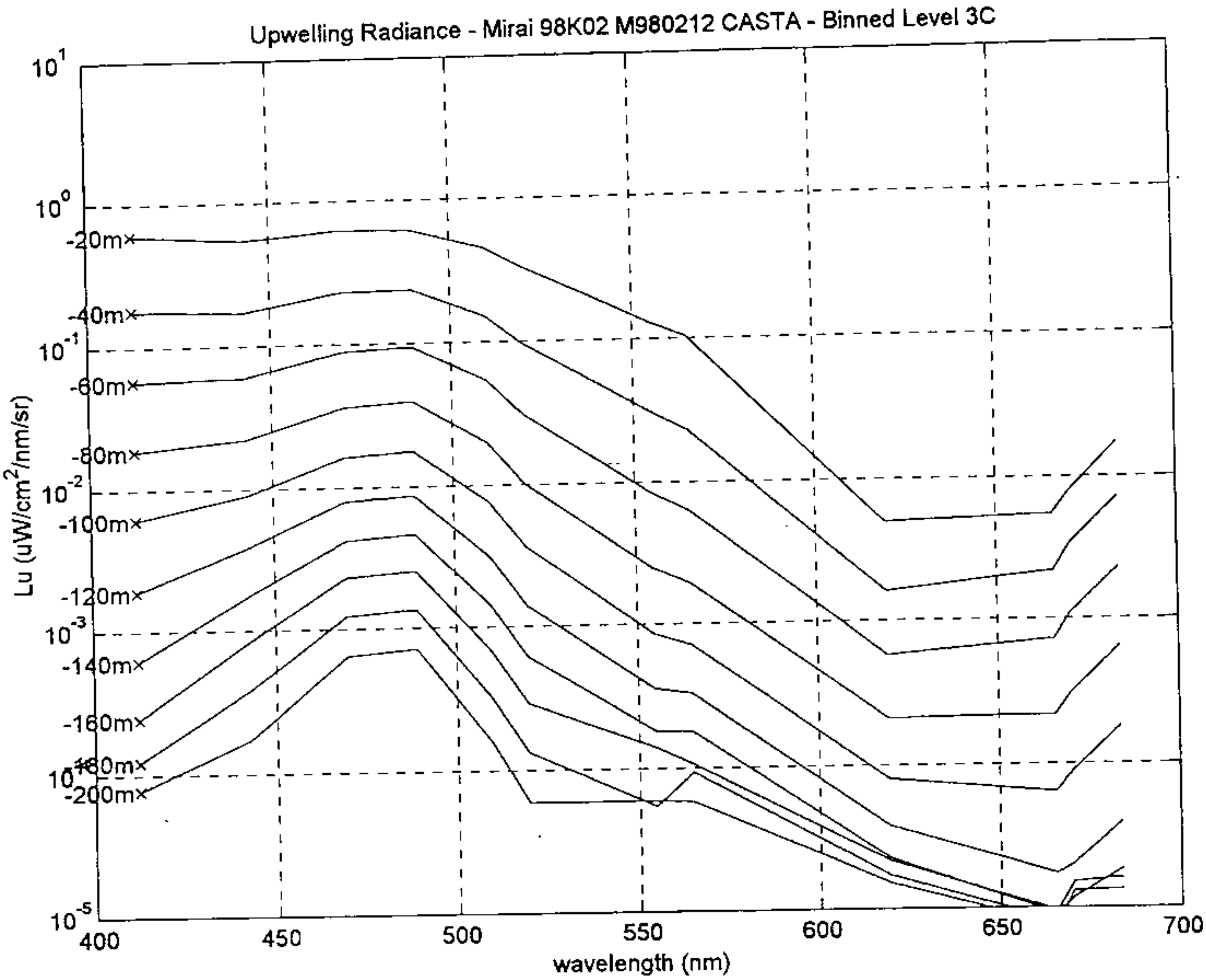
PAR Profile - Mirai 98K02 M980211 CASTA
Profiler PAR
Reference PAR(0.3m-) 1.21e+017
Surface PAR(0.0m-) 1.23e+017
Surface PAR(0.0m+) 1.30e+017
Kpar = 0.042/m
35.0%=-18m
20.0%=-29m
10.0%=-43m
5.0%=-54m
2.0%=-73m
1.0%=-88m
0.3%=-118m
depth (m)
0
-50
-100
-150
-200
-250
10^8
10^10
10^12
10^14
10^16
10^18
PAR (quanta/cm^2/sec)


Mirai 98K02 M980211 CASTA Kd442.4nm
Ave Kd442.4 = 0.042/m
depth (m)
0
-20
-40
-60
-80
-100
-120
-140
-160
-180
-200
0
0.01
0.02
0.03
0.04
0.05
0.06
0.07
0.08
0.09
0.1
k (/m)

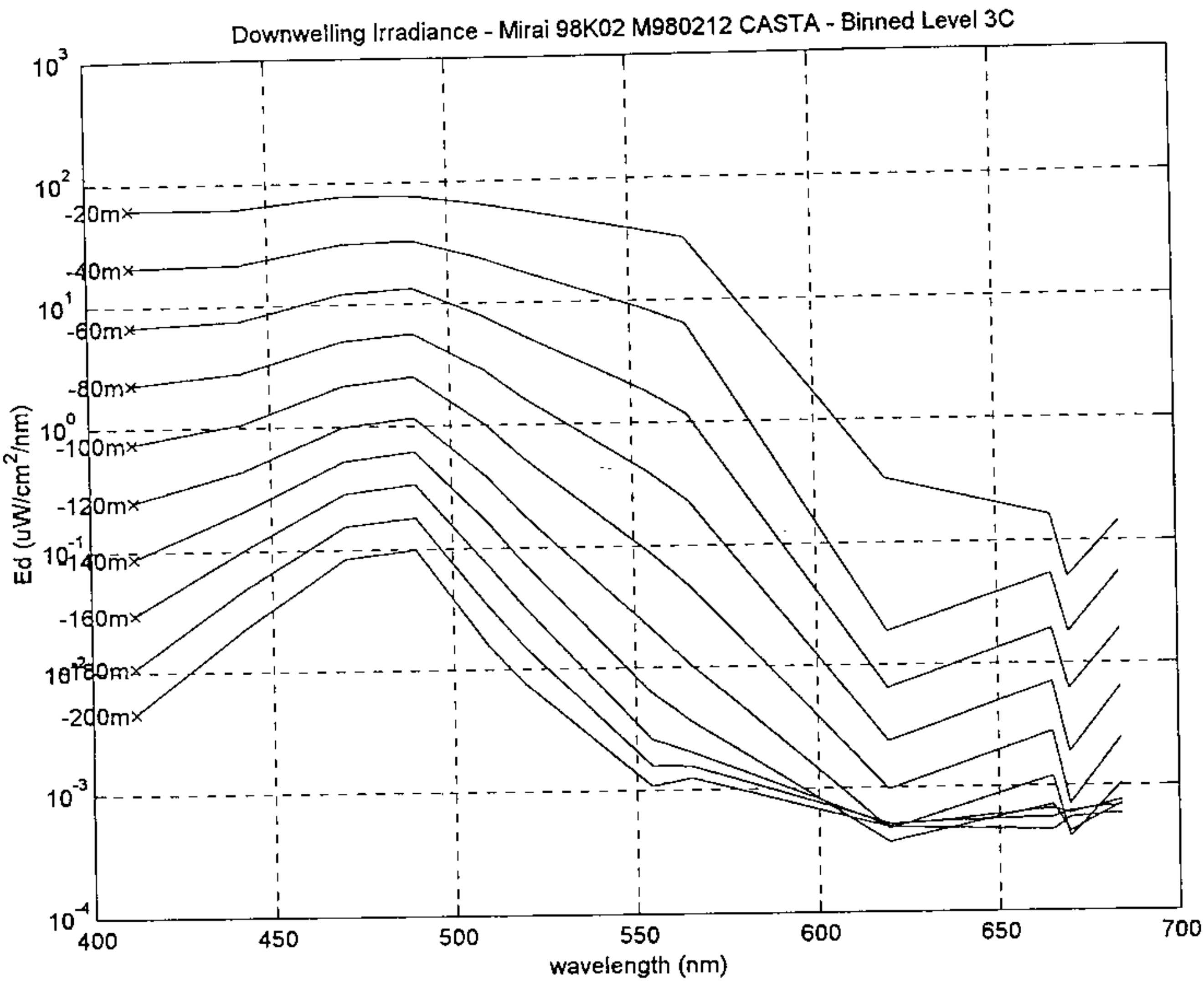


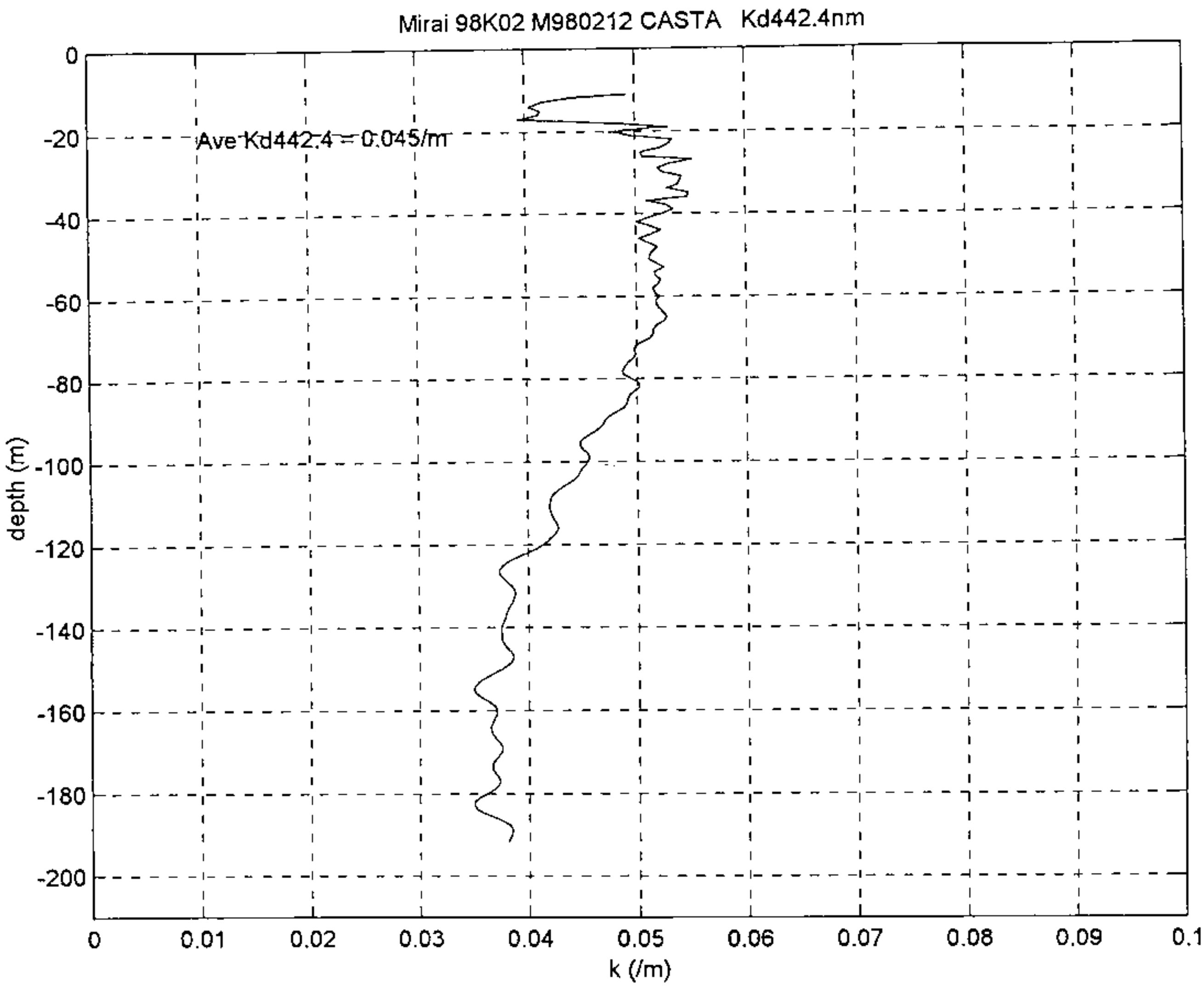
Normalized Water Leaving Radiances Mirai 98K02 M980211 CASTA
LWN algorithm CASE II
Lwn from PRO
Lw from PRO
radiance (uW/cm2/nm/sr)
wavelength (nm)
1.4
1.2
1
0.8
0.6
0.4
0.2
0
400
450
500
550
600
650
700


Profiler Temperatures Mirai 98K02 M980212 CASTA
External Thermistor
Internal Irradiance Thermistor
Internal Radiance Thermistor
Depth (m)
0
-50
-100
-150
-200
-250
Temp (C)
12
14
16
18
20
22
24
26

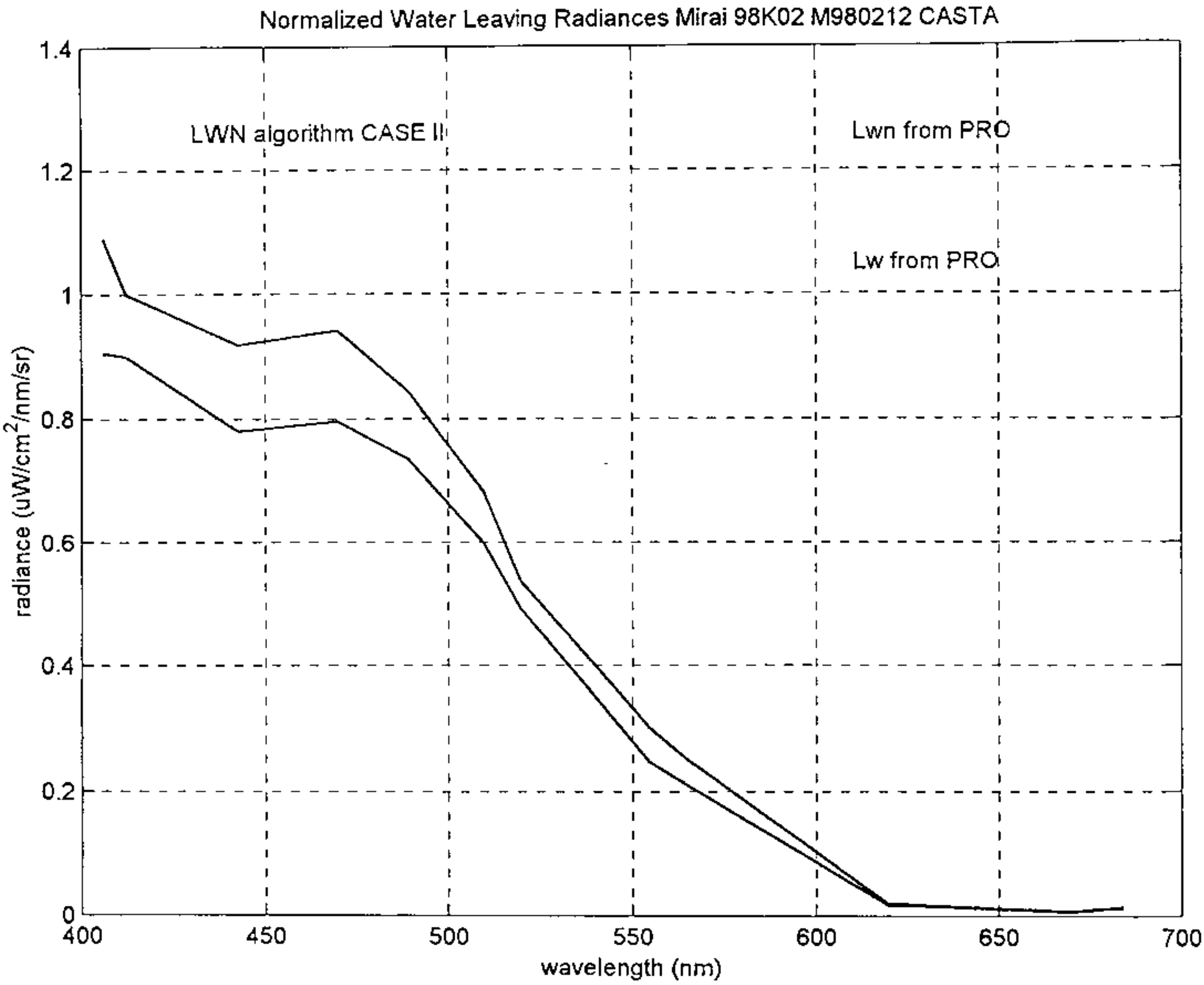


Upwelling Radiance - Mirai 98K02 M980212 CASTA - Binned Level 3C
Lu (uW/cm²/nm/sr)
wavelength (nm)
10^1
10^0
10^-1
10^-2
10^-3
10^-4
10^-5
400
450
500
550
600
650
700
-20m×
-40m×
-60m×
-80m×
-100m×
-120m×
-140m×
-160m×
-180m×
-200m×


Downwelling Irradiance - Mirai 98K02 M980212 CASTA - Binned Level 3C
Ed (uW/cm^2/nm)
10^3
10^2
10^1
10^0
10^-1
10^-2
10^-3
10^-4
-20m
-40m
-60m
-80m
-100m
-120m
-140m
-160m
-180m
-200m
400
450
500
550
600
650
700
wavelength (nm)



Mirai 98K02 M980212 CASTA Kd442.4nm
Ave Kd442.4 = 0.045/m
depth (m)
0
-20
-40
-60
-80
-100
-120
-140
-160
-180
-200
0
0.01
0.02
0.03
0.04
0.05
0.06
0.07
0.08
0.09
0.1
k (/m)


Normalized Water Leaving Radiances Mirai 98K02 M980212 CASTA
LWN algorithm CASE II
Lwn from PRO
Lw from PRO
radiance (uW/cm^2/nm/sr)
wavelength (nm)
0
0.2
0.4
0.6
0.8
1
1.2
1.4
400
450
500
550
600
650
700

(2) Hyperspectral Buoy System

Objectives:

A recently developed tethered buoy system, capable of making measurements of upwelling radiance below the surface, and downwelling irradiance measurements above the surface, with high spectral resolution was deployed. Data from the instrument are useful in precise definition of radiometry at higher spectral resolution than the profiling instrument and can be used to support multiple spacecraft sensors with differing spectral bands. In addition to the standard upwelling and downwelling measurements, experiments were undertaken to evaluate the influence of bubble clouds, generated by the ship's propellers, on the reflectance of the sea surface.

Methodology

The instrument consists of two sensors, one irradiance, and one radiance, looking up and down respectively from the instrument housing. A foam buoy provides floatation at the sea-surface. A Kevlar conducting cable, which also provides power to the instrument, and telemetry to the deckboard logging system, deploys the buoy from the stern of the ship. System performance and absolute radiometry is viewed in real time.

The resulting data consists of upwelling nadir radiance, taken at a depth of 0.5 meters below the sea-surface, and downwelling vector irradiance, taken at an altitude of 0.5 meters above the surface. Data is taken from 396 nm to 800 nm with spectral bands centered approximately every 3 nm, with approximate band-pass of 7 nm each.

The instrument was deployed near local noon at each station, in order to coincide with time of overflight of the SeaWiFS satellite. The instrument was first deployed with covers on the optical receivers for a period of 3 minutes to log dark readings from the optical arrays. The buoy was then hauled aboard, the covers removed, and then redeployed to rest at a distance of greater than 50 meters from the stern of the ship. A three-minute data record was then logged, and the buoy then hauled close by the ship.

For the bubble experiment, with the buoy resting about 10 meters from the stern, the ship propellers were turned smartly to generate bubbles by cavitation. The bubble cloud was allowed to pass by the buoy (the ship was now somewhat underway), then the buoy was released to drift with the cloud. Data was taken for 30-seconds to 1 minute in the bubble cloud.

Sampling

Stations were occupied periodically along the equator, and are given sequential station numbers. Hyperspectral deployments are further defined by the following cast name convention:

HMYYCSTI.xxx

Where,

HM refers to hyperspectral data taken on Mirai
YYC refers to the cruise ID year (982 in all cases from this cruise)
ST refers to sequential station number, 01 to 12,
I refers to the incremental cast alpha identifier at this station, i.e. A,B,C etc.
"xxx" refers to the level of processing, i.e. raw data is logged as *.raw, and level 3 data products (see below) are referred to as *.dat.

Deployments and casts were made as follows:

Stn. ID	Raw File name	Cast letter	Julian Day	Time Local	Time UTC	Latitude	Longitude	Data Type	Comments
3	HM98203	A	004	12:39	02:09	0 N	145 00.00 E	Darks	Var. Cloud
3	HM98203	B	004	12:46	02:46	0 N	145 00.00 E	Lights	Wind 10 knts
3	HM98203	C	004	12:50	02:50	0 N	145 00.00 E	Bubbles	No Irrad Sensor
4	HM98204	A	005	12:44	02:44	0 N	147 53.20 E	Darks	Clear, scattered
4	HM98204	B	005	12:48	02:48	0 N	147 53.20 E	Lights	High haze, 20kts
4	HM98204	C	005	12:52	02:52	0 N	147 53.20 E	Bubbles	1-2 m swell
5	HM98205	A	006	12:35	02:35	0 N	153 15.90 E	Darks	Clear,no haze
5	HM98205	B	006	12:39	02:39	0 N	153 15.90 E	Lights	W=10knts, 1 m sea
5	HM98205	C	006	12:43	02:43	0 N	153 15.90 E	Bubbles	15
6	HM98206	A	008	12:00	01:00	0 N	157 02.00 E	Darks	Scattered Cloud
6	HM98206	B	008	12:04	01:04	0 N	157 02.00 E	Lights	High Haze
6	HM98206	C	008	12:08	01:08	0 N	157 02.00 E	Bubbles	1-2 m, 15 kts
7	HM98207	A	009	12:30	01:30	00 00.2 N	163 35.70 E	Darks	Clear
7	HM98207	B	009	12:34	01:34	00 00.2 N	163 35.70 E	Lights	1-2 m, 15 kts
7	HM98207	C	009	12:38	01:38	00 00.2 N	163 35.70 E	Bubbles	
8	HM98208	A	010	12:30	01:30	0 N	169 00.40 E	Darks	Overcast, scattered
8	HM98208	B	010	12:34	01:34	0 N	169 00.40 E	Lights	Cloud, 1-2 m swell
8	HM98208	C	010	12:38	01:38	0 N	169 00.40 E	Bubbles	10 knts
9	HM98209	A	012	11:00	23:00/-1	00 00.4 S	174 54.60 E	Darks	Clear, scattered
9	HM98209	B	012	11:04	23:00/-1		174 54.60 E	Lights	Clouds, haze
9	HM98209	C	012	11:08	23:00/-1		174 54.60 E	Bubbles	<1 m, <10knts
10	HM98210	A	013	12:00	00:00	00 00.20 S	178 47.7 E	Darks	Clear, 1-2 m seas,
10	HM98210	B	013	12.04	00.04	00 00.20 S	178 47.7 E	Lights	12 knts, ENE
10	HM98210	C	013	12::08	00:08	00 00.20 S	178 47.7 E	Bubbles	
11	HM98211	A	013'	12:30	00:30/+1	00 00.20 S	176 17 W	Darks	Scattered cumulus
11	HM98211	B	013'	12:34	00:34/+1	00 00.20 S	176 17 W	Lights	1-2 m, 12 knts
11	HM98211	C	013'	12:38	00:34/+1	00 00.20 S	176 17 W	Bubbles	
12	HM98212	A	015	11:00	00:00/+1	00 03.30 S	170 11.22 W	Darks	Clear, 2-2.5 m
12	HM98212	B	015	11:04	00:04/+1	00 03.30 S	170 11.22 W	Lights	W/whtcaps, 20
12	HM98212	C		11:08	00:08/+1	00 03.30 S	170 11.22 W	Bubbles	Kts ENE

Data Processing To Date

Data processing onboard ship consisted of radiometrically calibrating the instrument recorded counts based on laboratory-derived gain and offset values. The dark samples were averaged, and removed from the light samples, as well as the data taken in the bubble cloud. Means and standard deviations of the spectral radiances (uW cm^{-2} nm^{-1} sr^{-1}) and irradiances (uW cm^{-2} nm^{-1}) are reported, as well as the ratio of the on-wavelength upwelling radiance relative to the downwelling irradiance (~remote sensing reflectances, sr^{-1}).

Data Products

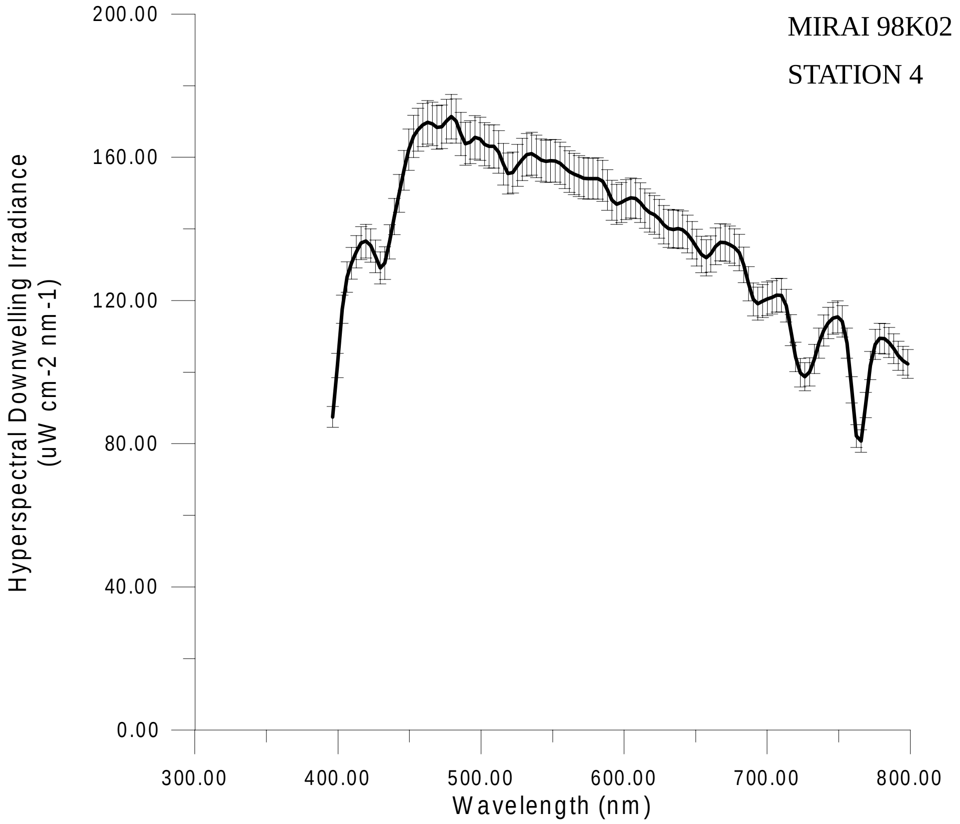
A single file is produced for each station, which provides the spectral radiances, irradiances, their standard deviations, and their ratio given as remote sensing reflectance. Similar data is provided for the bubble experiments. The data files are titled by station number, i.e. STN03.dat, and are formatted as comma-separated text files. A few sample lines are give below:

Wavelength	Radiance	STRad	Wavelength	Irrad	StIrad	Reflect	Bub Rad	Bub StRad	BubIrad	BubStIrad	Bub Refl
396.45	2.04	0.05	396.30	87.47	2.89	0.02	2.04	0.06	90.08	4.17	0.02
399.78	2.36	0.06	399.61	101.80	3.38	0.02	2.35	0.07	104.87	4.89	0.02
403.10	2.67	0.07	402.93	117.56	3.93	0.02	2.66	0.07	121.12	5.69	0.02
406.43	2.79	0.08	406.25	126.52	4.25	0.02	2.78	0.08	130.36	6.14	0.02
409.75	2.81	0.08	409.57	130.39	4.40	0.02	2.81	0.08	134.37	6.36	0.02
413.08	2.83	0.08	412.88	133.59	4.53	0.02	2.83	0.08	137.68	6.55	0.02

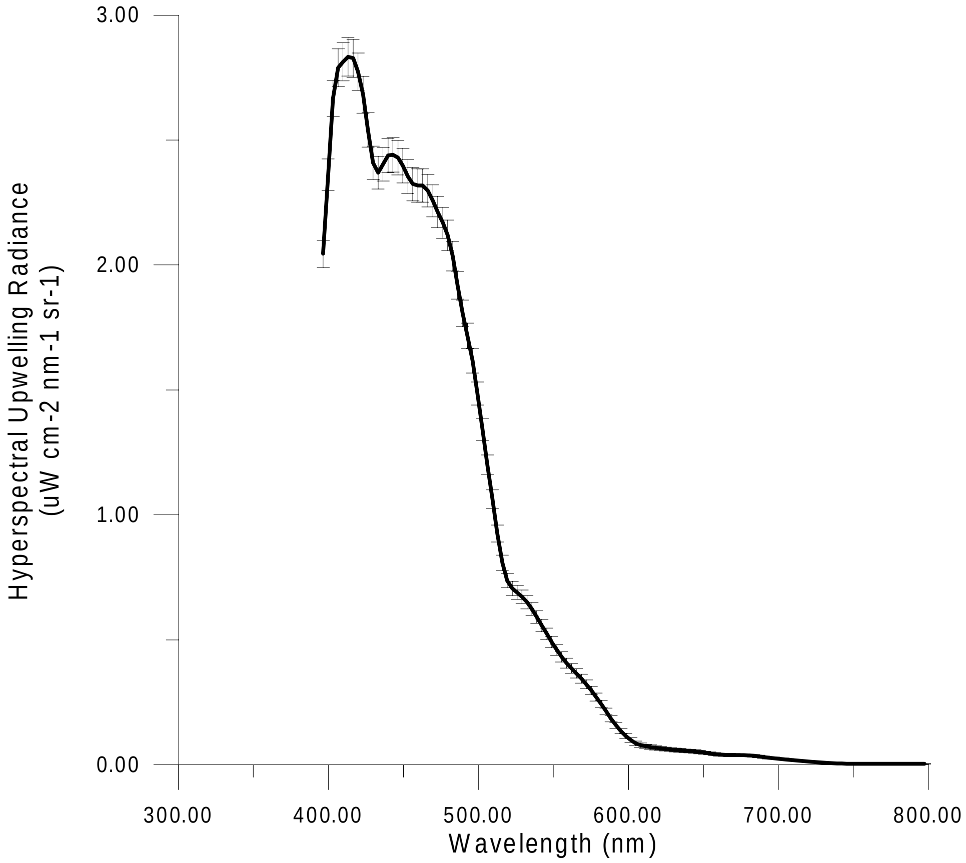
In this table, the column definitions are as follows:

1. Wavelength: Refers to the wavelength where the radiance measurement was taken.
2. Radiance: Calibrated, dark-corrected mean radiances (uW cm^{-2} nm^{-1} sr^{-1}).
3. STRad: Standard deviations about the mean radiance (uW cm^{-2} nm^{-1} sr^{-1}).
4. Wavelength: Refers to the wavelength where the irradiance measurement was taken.
5. Irrad: Calibrated, dark-corrected mean irradiances (uW cm^{-2} nm^{-1}).
6. StIrad: Standard deviations about the mean irradiance.
7. Reflect: Ratio of column 2 to column 5 (sr^{-1}).
8. Bub Rad.: As in column 2, except for bubble experiment.
9. Bub StRad: As in column 3, except for bubble experiment.
10. BubIrad: As in column 5, except for bubble experiment.
11. BubStIrad: As in column 6, except for bubble experiment.
12. Bub Refl: As in column 7, except for bubble experiment.

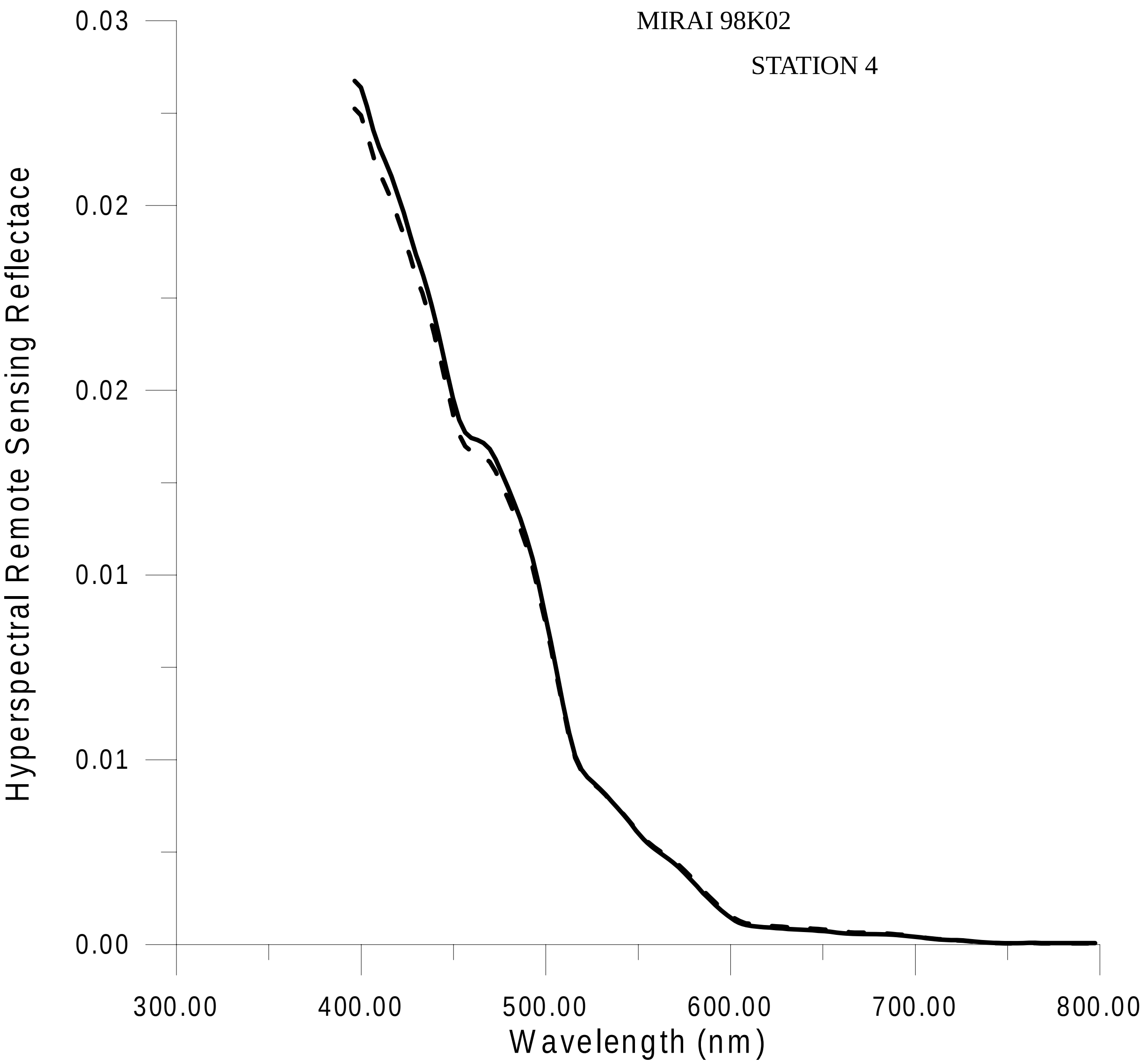
Preliminary Data

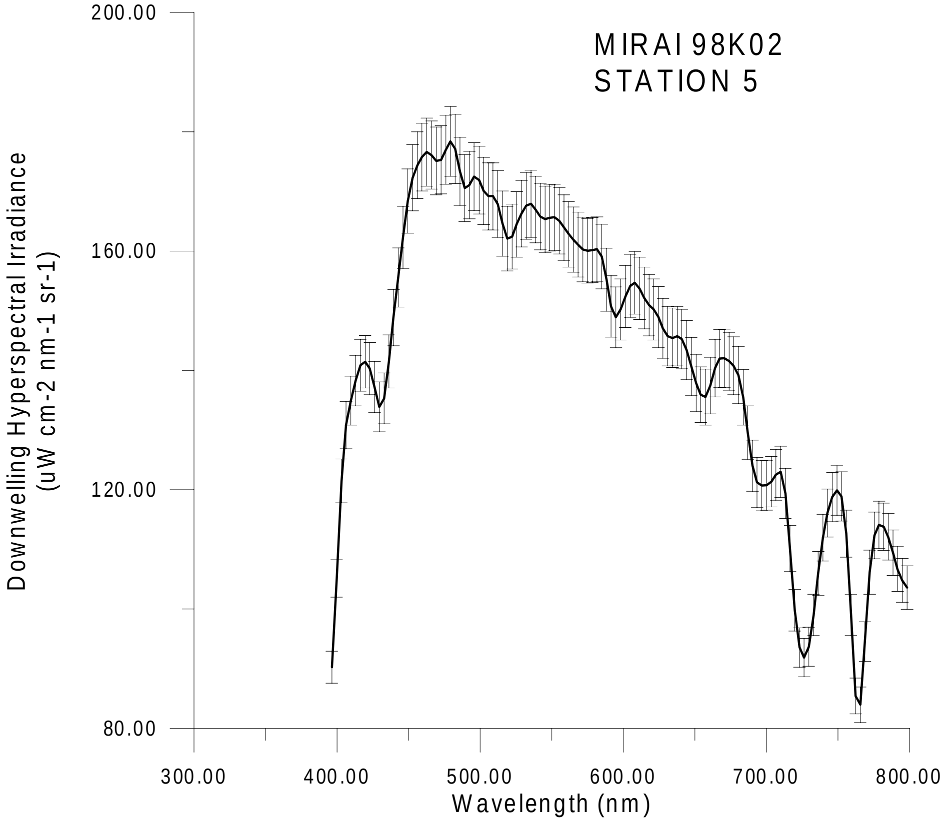


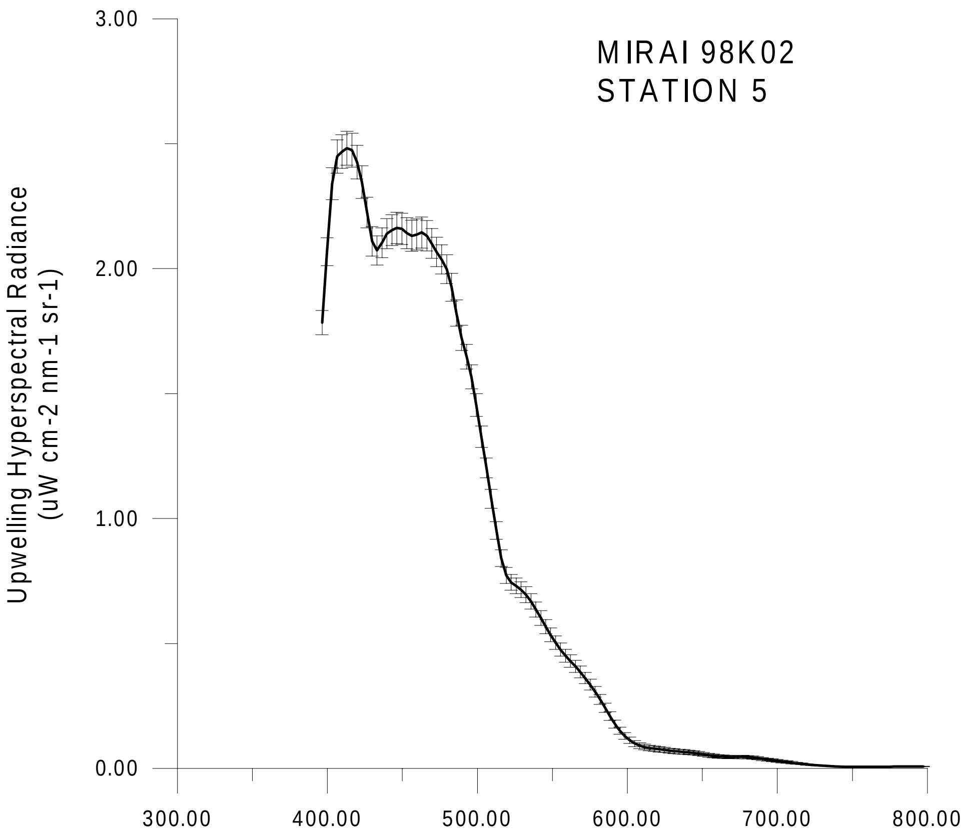
MIRAI 98K02
STATION 4
Hyperspectral Downwelling Irradiance
(uW cm-2 nm-1)
200.00
160.00
120.00
80.00
40.00
0.00
300.00
400.00
500.00
600.00
700.00
800.00
Wavelength (nm)

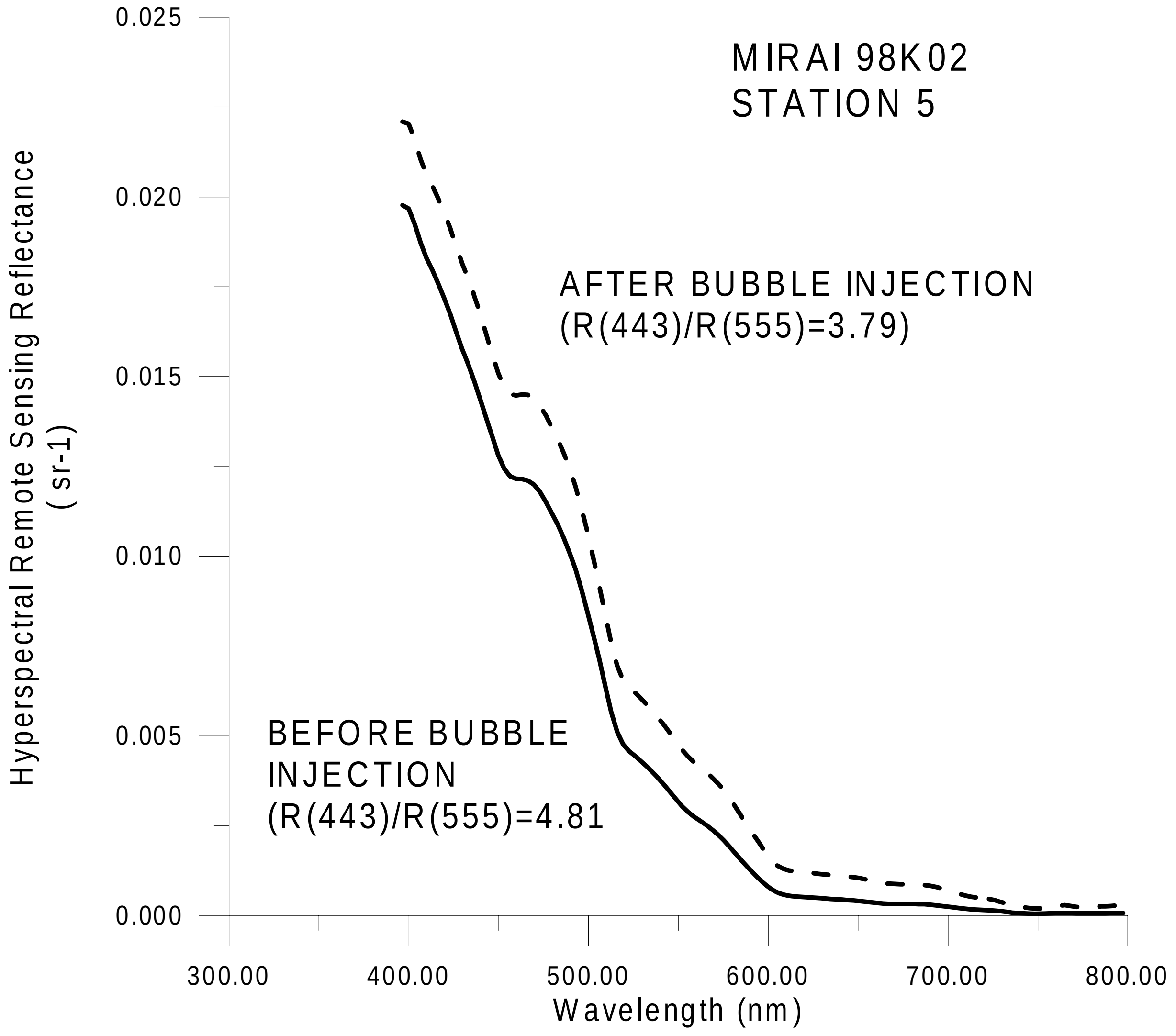


Hyperspectral Upwelling Radiance
(uW cm-2 nm-1 sr-1)
3.00
2.00
1.00
0.00
300.00
400.00
500.00
600.00
700.00
800.00
Wavelength (nm)

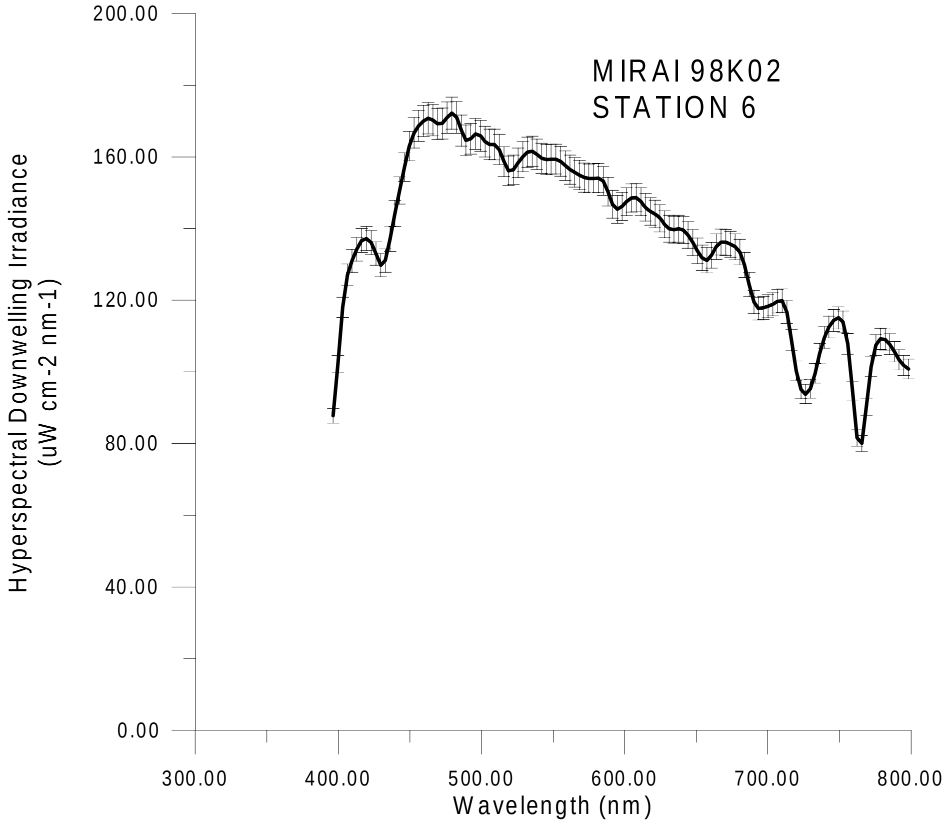

MIRAI 98K02
STATION 4
Hyperspectral Remote Sensing Reflectace
0.03
0.02
0.02
0.01
0.01
0.00
300.00
400.00
500.00
600.00
700.00
800.00
Wavelength (nm)

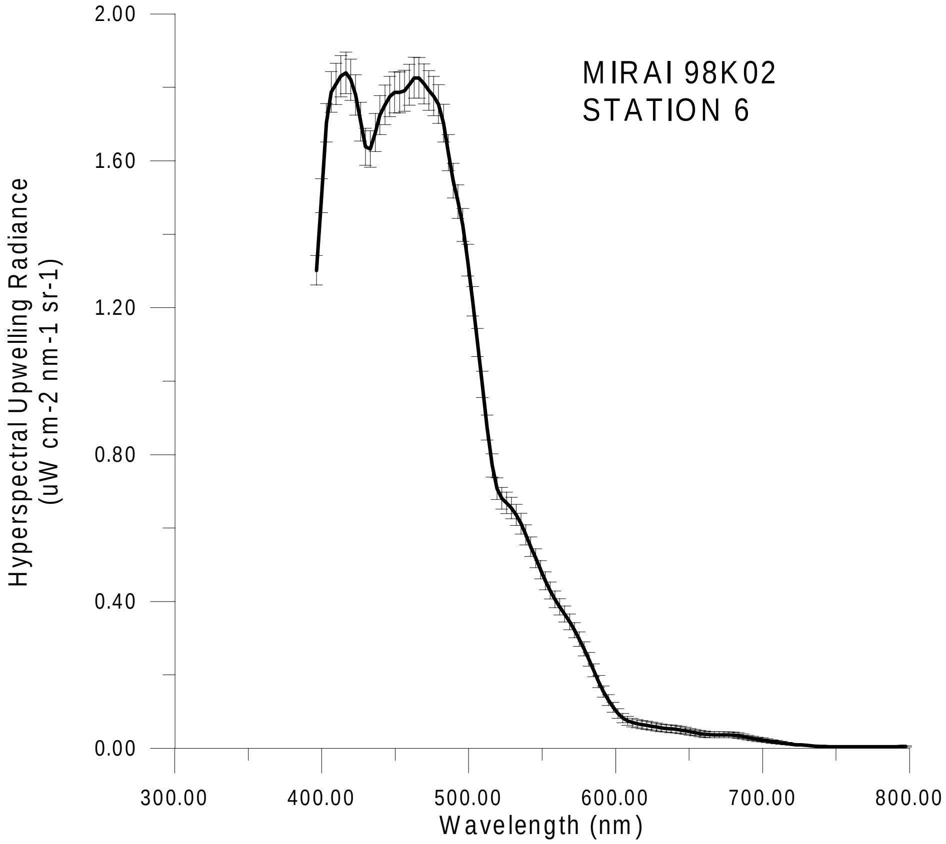

MIRAI 98K02
STATION 5
Downwelling Hyperspectral Irradiance
(uW cm-2 nm-1 sr-1)
200.00
160.00
120.00
80.00
300.00
400.00
500.00
600.00
700.00
800.00
Wavelength (nm)

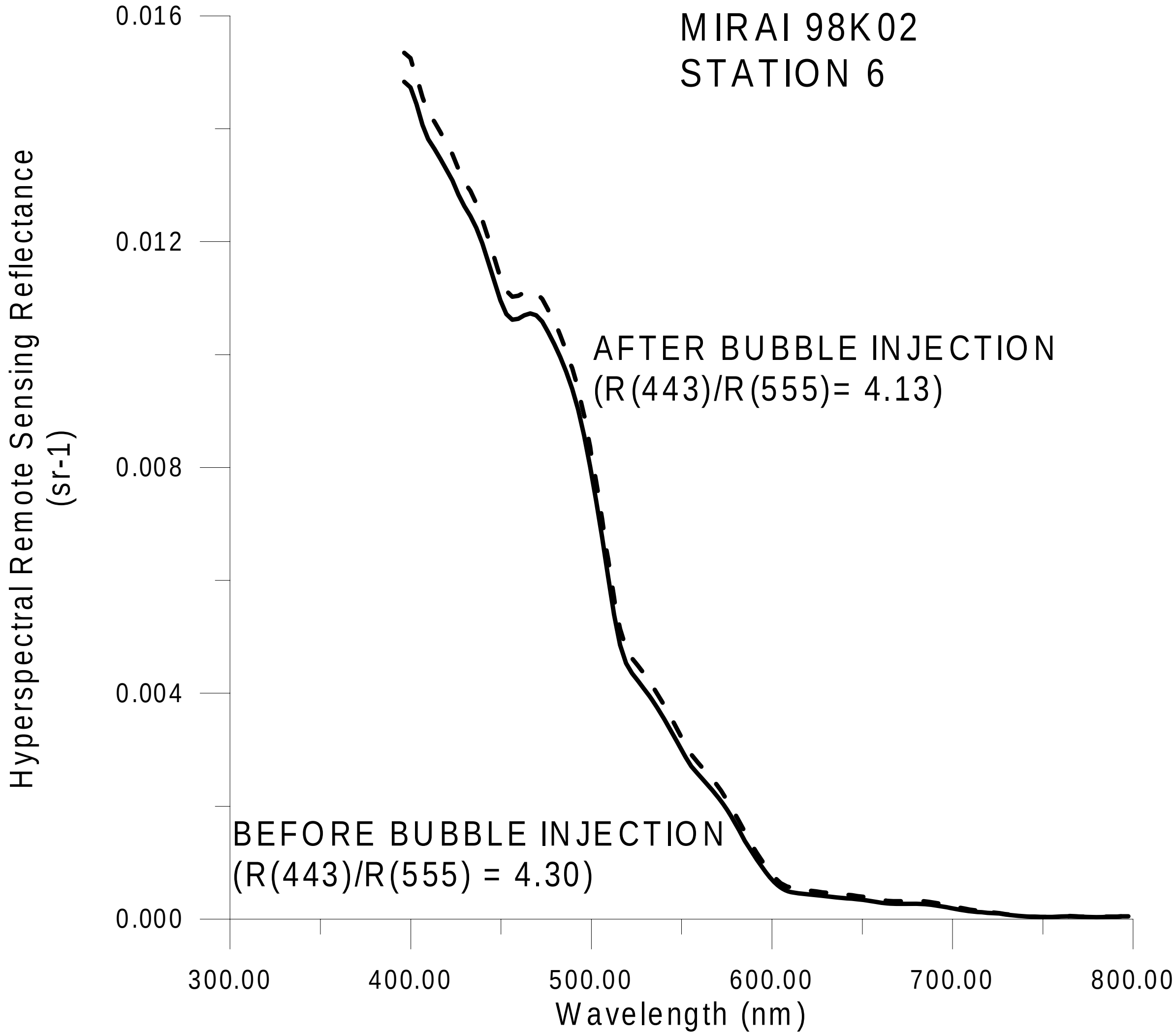

MIRAI 98K02
STATION 5
Upwelling Hyperspectral Radiance
(uW cm-2 nm-1 sr-1)
3.00
2.00
1.00
0.00
300.00
400.00
500.00
600.00
700.00
800.00
Wavelength (nm)

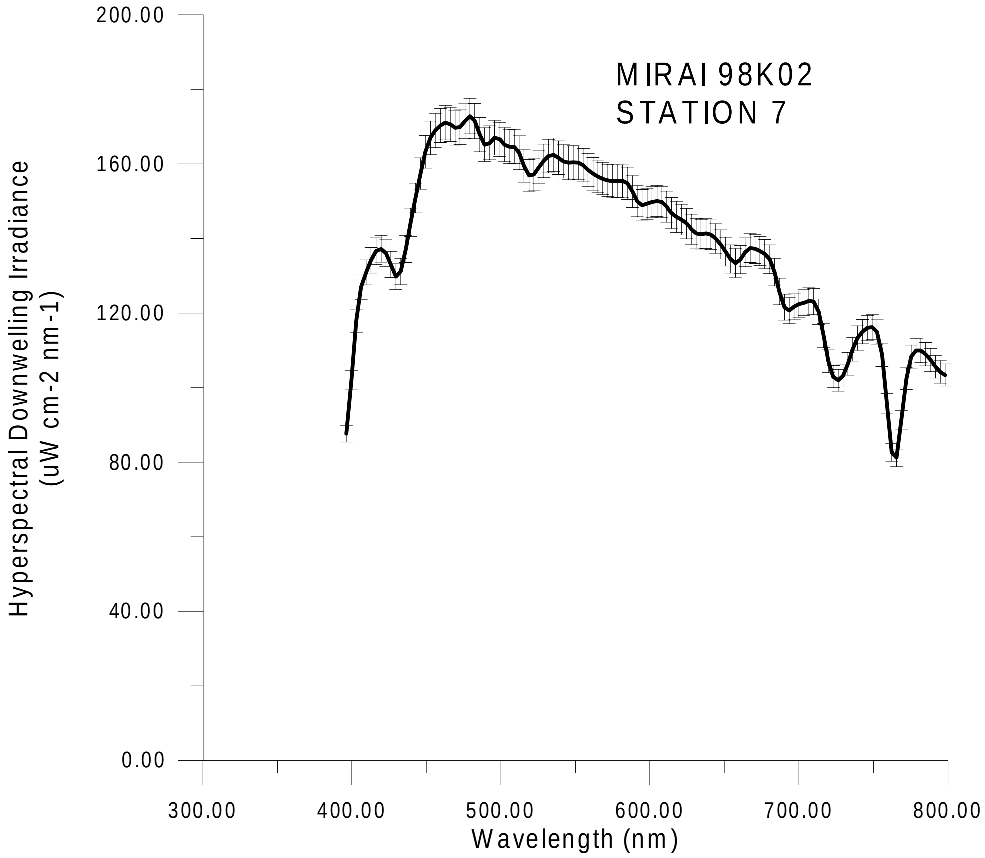


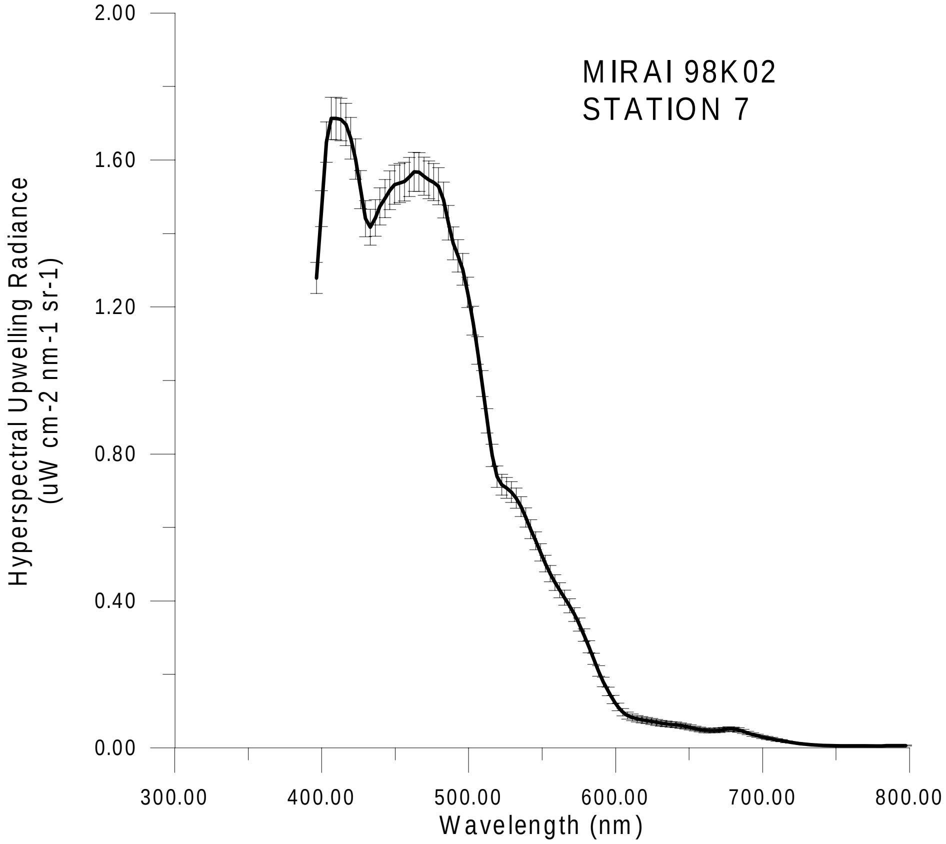
MIRAI 98K02
STATION 5
AFTER BUBBLE INJECTION
(R(443)/R(555)=3.79)
BEFORE BUBBLE
INJECTION
(R(443)/R(555)=4.81)
Hyperspectral Remote Sensing Reflectance
(sr-1)
0.025
0.020
0.015
0.010
0.005
0.000
300.00
400.00
500.00
600.00
700.00
800.00
Wavelength (nm)

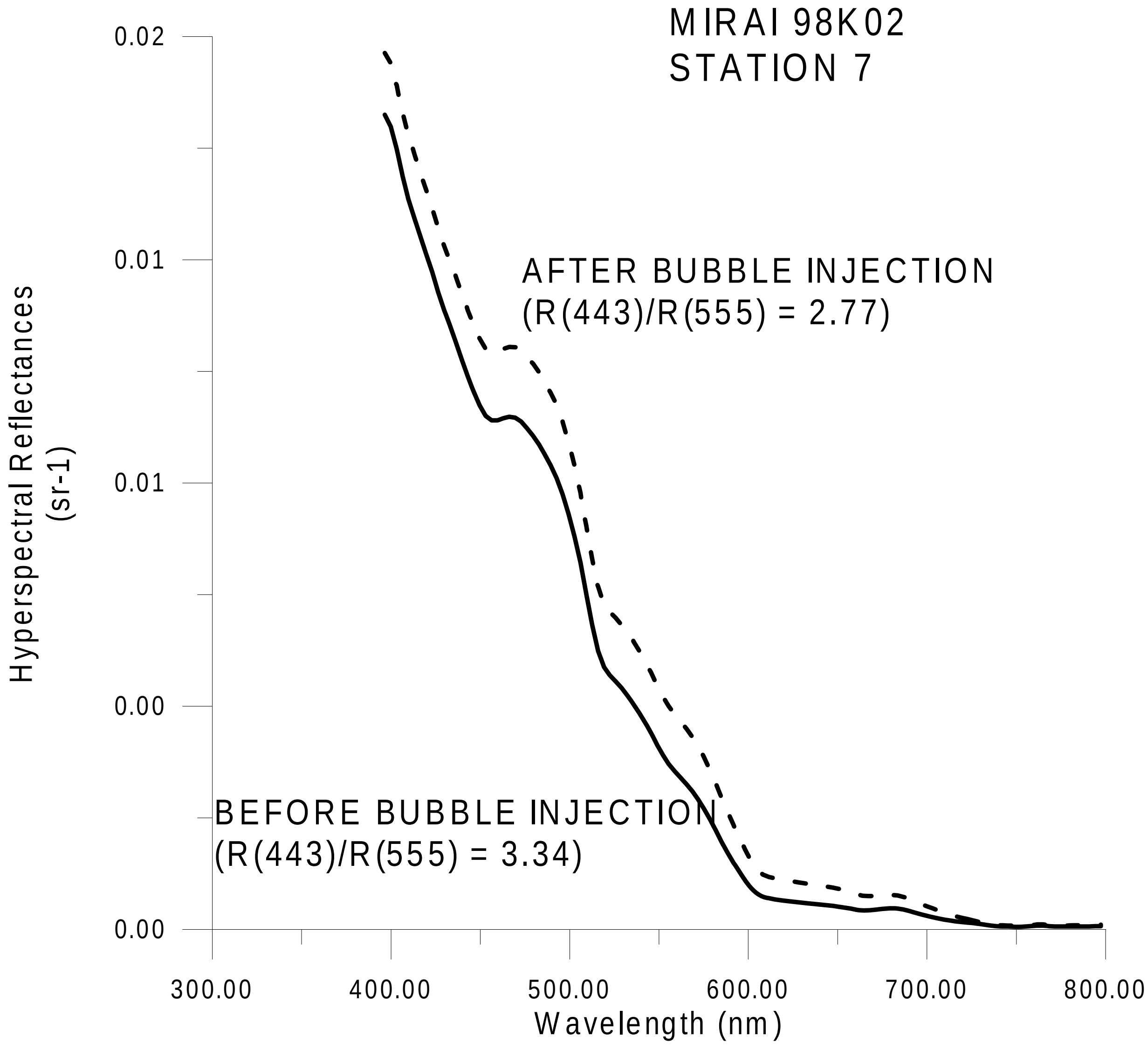

MIRAI 98K02
STATION 6
Hyperspectral Downwelling Irradiance
(uW cm-2 nm-1)
200.00
160.00
120.00
80.00
40.00
0.00
300.00
400.00
500.00
600.00
700.00
800.00
Wavelength (nm)

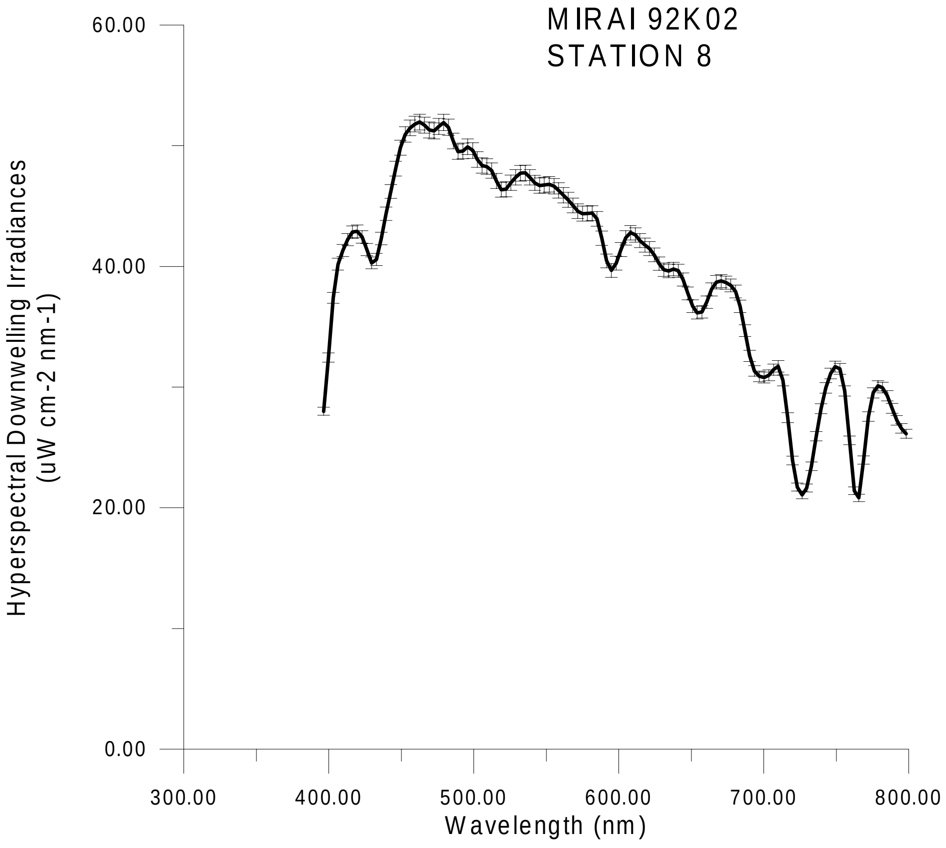

MIRAI 98K02
STATION 6
Hyperspectral Upwelling Radiance
(uW cm-2 nm-1 sr-1)
2.00
1.60
1.20
0.80
0.40
0.00
300.00
400.00
500.00
600.00
700.00
800.00
Wavelength (nm)

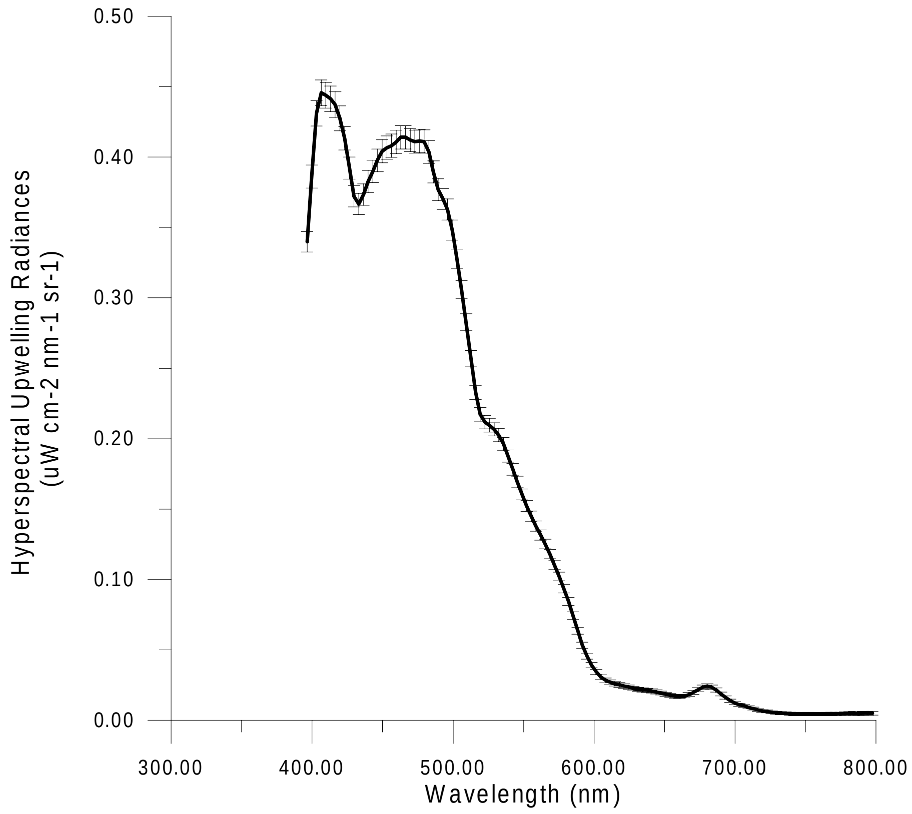

MIRAI 98K02
STATION 6
AFTER BUBBLE INJECTION
(R(443)/R(555)= 4.13)
BEFORE BUBBLE INJECTION
(R(443)/R(555) = 4.30)
Hyperspectral Remote Sensing Reflectance
(sr-1)
0.016
0.012
0.008
0.004
0.000
300.00
400.00
500.00
600.00
700.00
800.00
Wavelength (nm)

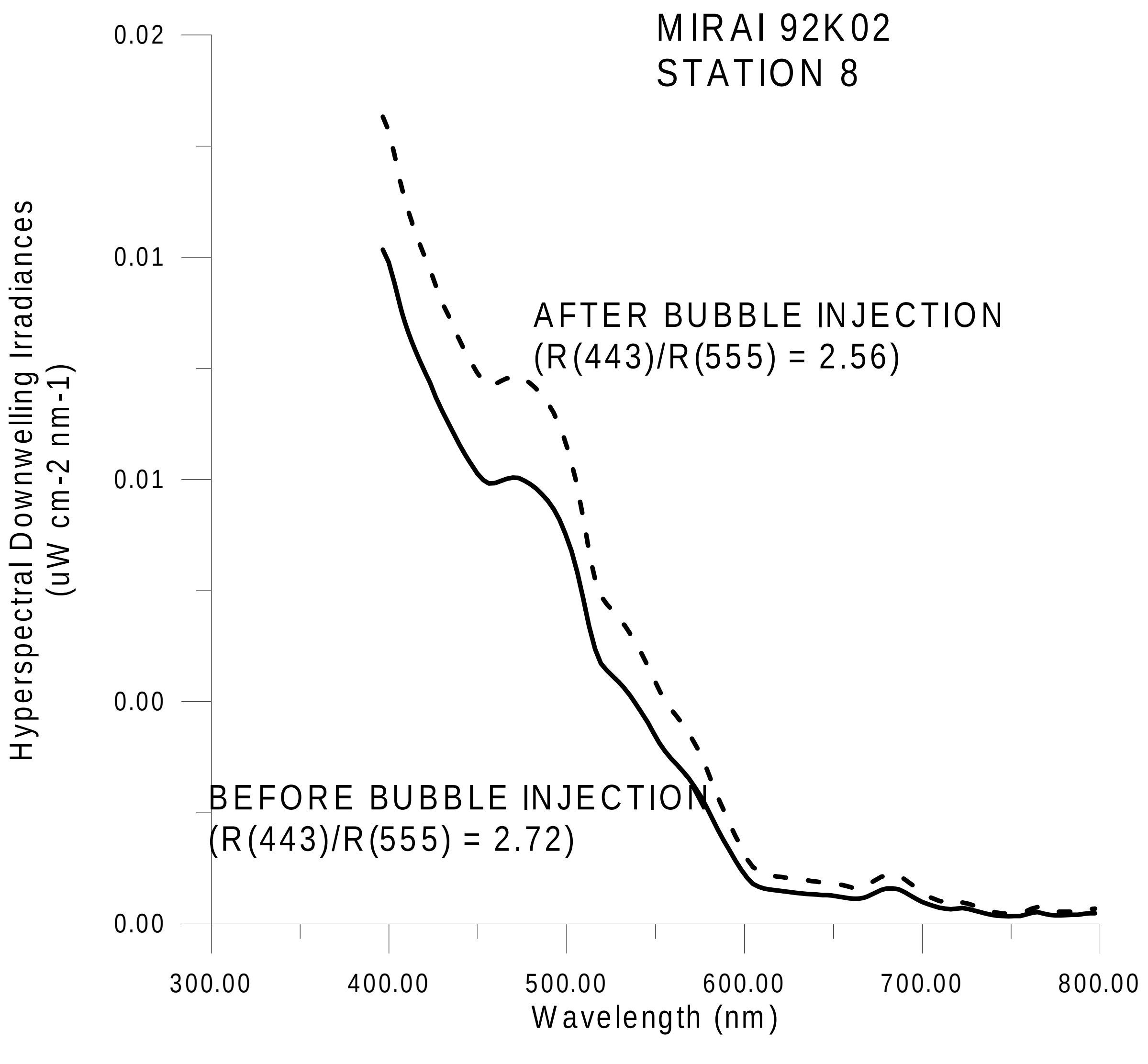

MIRAI 98K02
STATION 7
Hyperspectral Downwelling Irradiance
(uW cm-2 nm-1)
200.00
160.00
120.00
80.00
40.00
0.00
300.00
400.00
500.00
600.00
700.00
800.00
Wavelength (nm)

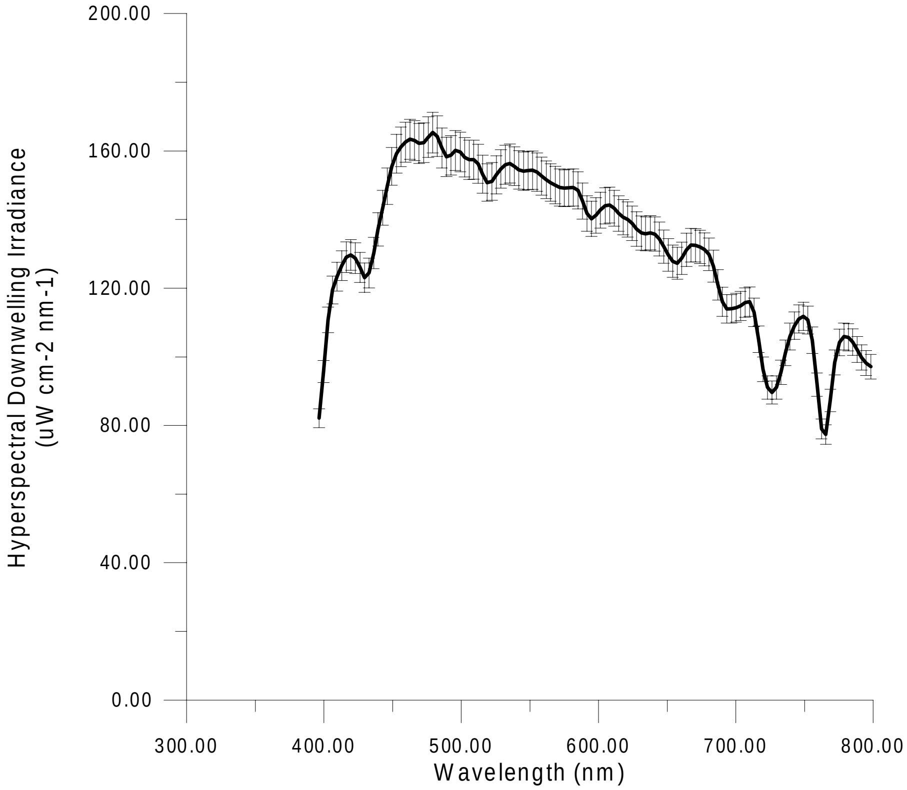

MIRAI 98K02
STATION 7
Hyperspectral Upwelling Radiance
(uW cm-2 nm-1 sr-1)
2.00
1.60
1.20
0.80
0.40
0.00
300.00
400.00
500.00
600.00
700.00
800.00
Wavelength (nm)


MIRAI 98K02
STATION 7
AFTER BUBBLE INJECTION
(R(443)/R(555) = 2.77)
BEFORE BUBBLE INJECTION
(R(443)/R(555) = 3.34)
Hyperspectral Reflectances
(sr-1)
0.02
0.01
0.01
0.00
0.00
300.00
400.00
500.00
600.00
700.00
800.00
Wavelength (nm)

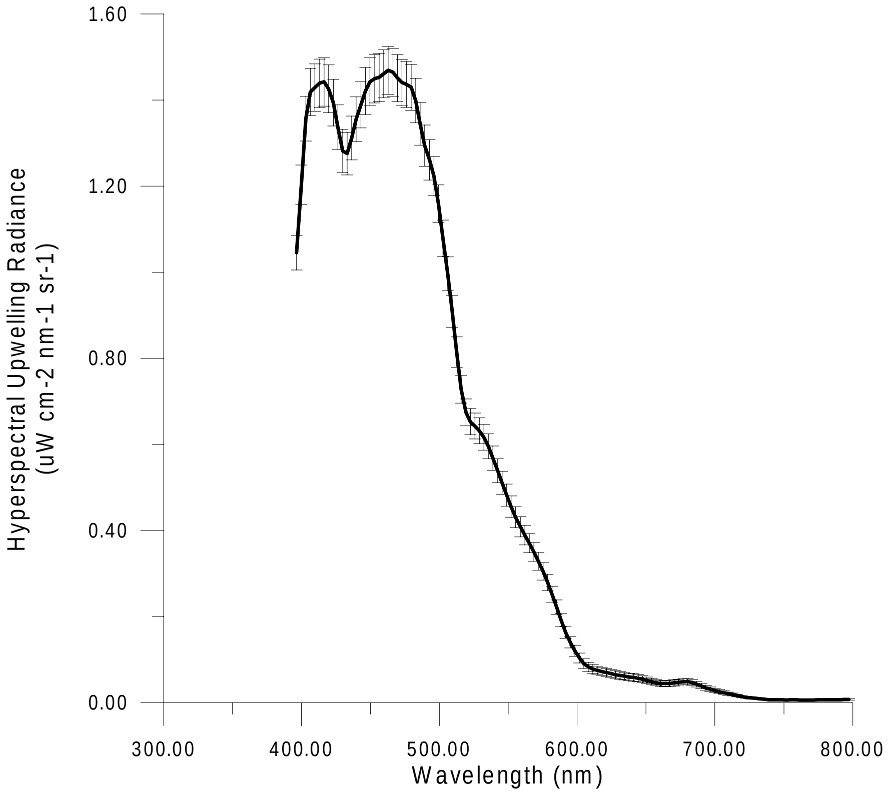

MIRAI 92K02
STATION 8
60.00
40.00
20.00
0.00
Hyperspectral Downwelling Irradiances
(uW cm-2 nm-1)
300.00
400.00
500.00
600.00
700.00
800.00
Wavelength (nm)


0.50
0.40
0.30
0.20
0.10
0.00
Hyperspectral Upwelling Radiances
(uW cm-2 nm-1 sr-1)
300.00
400.00
500.00
600.00
700.00
800.00
Wavelength (nm)

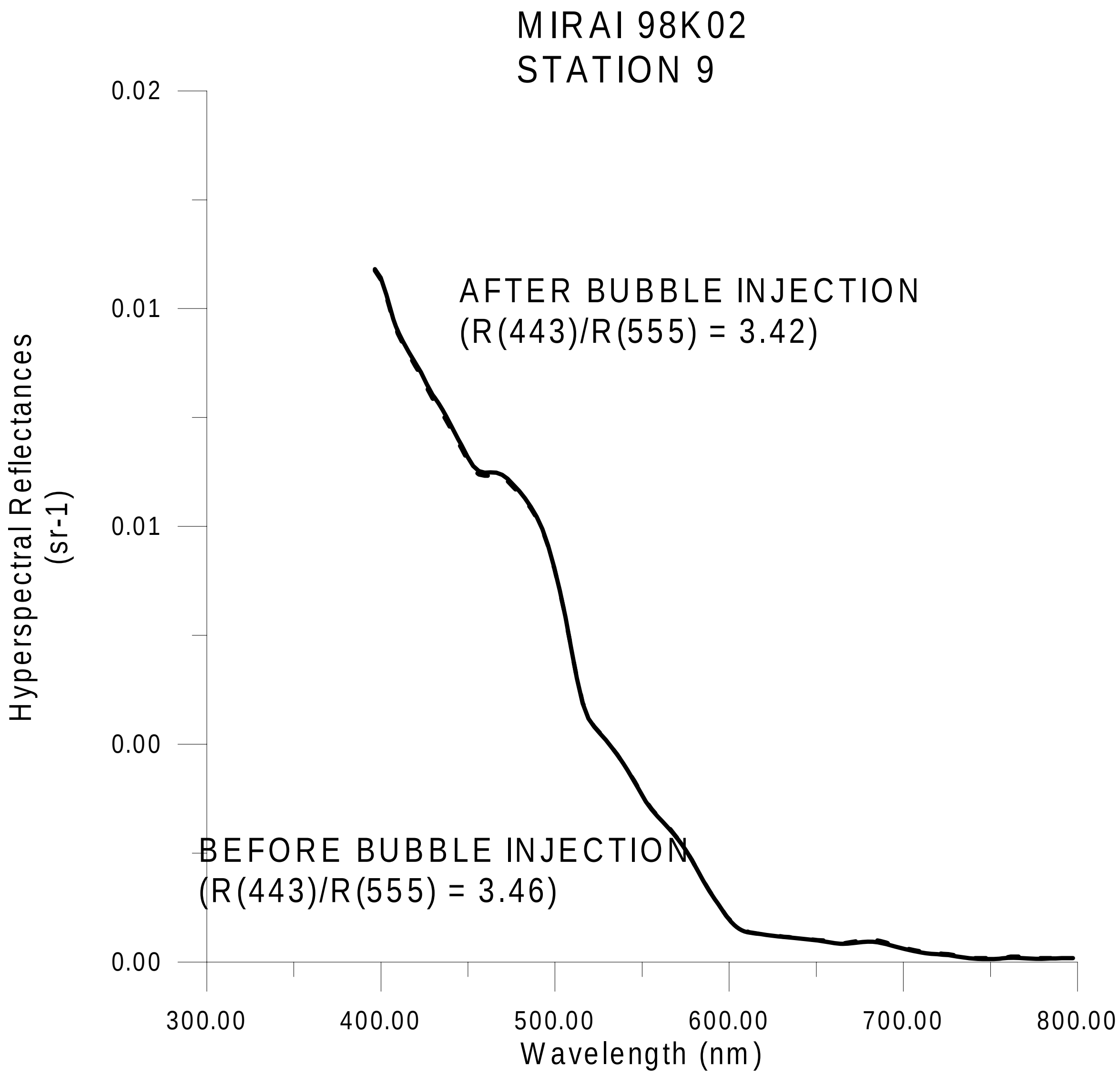

MIRAI 92K02
STATION 8
AFTER BUBBLE INJECTION
(R(443)/R(555) = 2.56)
BEFORE BUBBLE INJECTION
(R(443)/R(555) = 2.72)
Hyperspectral Downwelling Irradiances
(uW cm-2 nm-1)
0.02
0.01
0.01
0.00
0.00
300.00
400.00
500.00
600.00
700.00
800.00
Wavelength (nm)



200.00
160.00
120.00
80.00
40.00
0.00
Hyperspectral Downwelling Irradiance
(uW cm-2 nm-1)
300.00
400.00
500.00
600.00
700.00
800.00
Wavelength (nm)

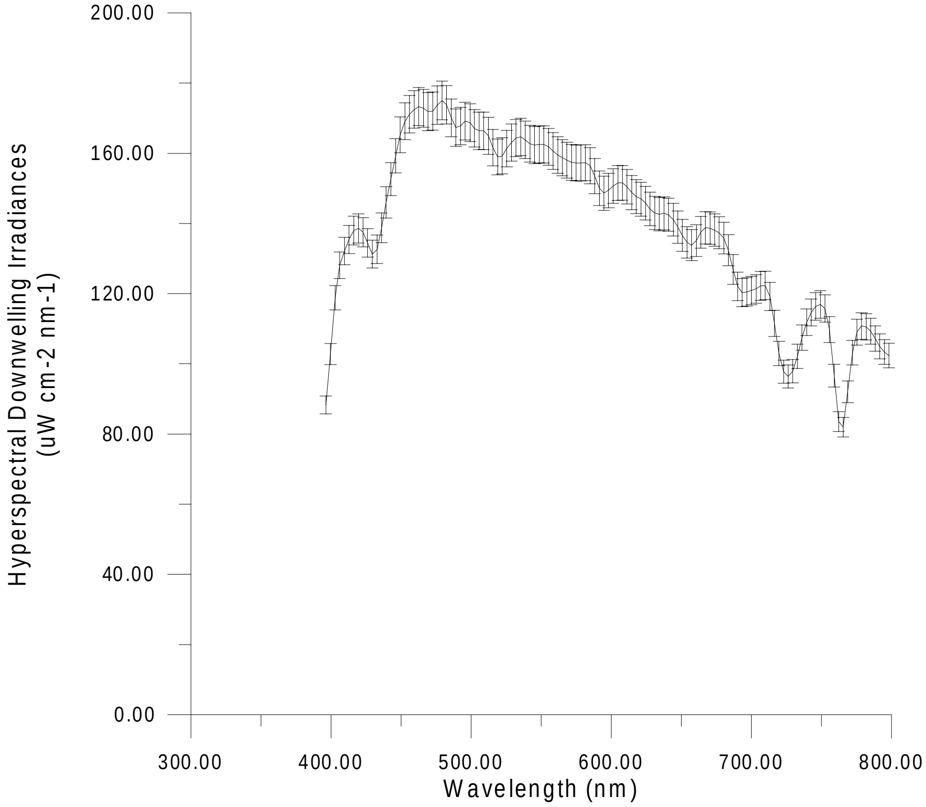


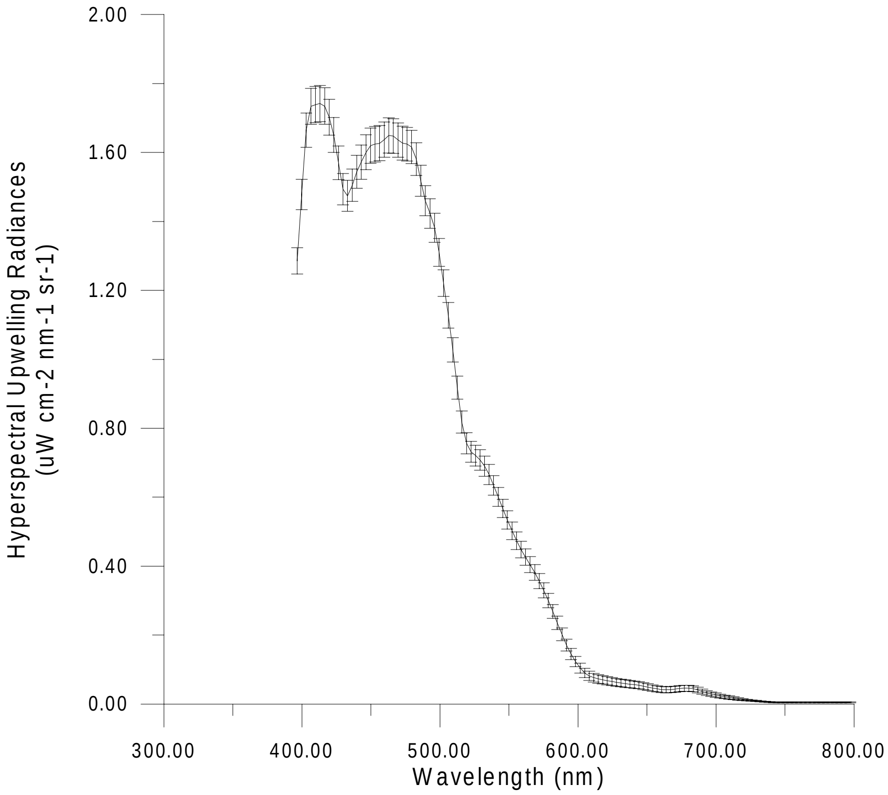
1.60
1.20
0.80
0.40
0.00
Hyperspectral Upwelling Radiance
(uW cm-2 nm-1 sr-1)
300.00
400.00
500.00
600.00
700.00
800.00
Wavelength (nm)


MIRAI 98K02
STATION 9
AFTER BUBBLE INJECTION
(R(443)/R(555) = 3.42)
BEFORE BUBBLE INJECTION
(R(443)/R(555) = 3.46)
Hyperspectral Reflectances
(sr-1)
0.02
0.01
0.01
0.00
0.00
300.00
400.00
500.00
600.00
700.00
800.00
Wavelength (nm)

MIRAI 98K02

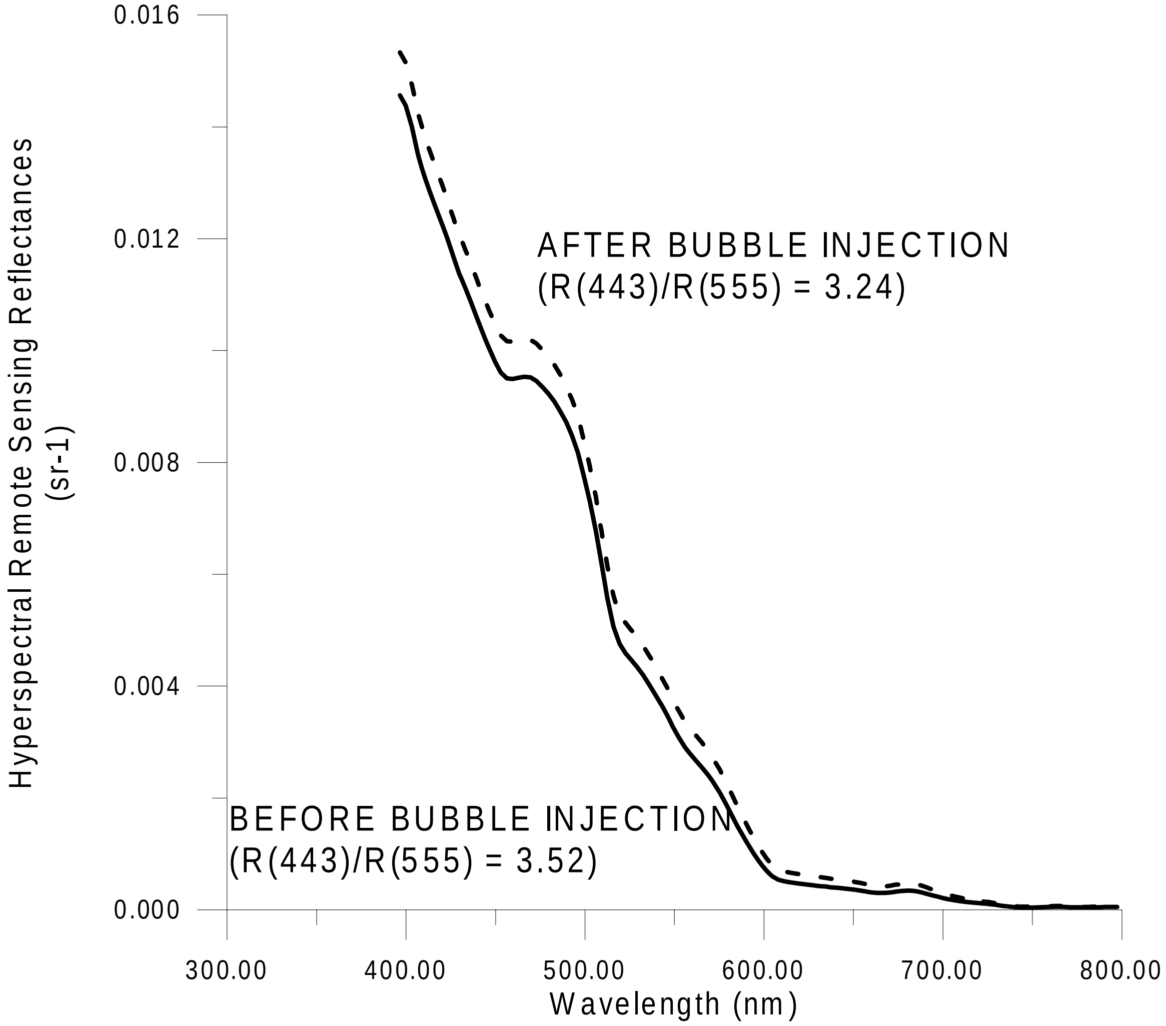
STATION 10





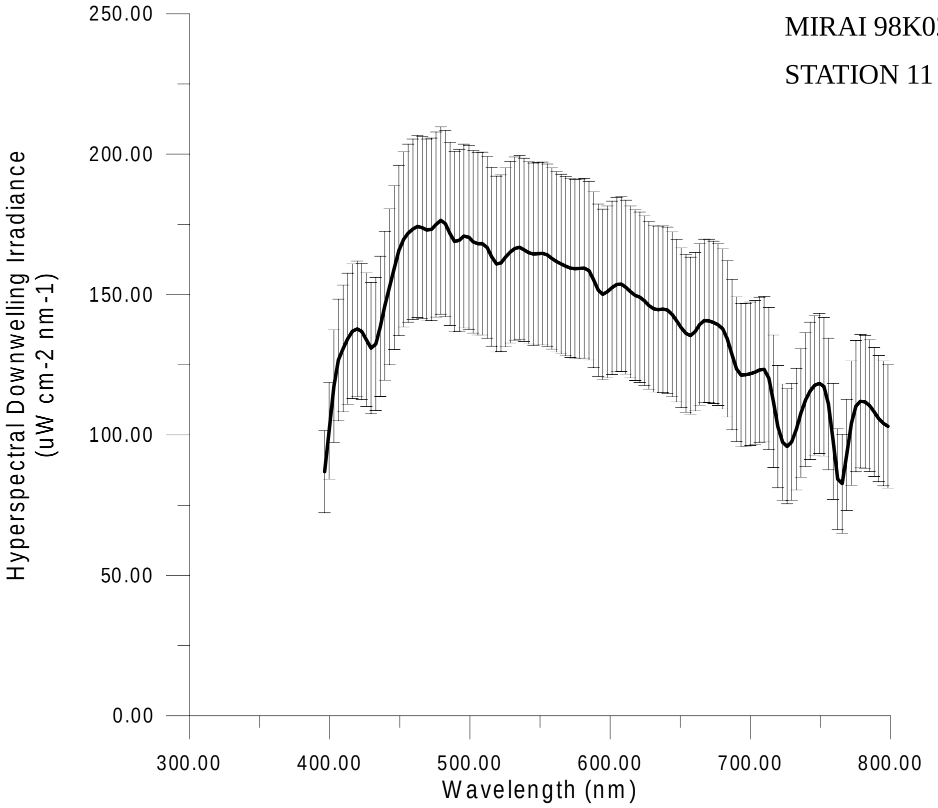
MIRAI 98K02

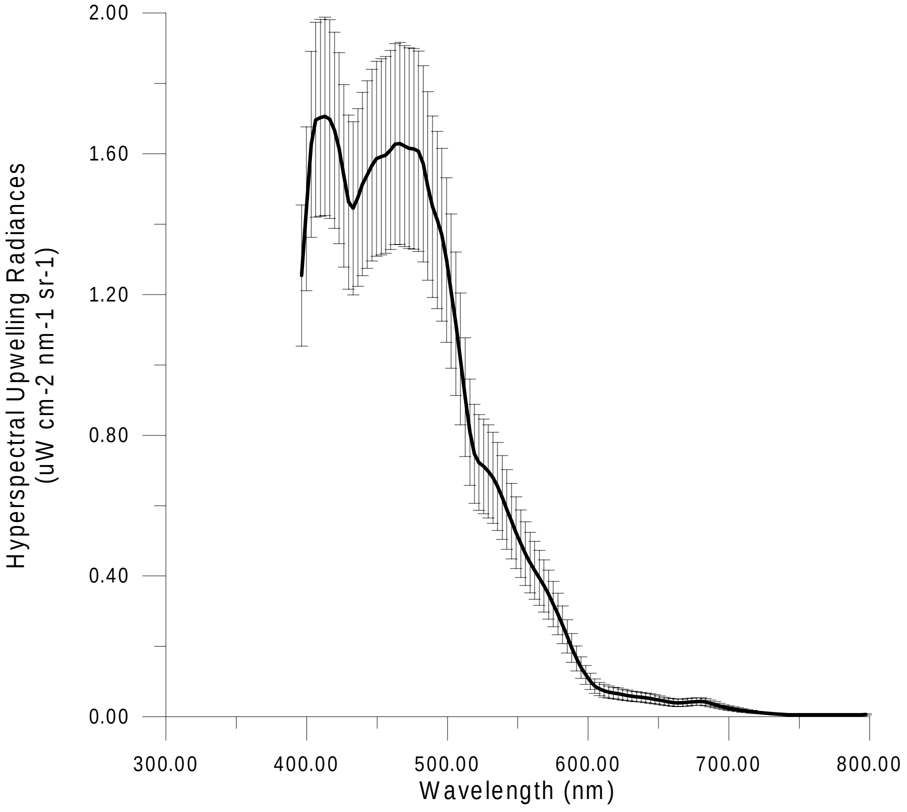
STATION 10



MIRAI 98K02

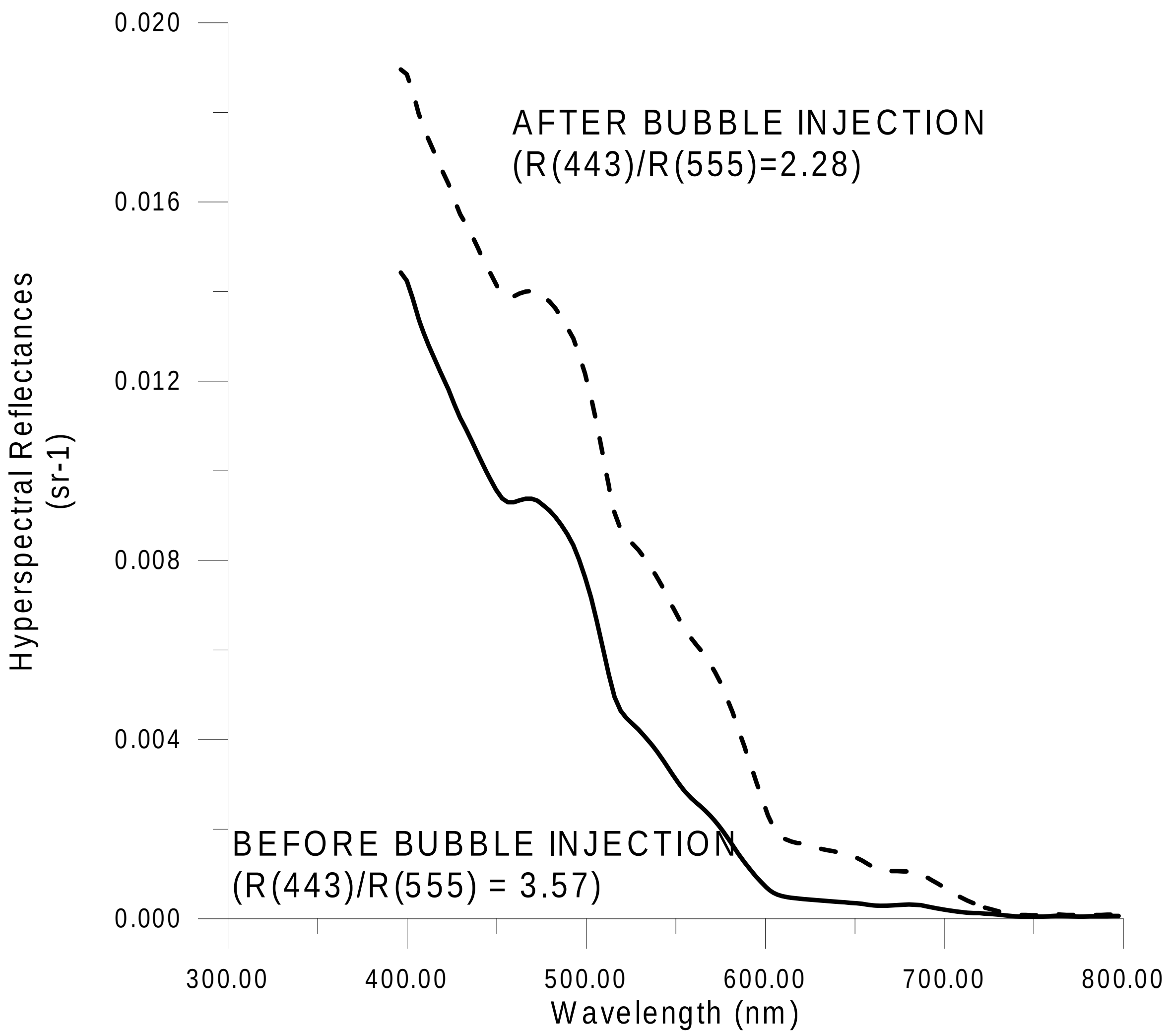
STATION 11

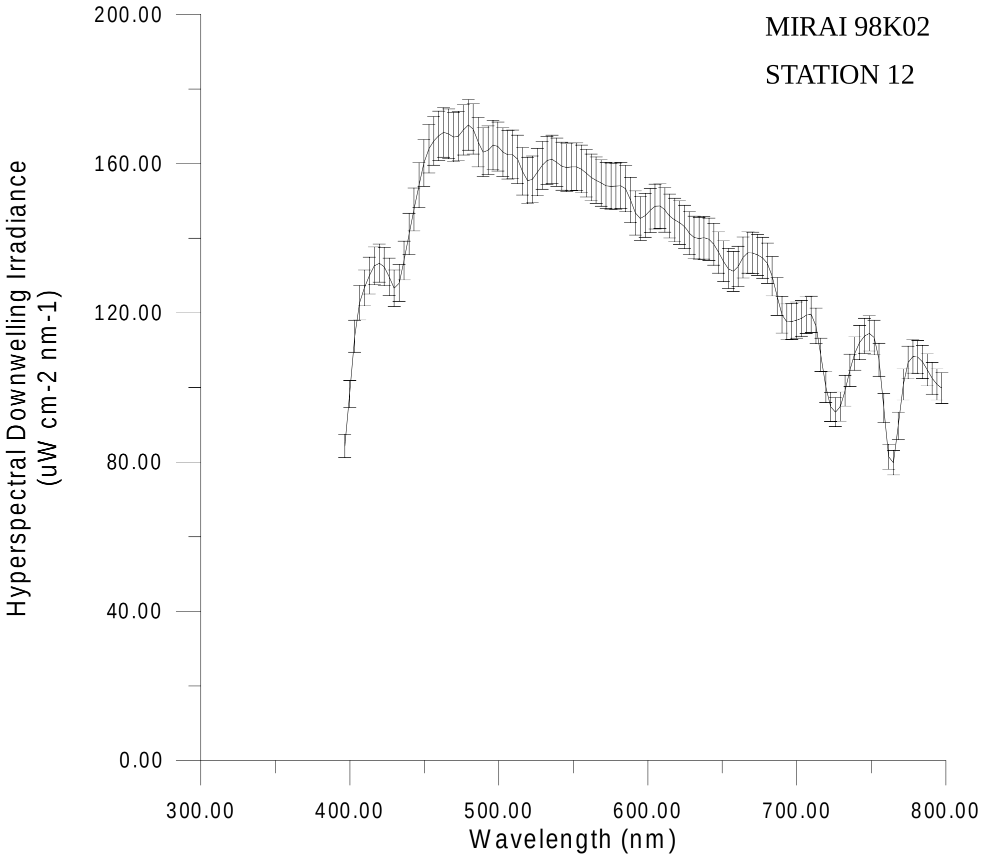


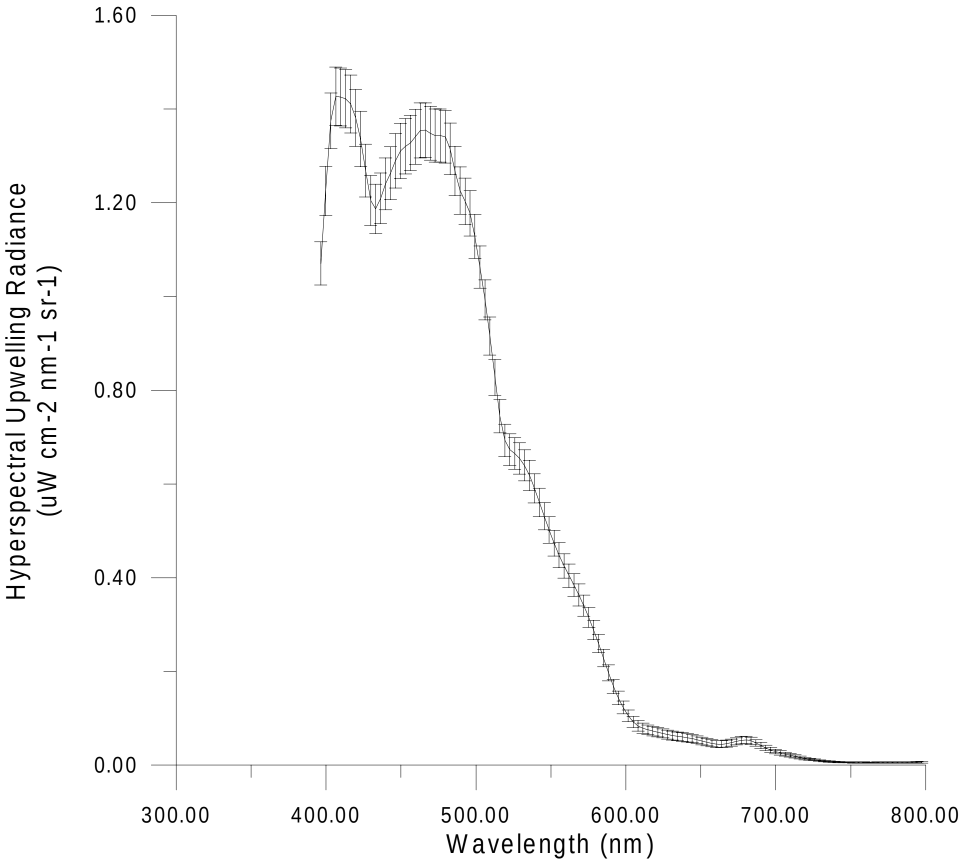


MIRAI 98K02

STATION 11

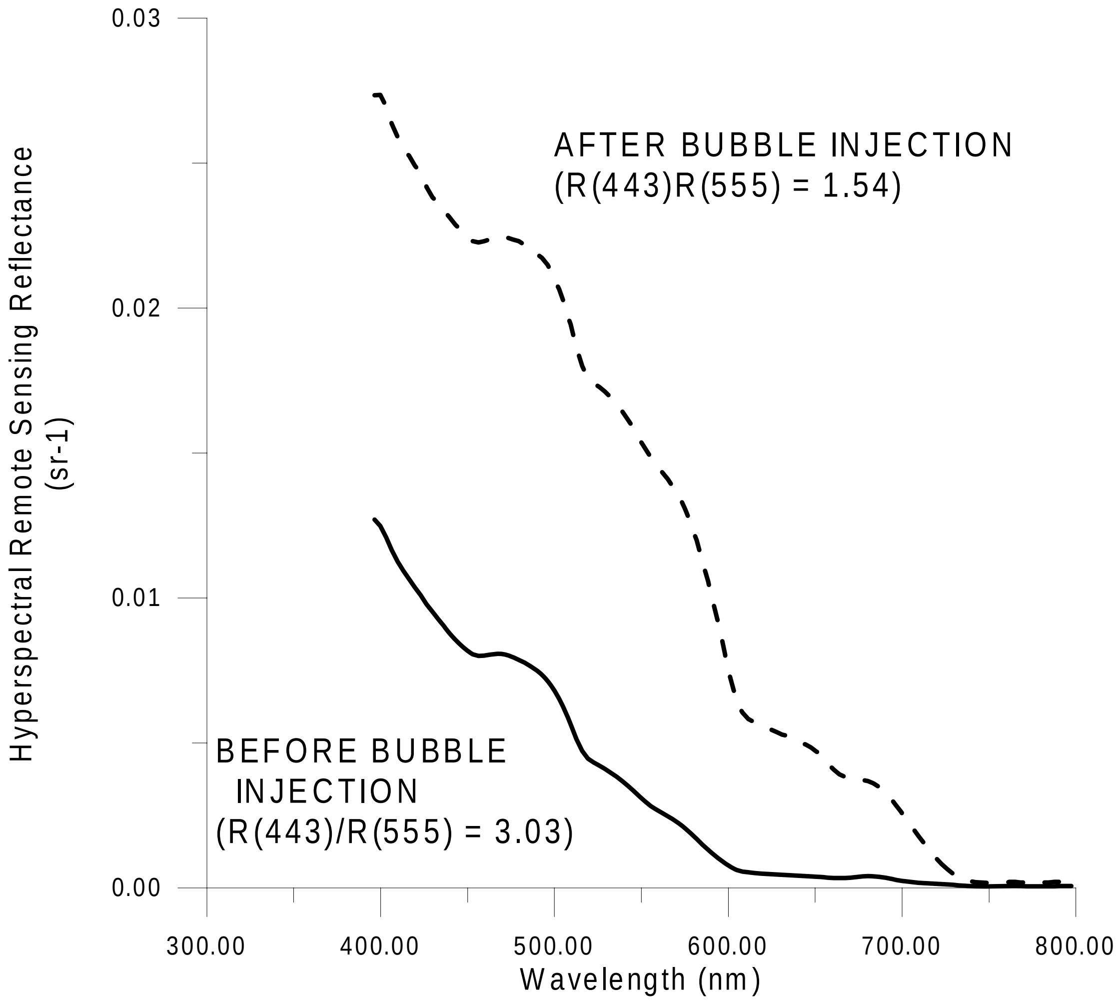


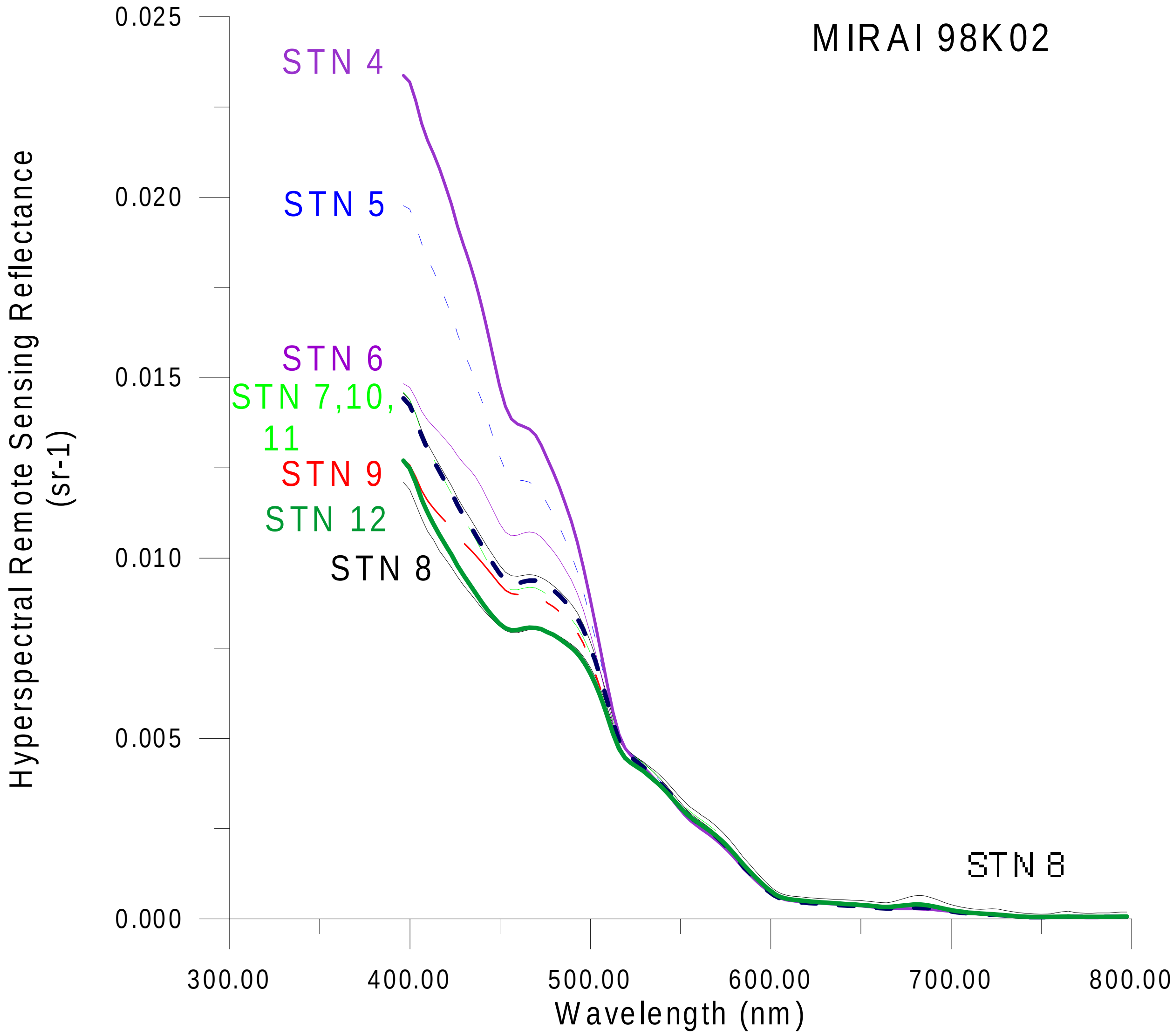

MIRAI 98K02
STATION 12
Hyperspectral Downwelling Irradiance
(uW cm-2 nm-1)
200.00
160.00
120.00
80.00
40.00
0.00
300.00
400.00
500.00
600.00
700.00
800.00
Wavelength (nm)


Hyperspectral Upwelling Radiance
(uW cm-2 nm-1 sr-1)
1.60
1.20
0.80
0.40
0.00
300.00
400.00
500.00
600.00
700.00
800.00
Wavelength (nm)

MIRAI 98K02

STATION 12




MIRAI 98K02
STN 4
STN 5
STN 6
STN 7,10,
11
STN 9
STN 12
STN 8
STN 8
0.025
0.020
0.015
0.010
0.005
0.000
Hyperspectral Remote Sensing Reflectance
(sr-1)
300.00
400.00
500.00
600.00
700.00
800.00
Wavelength (nm)

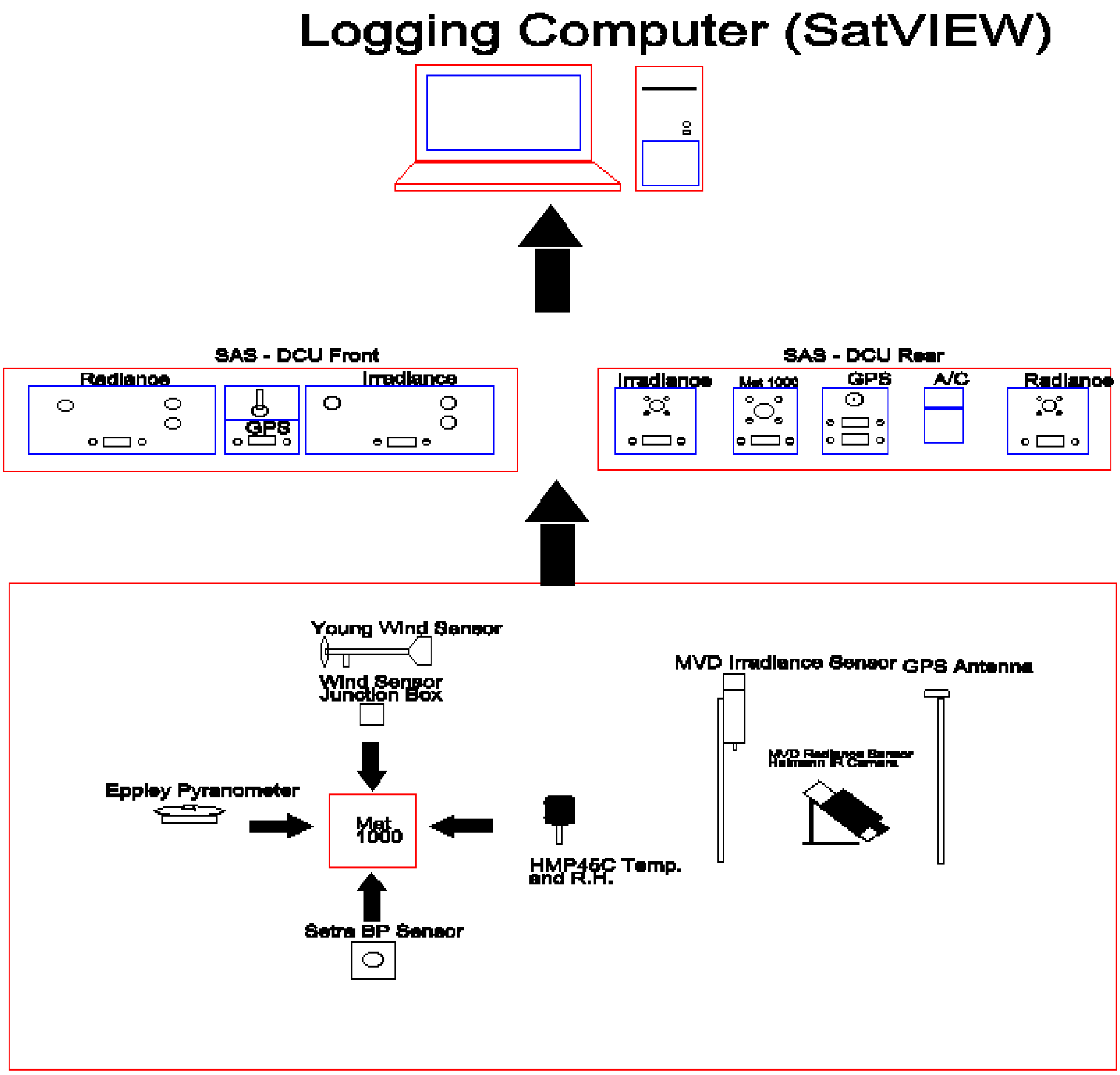
(3) Underway Automated SeaWiFS Aircraft Simulator & Meteorology

Objectives

The objectives of this measurement system are to provide continuous observations of key meterological variables, and continuous radiometric observations of the ocean and atmosphere.

Methodology

An instrument suite developed by Satlantic was deployed on the compass deck of the vessel. The suite included a meterological package (MET1000), an upward looking, 7-channel irradiance sensor, and a downward-looking, 7-channel radiance sensor. The radiance sensor was mounted to view the sea-surface at an angle of 35 degrees. The met package includes sensors for air temperature, barometric pressure, humidity, wind speed and direction, solar radiation (full spectrum), and an split-channel infrared sensor looking at the sea-surface for surface skin temperature measurement. All sensors log together with continuous GPS position, heading, ship speed, and accurate time.



The sensor system is diagrammed above and consists of

SAS s/n44/45 (Met 1000)

Ls sensors Ls412.8, Ls443.0, Ls490.4, Ls510.5,Ls554.4, Ls665.3, Ls780.7

EG&G Heiman Infrared camera

Es sensors Es412.4, Es442.8, Es 490.7, Es509.8, Es554.6, Es665.6, Es780.5

Calibration file name: SAS4445A.CAL (Calibrated 24 Nov 1998 at Satlantic)

Model HMP35C Temperature and relative humidity sensor

Setra Model SBP270 barometric pressure sensor

RM Young 05106 Wind Monitor

Eppley PSP Pyranometer

Sampling

The system was operated on a continuous basis for the duration of the cruise. Files were split up into daily files, usually broken at around 2000 local. The optical sensors were checked for calibration stability every two days using the SeaWiFS Quality Monitor.

Data Processing

Due to problems with the processing software, no data was processed onboard ship. It will be completed shortly after return to Halifax.

(4) Sun Photometry

Objectives

The objectives of this measurement program were to analyze the atmospheric transmission of visible light for the purpose of making accurate atmospheric correction to the visible satellite imagery.

Methodology.

Measurements were made with a MicrotopsII hand-held sun photometer. The instrument is equipped with 5 optical collimators with specific bandpass filters that are used to measure the irradiance of the output of the solar disk. The instrument is coupled to a GPS receiver, which provides positonal location, as well as time.

The instrument is pointed at the sun, and measurements taken for a 10 second period. A digital photograph of the occluded sun is taken shortly after the irradiance measurement.

Sampling

Measurements were taken several times per day, centered around local noon to coincide with the passing of the SeaWiFS satellites. Only days with clear skies were used. Sampling was carried out as in the following table:

MR98K02 MicroTops Sunphotometer Log Sheet

SN	DATE	TIME(UTC)	DATA_DESCR	LOCATION	Cloud Cover	*LAT*	*LONG*
3773	1/5/99	12:40:36 AM	01/05/1999	Stn04_1	high cirrus	-0.001	147.846
3773	1/5/99	12:40:56 AM	01/05/1999	Stn04_2	high cirrus	-0.001	147.847
3773	1/5/99	1:21:22 AM	01/05/1999	Stn04_3	high cirrus	-0.001	147.886
3773	1/5/99	1:59:55 AM	01/05/1999	Stn04_4	clear	0.000	147.885
3773	1/5/99	2:01:51 AM	01/05/1999	Stn04_5	clear	0.000	147.884
3773	1/5/99	2:02:31 AM	01/05/1999	Stn04_6	clear, slight haze	0.000	147.884
3773	1/6/99	1:32:42 AM	01/06/1999	Stn05_1	clear, scattered clouds	-0.002	153.265
3773	1/6/99	3:32:58 AM	01/06/1999	Stn05_2	clear, scattered clouds	0.000	153.398
3773	1/7/99	12:17:36 AM	01/07/1999	underway	clear	0.007	158.417
3773	1/7/99	12:18:05 AM	01/07/1999	underway	clear	0.007	158.419
3773	1/7/99	1:55:09 AM	01/07/1999	underway	clear	0.010	158.815
3773	1/7/02	1:55:20 AM	01/07/1999	underway	clear	0.010	158.815
3773	1/7/02	1:55:30 AM	01/07/1999	underway	clear	0.010	158.817
3773	1/7/99	2:26:01 AM	01/07/1999	underway	clear	0.010	158.942
3773	1/8/99	12:18:00 AM	01/08/1999	Stn06_1	slight haze	0.075	159.964
3773	1/8/99	2:08:34 AM	01/08/1999	Stn06_1	slight haze	0.051	159.964
3773	1/8/99	2:10:11 AM	01/08/1999	Stn06_1	slight haze	0.051	159.963
3773	1/8/99	11:42:58 PM	01/09/1999	Stn07_1	clear	0.002	163.581
3773	1/8/99	11:45:02 PM	01/09/1999	Stn07_2	clear	0.002	163.586
3773	1/9/99	2:24:52 AM	01/09/1999	Stn07_3	clear	0.007	163.620
3773	1/9/99	2:25:14 AM	01/09/1999	Stn07_4	clear	0.007	163.620

3773	1/10/99 10:12:07 PM	01/11/1999	underway	high haze	0.008	173.740
3773	1/10/99 10:13:37 PM	01/11/1999	underway	high haze	0.008	173.746
3773	1/11/99 1:22:46 AM	01/11/1999	underway	clear	0.003	174.455
3773	1/11/99 1:23:08 AM	01/11/1999	underway	clear	0.003	174.456
3773	1/11/99 1:31:10 AM	01/11/1999	underway	clear	0.003	174.488
3773	1/11/99 11:21:41 PM	01/12/1999	Stn09_1	slight haze	0.064	174.911
3773	1/12/99 1:27:52 AM	01/12/1999	Stn09_2	slight haze	0.060	174.913
3773	1/12/99 1:28:27 AM	01/12/1999	Stn09_3	slight haze	0.060	174.913
3773	1/12/99 10:13:45 PM	01/13/1999	Stn10_1	slight haze	0.001	178.674
3773	1/12/99 10:14:06 PM	01/13/1999	Stn10_2	slight haze	0.001	178.675
3773	1/13/99 12:27:18 AM	01/13/1999	Stn10_3 rejected	slight haze	-0.003	178.775
3773	1/13/99 12:27:40 AM	01/13/1999	Stn10_4	slight haze	-0.003	178.776
3773	1/13/99 10:54:06 PM	01/14/1999	Stn11_1	slight haze	0.002	-176.296
3773	1/13/99 10:55:14 PM	01/14/1999	Stn11_2	slight haze	0.002	-176.294
3773	1/14/99 1:20:49 AM	01/14/1999	Stn11_3	slight haze	-0.002	-176.140
3773	1/14/99 1:21:25 AM	01/14/1999	Stn11_4	slight haze	-0.002	-176.138
3773	1/14/99 11:58:48 PM	01/14/1999	underway	slight haze	0.002	-170.774
3773	1/14/99 11:59:10 PM	01/14/1999	underway	slight haze	0.002	-170.773
3773	1/15/99 8:35:20 PM	01/16/1999	Stn12_1	clear	-0.038	-170.163
3773	1/15/99 9:10:46 PM	01/16/1999	Stn12_2	clear	-0.041	-170.174
3773	1/15/99 9:59:28 PM	01/16/1999	Stn12_3	clear	-0.052	-170.184
3773	1/15/99 11:43:17 PM	01/16/1999	Stn12_4	clear	-0.055	-170.182
3773	1/16/99 12:42:44 AM	01/16/1999	Stn12_5	clear	-0.057	-170.168

Data Processing.

Little processing beyond what is accomplished by the instrument has been carried out. Data is organized into separate text files by station. The format of the files is as follows:

MicroTOPS Sunphotometer Data Description

SN	DATE	TIME	DATA_DESCR	LOCATION	C1	C2	C3
Instrument ID	UTC DATE From gps	UTC TIME From gps	User chooses during data download	***MIRAI***	Calibration Constant 440	Calibration Constant 500	Calibration Constant 675
C4	**C5**	**LNV01**	**LNV02**	**LNV03**	**LNV04**	**LNV05**	
Calibration Constant 870	Calibration Constant 936	Not used	Not used	Not used	Not used	Not used	
K	**B**	**C**	**POFFS**	**PSCALE**	**LATITUDE**	**LONGITUDE**	
Constant dependent on spectral Tran.of # 4 filter	Constant dependent on spectral Tran.of # 4 filter	Correction factor between aerosol op.depth 1020 & 940	Pressure Calibration factor	Pressure Calibration factor	GPS	GPS	
ALTITUDE	**PRESSURE**	**SZA**	**TEMP**	**WATER**	**AM**	**SDCORR**	
METERS	mBARS	Solar zenith angle	Internal temp of diode array bock	Precipitable Water column in cm	Air MASS	Solar distance correction	
ID	**SIG440**	**SIG500**	**SIG675**	**SIG870**	**SIG936**	**STD440**	
Identification #	Signal in mV	Signal in mV	Signal in mV	Signal in mV	Signal in mV		
STD500	**STD675**	**STD870**	**STD936**	**R440_500**	**R500_675**	**R675_870**	
Std. Deviation of signal in mW	Std. Deviation of signal in mW	Std. Deviation of signal in mW	Std. Deviation of signal in mW	Ratio	Ratio	Ratio	
AOT440	**AOT500**	**AOT675**	**AOT870**	**AOT936**			
Aerosol optical thickness	Aerosol optical thickness	Aerosol optical thickness	Aerosol optical thickness	Aerosol optical thickness			

(5) Total and New Production

Objective

The objective of the present study is to investigate the uptake rates of labeled ^{15}N-nitrate and labeled inorganic ^{13}C-carbon in simulated *in-situ* incubations to determine rates of new and total primary production along equatorial transect 135E to 170W.

Methodology for measurements

A rosette system equipped with 30L General Oceanics Niskin bottles was used to collect seawater at eight optical depths for simulated in-situ incubation and nitrate uptake kinetics experiments at each station. A surface water sample was collected just prior to retrieval of the rosette system with a HDPE bucket. The optical depths were determined using Satlantic SPMR Profiler to correspond to eight light levels (100, 40, 20, 10, 5, 2 and 0.2 % of surface irradiance for new and primary production measures, and 30 % of surface irradiance for nitrate uptake kinetic measures) available in the incubators aboard the R/V Mirai. A summary of station locations, sample times and depths is shown in table 1. The incubators consisted of two types; a 0.6 m long acrylic tube covered with a neutral density screen (used for simulated *in-situ* incubations, and a aluminum mesh screen wrapped around the polycarbonate bottle (used for nitrate uptake kinetics). Measurement of light transparencies for the incubators is shown in Table 2. For estimation of ^{15}N and ^{13}C uptake rates, triplicate - 1L polycarbonate bottles were rinsed with sample water from each optical depth and filled to 1L using a silicon tube connected to the Niskin bottle to deliver the sample gently into the bottles, allowing a small air space at the top of the bottle. All sample bottles were then innoculated with 200 μM ^{13}C-sodium bicarbonate and 0.5 μM ^{15}N-potassium nitrate in the surface mixed layer above the chlorophyll-a maximum, and 1.0 μM of ^{15}N-potassium nitrate at and below the chlorophyll maximum. For estimation of nitrate uptake kinetics, 9-1L polycarbonate bottles were rinsed and filled as above. Kinetic uptake studies using ^{15}N-potassium nitrate were conducted at nine different concentrations (0, 10, 20, 50, 100, 200, 500, 1000, and 2000 nM) and were innoculated with 200 μM ^{13}C-sodium bicarbonate. Immediately after innoculation with stable isotopes, sample bottles were placed into incubators corresponding to their nearest light level and then put into large tanks located on the deck with continuously flowing seawater pumped from 7 m below the surface to maintain stable temperatures in the sample bottles. All isotope additions were done in a dark room prior to placing sample bottles into incubators. All sample bottles were maintained just under the surface in the holding tanks during the 3 hour incubation under ambient irradiance and temperature conditions. After initiating incubations, unfiltered seawater from surface to the chlorophyll maximum layer were collected in 50 ml Falcon tubes and immediately frozen for low level nitrate analysis. At the end of the incubation, samples were filtered onto 21 mm pre-combusted (475 ^{o}C for 4 h) Whatman GF/F filters and placed into labelled Petri dishes and dried at 50 ^{o}C for 6 h. Samples were then placed into plastic bags with silica gel (dessicant) and vacuum sealed. Sample filters will be maintained under vacuum and dessicant until analysis with an CN Analyzer coupled to a Europa Tracemass Spectrometer located at the Bedford Institute of Oceanography located in Dartmouth, Nova Scotia, Canada. Residual nitrate samples will be kept frozen until analysis with an Antek 720 Nitrogen Analyzer located at the Department of Oceanography, Dalhousie University, Halifax, Nova Scotia, Canada.

Sampling.

Table 1. Summary of station locations, start times, and depths for simulated in-situ incubations.

station #	UTC date d/m/y	UTC time hh:mm	local date d/m/y	local time hh:mm	latitude	longitude	Sampling depths (m)
1	1/1/99	04:50	31/12/98	13:50	04 03.3N	135 01.31E	0,15,30,40,60,80,100
2	3/1/99	03:00	2/1/99	12:00	05 02.0N	140 05.80E	0,15,30,40,60,80,100,120
3	5/1/99	03:00	4/1/99	13:00	00 00.0N	145 00.00E	0,15,30,40,60,80,100,120
4	6/1/99	03:05	5/1/99	13:05	00 00.0N	147 53.20E	0,15,45,60,80,100,110
5	7/1/99	03:00	6/1/99	13:00	00 00.0N	153 15.90E	0,15,30,40,60,80,100,120
6	9/1/99	00:55	8/1/99	11:55	00 00.0N	160 00.00E	0,15,30,40,60,80,100,120
7	10/1/99	02:15	9/1/99	13:15	00 00.2N	163 35.70E	0,20,30,40,60,80,100,120
8	11/1/99	01:45	10/1/99	12:45	00 00.45N	168 59.00E	0,20,30,40,60,80,100,120
9	12/1/99	23:50	12/1/99	11:50	00 00.40N	174 54.60E	0,20,30,40,60,80,100,120
10	14/1/99	00:50	13/1/99	12:50	00 00.40S	178 47.00E	0,20,30,40,60,80,100,120
11	14/1/99	00:55	13/1/99	12:55	00 00.10S	176 17.70W	0,20,30,40,60,80,100,120
12	16/1/99	01:25	15/1/99	12:25	00 03.30S	170 11.22W	0,20,30,40,60,80,100,120

Table 2. Summary of percent light transparencies for simulated *in-situ* (SIS) and uptake kinetics (UK) incubators measured under ambient photosynthetic active radiation (PAR 400-700 nm) with Li-Cor 1400 light meter.

Tube I.D.	Light transparency (% of ambient)	Depth (m) of seawater sample
SIS-1	99	0
SIS-2	55	20
SIS-3	28	40
SIS-4	17	60
SIS-5	15	80
SIS-6	3	100
SIS-7	1	120
UK-1	79	30

Data Processing To Date

A total of 283 samples were collected for measurement of uptake rates of ^{15}N and ^{13}C for determination of new and total primary production. A total of 98 samples were collected for measurement of nitrate uptake kinetics. We were unable to process samples for mass spectrometric analysis due to difficulties with the Europa Mass Spectrometer aboard the R/V Mirai. We anticipate completion of mass spectrometric analyses of all samples at the Bedford Institute of Oceanography by the end of March 1999. The uptake rate of nitrate into phytoplankton will be calculated using equation 1;

$$\rho_N = \frac{\Delta APE\ PON\ (^{14}N + {^{15}N})}{100\ {^{15}N}\ \Delta t} \qquad \text{mg N m}^{-3}\ \text{h}^{-1} \qquad (1)$$

where ΔAPE = atom percent enrichment of ^{15}N in sample

PON = particulate organic nitrogen (mg N m^{-3})

^{15}N = µM concentration of labeled nitrate added to the sample bottle

^{14}N = µM concentration of ambient nitrate

Δt = time of incubation in hours

The uptake rate of carbon into phytoplankton will be calculated using equation 2;

$$\rho_{TC} = \frac{POC\ (AP^{13}C_{inc} - AP^{13}C_n)}{\Delta t\ (AP^{13}C_{tic} - AP^{13}C_n)\ f} \qquad \text{mg C m}^{-3}\ \text{h}^{-1} \qquad (2)$$

where POC = particulate organic carbon (mg C m^{-3})

$AP^{13}C_{inc}$ = atom percent enrichment of 13C in sample

$AP^{13}C_n$ = atom percent of 13C in natural sample ($AP^{13}C_n = 1.1$)

$AP^{13}C_{tic}$ = atom percent of total inorganic carbon

Δt = incubation time in h

f = discrimination factor of ^{13}C ($f = 1.025$)

3.24 Satellite observation

Ichio Asanuma, JAMSTEC
Takeshi Kawano, JAMSTEC
Takanori Akiyoshi, Nippon Hakuyo Electronics

Objectives

It is our objectives to monitor the ocean color and the sea surface temperature, to build the data set of those parameters, and to build the practical algorithm to estimate the primary production.

Methods

a) Ocean Color

We receive the down link HRPT signal from the OrbView-2 polar orbit satellite by the HRPT receiving station on the R/V Mirai. Our receiving station is the TeraScan receiving system, which has the 1.2 m antenna in the redome, the down converter, the bit synchronizer, the frame synchronizer, and the workstation to control antenna and to process received data.

We generated the level-0 data from the pass disk of the receiving system with the function 'swlevel-0', which is a products of SeaSpace. Then we generated the level-1a data by the function 'runl1a', which is a software of NASA. Then we processed data into the geophysical values including chlorophyll-a by the function in the SeaDAS.

b). Sea Surface Temperature

We receive the down link HRPT signal from the NOAA polar orbit satellite by the same way as the signal of the OrbView-2. We processed the HRPT signal with the inflight calibration and computed the sea surface temperature by the multi-channel sea surface temperature method. We projected the data on the map, which covers 20S to 20N and 150E to 130W. In the daily steps, we overlayed data of 6 to 8 passes to generate a daily composite. Finally, we generated two images of the weekly composite for this cruise.

Data

Data will be analyzed after the cruise.

3.25 Geophysical Observation

Akinori Uchiyama and Naoto Morioka (G.O.D.I.)

The observations were carried out only in the EEZ of Japan and the public sea.

(1) Sea Beam Observation

Objectives

-To obtain the continuous swath water depth for contribution of geophysical investigation and

- To obtain bathymetric data for deep water sampling.

To perform the above 2 items, the Sea Beam observation is carried out routinely along the ship tracks through the cruise of Hachinohe to Palau and Honolulu to Hachinohe. In addition to the swath survey along the tracks , the determination of water depth is performed on the mooring sites.

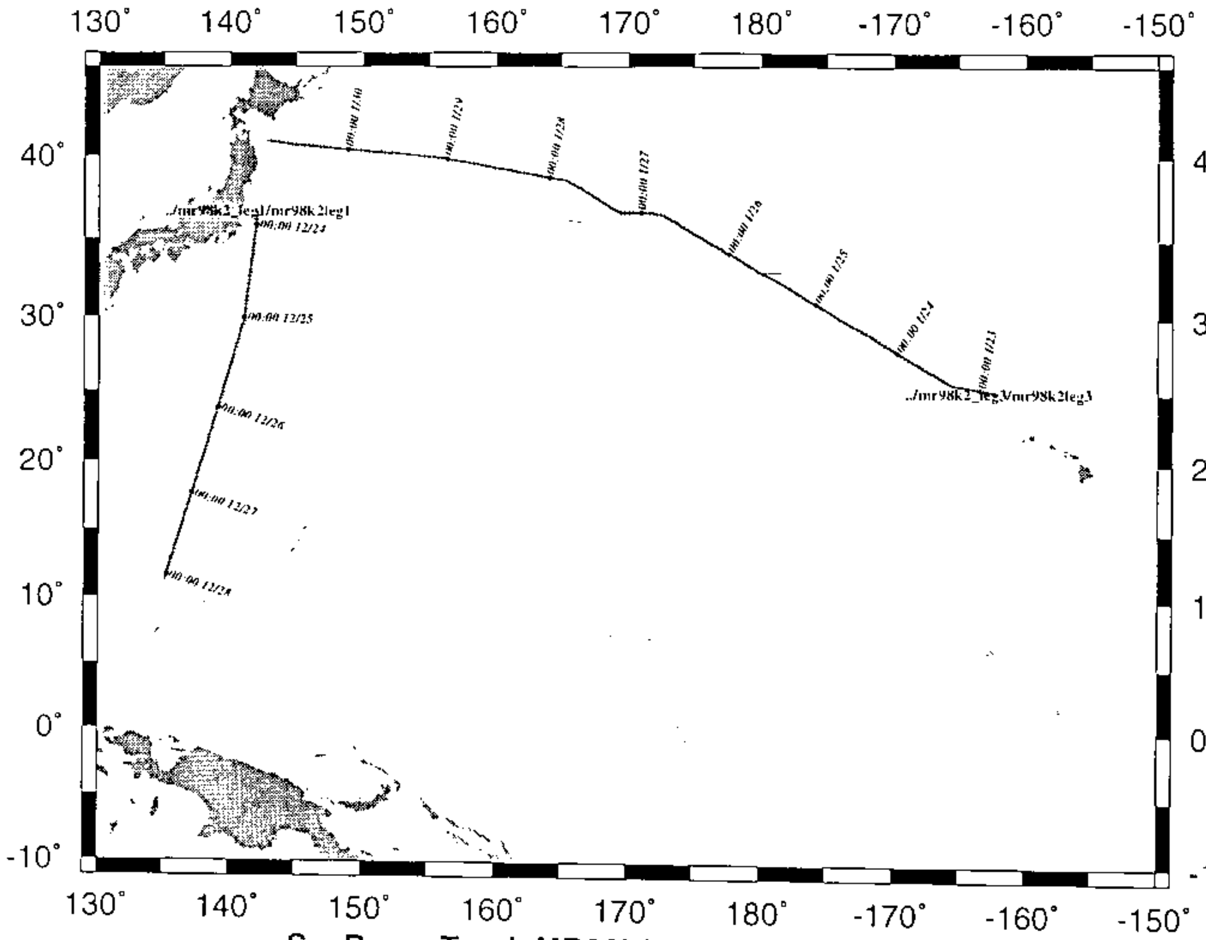
Instruments

A 12kHz Seabeam 2112 MultiNarrow Beam Bathymetric Survey System manufactured by the Sea Beam Instruments, Inc., USA is used for measuring water depth.

Summary

We carried out bathymetric survey during MR98-K02 cruise. Sound velocity profiles to be used ray path correction of acoustic multibeam were provided from data of CTD casts along the ship tracks and short XBT data.

The whole ship tracks of Sea Beam observation are shown in Figure.



SeaBeam Track MR98k02

GMT Feb 2 15:43

Mercator Projection

on board report

(2) Sea Surface Gravity Measurement

Objective

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

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

Instruments

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

Summary

We carried out gravity measurement during MR98-K02 cruise(from Hachinohe to Palau and Hawaii to Hachinohe). Detailed data analysis based on the measurements will be done on the shore base.

Remarks

The gravitymeter at the port showed the small fructuation even if the sea condition was calm . The cause of this phenomenon dose not be clarified to day. The next cruise should be ckecked the cause of this and adjusted to the best condition of the system

(3) Surface Three Component Magnetometer

Objective

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

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

Instruments

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

Summary

We get three component magnetic data during MR98-K02 cruise(from Hachinohe to Palau and Hawaii to Hachinohe). The database containing high ratio of ship attitude is a very useful not only for geomagnetic investigation but for precise ship movement analysis.

Remarks

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

4. Acknowledgement

We thank Dr. Akamine, the commanding officer of MIRAI, and his crew for their skillful and diligent work. We also thank Mr. AIWARA for his supervision on the observation in EEZ of Kiribati.