

# Oceanographic Data of the 40th Japanese Antarctic Research Expedition from November 1998 to March 1999

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The results of oceanographic observations on board the icebreaker "Shirase" and tidal observations at Syowa Station, Antarctica are presented in this report. The oceanographic observations were carried out by the summer party of the 40th Japanese Antarctic Research Expedition (JARE-40) during the austral summer of 1998/1999. The tidal observations were carried out by the winter party of JARE-39 from February 1998 to January 1999.

## **1. Oceanographic observations**

The track of the icebreaker "Shirase" and the sites of oceanographic stations are shown in Fig. 1. Surface water was sampled during the cruise using a plastic bucket of 10 liter capacity. XBT (expendable bathythermograph), XCTD (expendable CTD) and serial observations were taken in the Southern Ocean. Three surface drifting buoys were deployed and four XCP (expendable current profiler) observations were taken in the Antarctic Circumpolar Current.

### **(1) Surface water sampling**

Surface water was sampled one or two times a day at 42 stations for chemical analysis. The results are given in Table 1.

### **(2) Monitoring of marine pollution**

Surface water was sampled at 11 stations in the Southern Ocean for monitoring of marine pollution. Items and methods of analyses are given in the following section of (6).

### **(3) XBT observations**

XBT observations were carried out at 47 stations in the Southern Ocean from Fremantle to Antarctica and back to Sydney. The results are listed in Table 2.

### **(4) XCTD observations**

XCTD observations were carried out at 65 stations along the same route as XBT observations. The results are listed in Table 3. Salinity is not calibrated.

Vertical sections of water temperature with XBT and XCTD observations are shown in Figs. 2 and 3.

#### (5) Serial observations

Serial observations with Rosette sampler, equipped with twenty-three Niskin bottles of 2.5 liter capacity, and CTD (Conductivity, Temperature and Depth profiling system: Falmouth Scientific FSI TRITON ICTD) were carried out at 11 stations. The results of the observations and meteorological data are given in Table 4.

#### (6) Chemical analysis of sampled water

Chemical analysis of seawater collected with the bucket or the Niskin bottle was done by the following methods. Item (a) was calculated from conductivity using the 1978 practical salinity scale (UNESCO, 1981). Item (b), (d) and (h) were carried out with the method described by Strickland and Parsons (1972). Item (c) was analyzed by the Winkler method as modified by Carpenter (1965) for more precision. Item (e) was analysed with the method in Motomizu and Korechika (1988). Item (f) and (g) were analyzed with the method in Bergamin et al. (1978), Andersson (1979) and Gine et al. (1980). Item (i), (j) and (k) were analyzed with the method in Hydrographic Department (1995).

- (a) Practical salinity: Conductive salinometer (Guildline Autosol salinometer model 8400B).
- (b) pH: Glass electrode method (Horiba digital pH meter F-16).
- (c) Dissolved oxygen: Carpenter method (Hirama model ART-3 DO-1).
- (d) Phosphate-P: Molybdenum blue method (BRAN+LUEBBE model Traacs 800 auto analyzer).
- (e) Silicate-Si: Molybdenum yellow method (BRAN+LUEBBE model Traacs 800 auto analyzer).
- (f) Nitrite-N: Naphthylethylenediamine method (BRAN+LUEBBE model Traacs 800 auto analyzer).
- (g) Nitrate-N: Cadmium (Cd) - copper (Cu) reduction column, Naphthylethylenediamine method (BRAN+LUEBBE model Traacs 800 auto analyzer).
- (h) Ammonium-N: Indophenol blue method (Shimadzu model UV-1600 spectrophotometer).
- (i) Petroleum oil: n-hexane extraction - fluorophotometric analysis.
- (j) Cadmium (Cd): Solvent extraction - atomic absorption spectrophotometry.
- (k) Mercury (Hg): Cold vapor atomic absorption spectrophotometry.

The results of analytical items (a) to (h) are given in Tables 1 and 4. The results of monitoring of marine pollution items (i) to (k) are given in Table 5.

#### (7) Current observation with surface drifting buoys

Each surface drifting buoy is a spherical buoy of 35 cm diameter, from which hangs a drogue of 1 m diameter, 8 m length (C-2340, TOYOCOM Co.). Buoy data from each

drift buoy were transmitted to the data processing center through the NOAA satellite, and the Argos system offered buoy position and surface water temperature to each user.

The first surface drifting buoy was deployed at 59°59' S, 104°06' E on December 9, 1998. It was operated until January 20, 1999. The second was deployed at 60°47' S, 150°01' E on March 13, 1999. It was operated until March 21, 1999. The third was deployed at 57°34' S, 150°47' E on March 15, 1999. It was operated until September 22, 1999. The trajectories are shown in Fig. 4.

#### (8) Vertical current observations with XCP

XCP (Sippican Inc. U.S.A.) observations were carried out at the following 4 stations.

December 5, 1998	11:24 (UT)	43° 32' S, 110° 00' E (St. 1)
December 7, 1998	07:35 (UT)	52° 53' S, 110° 06' E (St. 3)
December 9, 1998	02:27 (UT)	59° 59' S, 103° 56' E (St. 5)
March 13, 1999	05:41 (UT)	60° 48' S, 149° 59' E

The results are given in Fig. 5. The XCP data for March 15, 1999 (St. 7) are not shown in this report because they are not available.

#### (9) Ocean current observations

We entrusted ocean current observations to the JARE-40 biological winter party because the sea ice condition was bad during the austral summer. The observation was carried out for 92 days (from August 11 to November 10) at 69°15.0' S, 39°39.0' E in the coastal fast ice off Langhovde, with an electromagnetic current meter (ACM8M, ALEC ELECTRONICS Co.), 15 m below the sea surface. The results are given in Fig.6.

## 2. Tidal observations

### (1) Tidal observations at Syowa Station

Tidal observations at Syowa Station have been carried out since 1965. The tide gauge (QWP-8-303D, Meisei Denki Co.) was set on the sea bottom about 15 m below the sea surface at Nisi-no-ura Cove, East Ongul Island by JARE-36 members on February 2, 1995. The results obtained from February 1998 to January 1999 are described in this report. The methodology of tidal observations is described by Odamaki et al. (1991). In this system, the relative water pressure compensated for atmospheric pressure is measured with a quartz oscillator. The range of the sensor is 0-50 m and its precision is 0.01 % to the full scale, *i.e.* 0.005 m. The data sampled 5 times per second are averaged over one minute and record on solid IC memory every 10 min. The gauge was maintained by Miss Y. Tono, a member of the JARE-39 winter party, through the year. Hourly sea level was recorded on the hour. Daily and monthly mean sea levels were calculated from the hourly data. The results are given in Table 6.

## (2) Tidal observations at Tonagh Island

Tidal observations at Tonagh Island were carried out for 24 days (from December 23 to January 15) with a pressure gauge (WLR-7, AANDERAA INSTRUMENTS). The sensor was placed at the sea bottom about 2 m below the sea surface. In this system total pressure is measured with a quartz oscillator. The range of the sensor is 0-60 m and its precision is 0.01% to the full scale, *i.e.* 0.006 m. The pressure averaged over 40 seconds is recorded in an EEPROM memory every 10 min. The data were corrected for atmospheric pressure. Hourly sea level was recorded on the hour. Daily mean sea levels were calculated from the hourly data. The results are given in Fig. 7 and Table 7. The tidal harmonic constants are given in Table 8.

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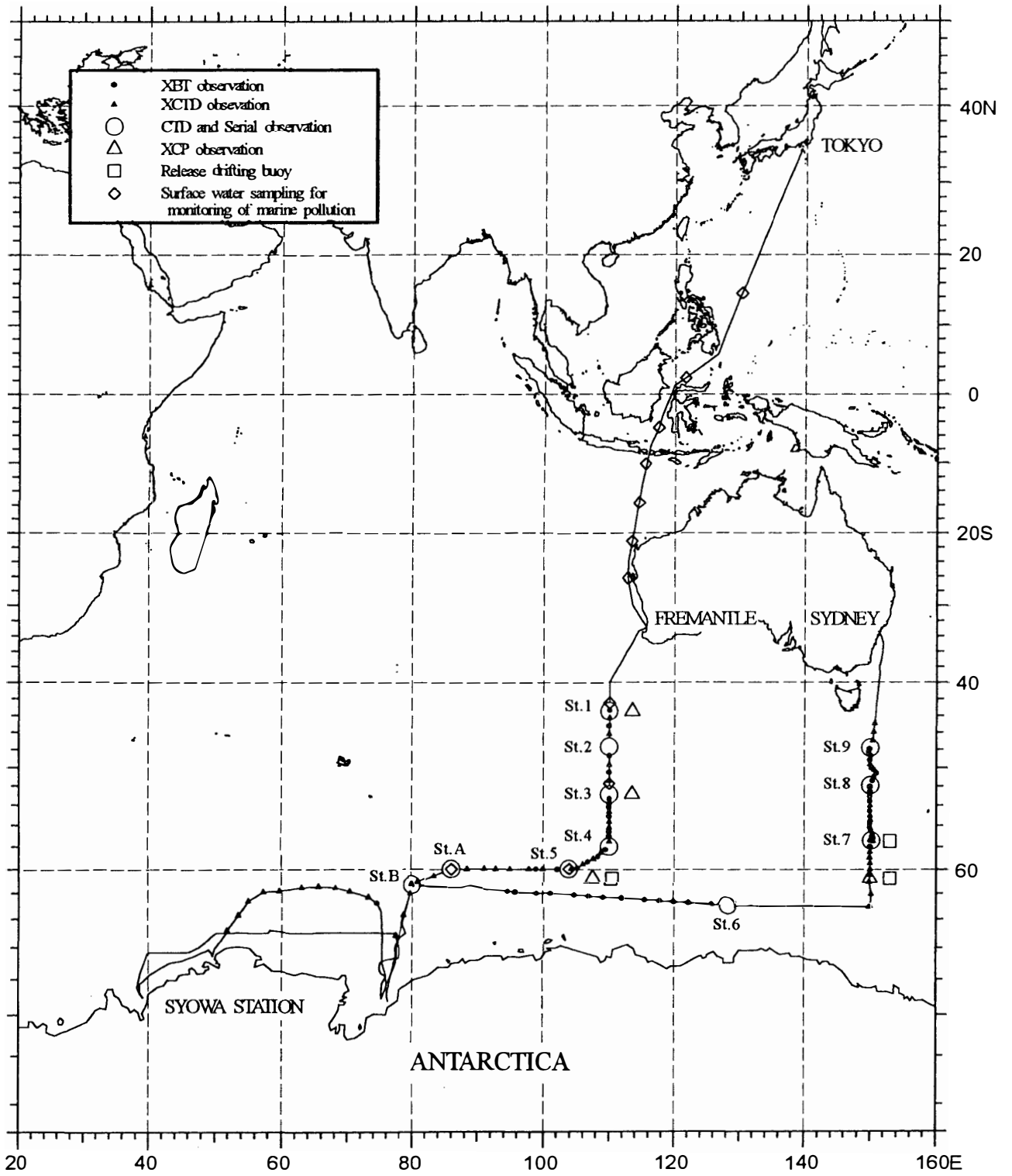


Fig. 1. The track of the icebreaker "Shirase" and the sites of oceanographic stations.

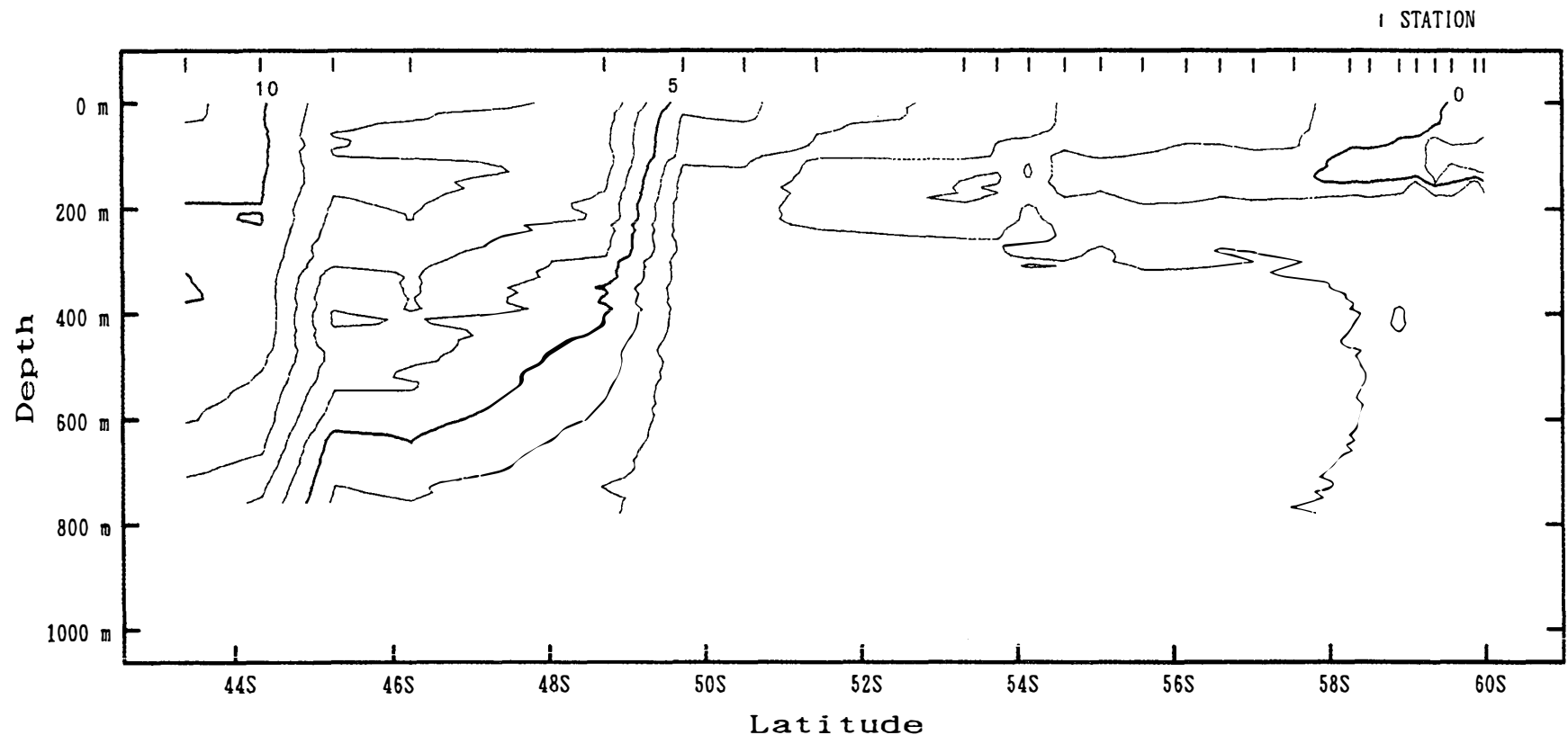


Fig. 2. Vertical profile of water temperature (°C) observed with XBT and XCTD along 110°E. Vertical bars on the top of the profile indicate sites of XBT and XCTD observations.

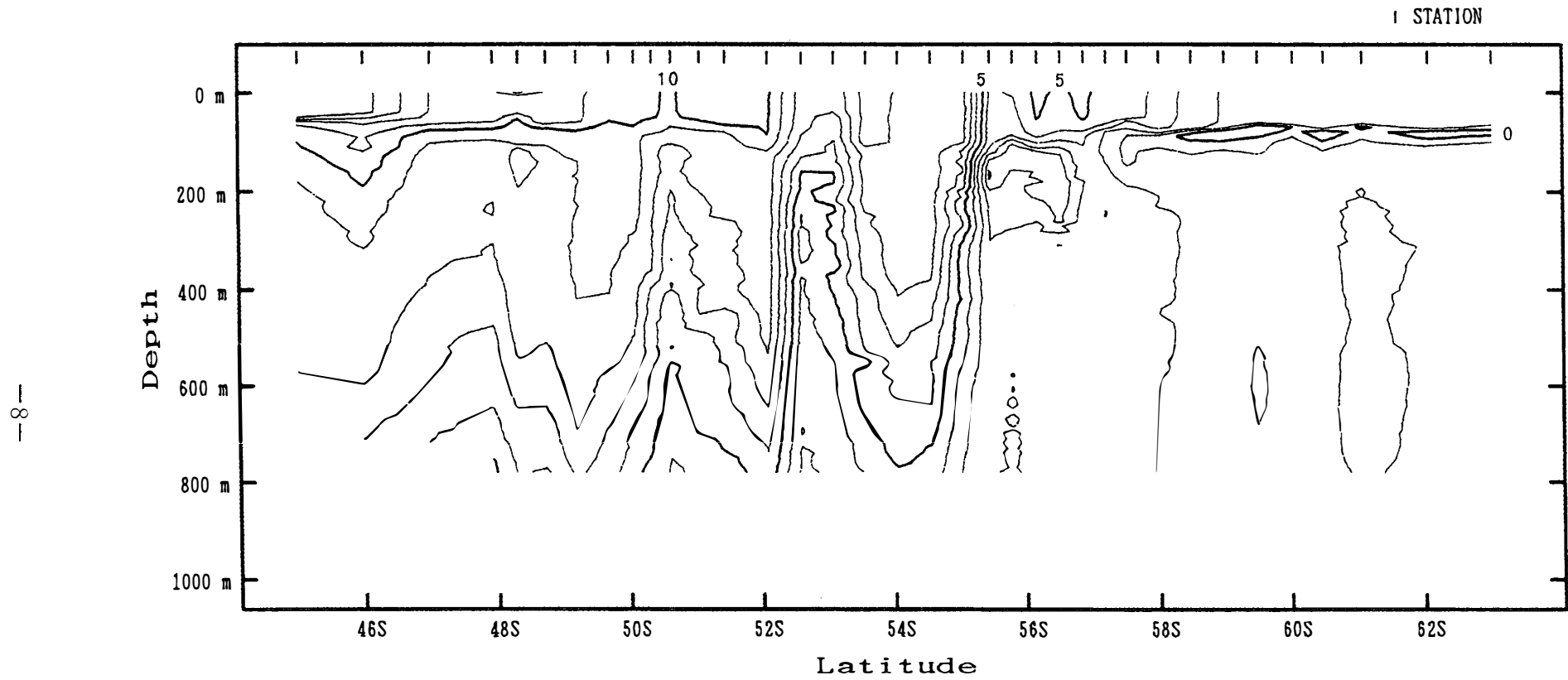


Fig. 3. Vertical profile of water temperature ( $^{\circ}\text{C}$ ) observed with XBT and XCTD along  $150^{\circ}\text{E}$ . Vertical bars on the top of the profile indicate sites of XBT and XCTD observations.



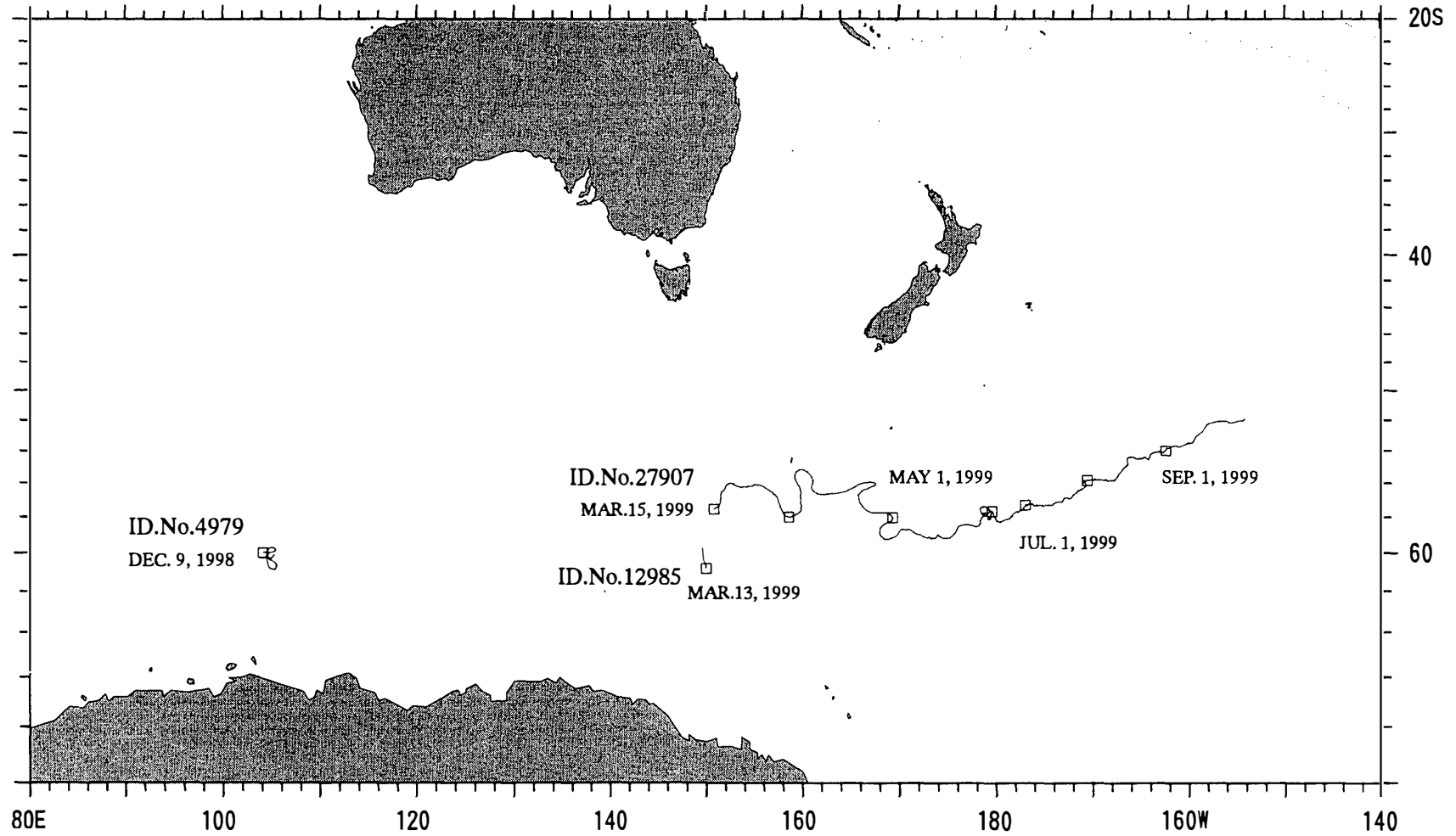


Fig. 4. Trajectory of surface drifting buoy. Squares mark the deployment location and the location on the first day of every month for the each buoys.

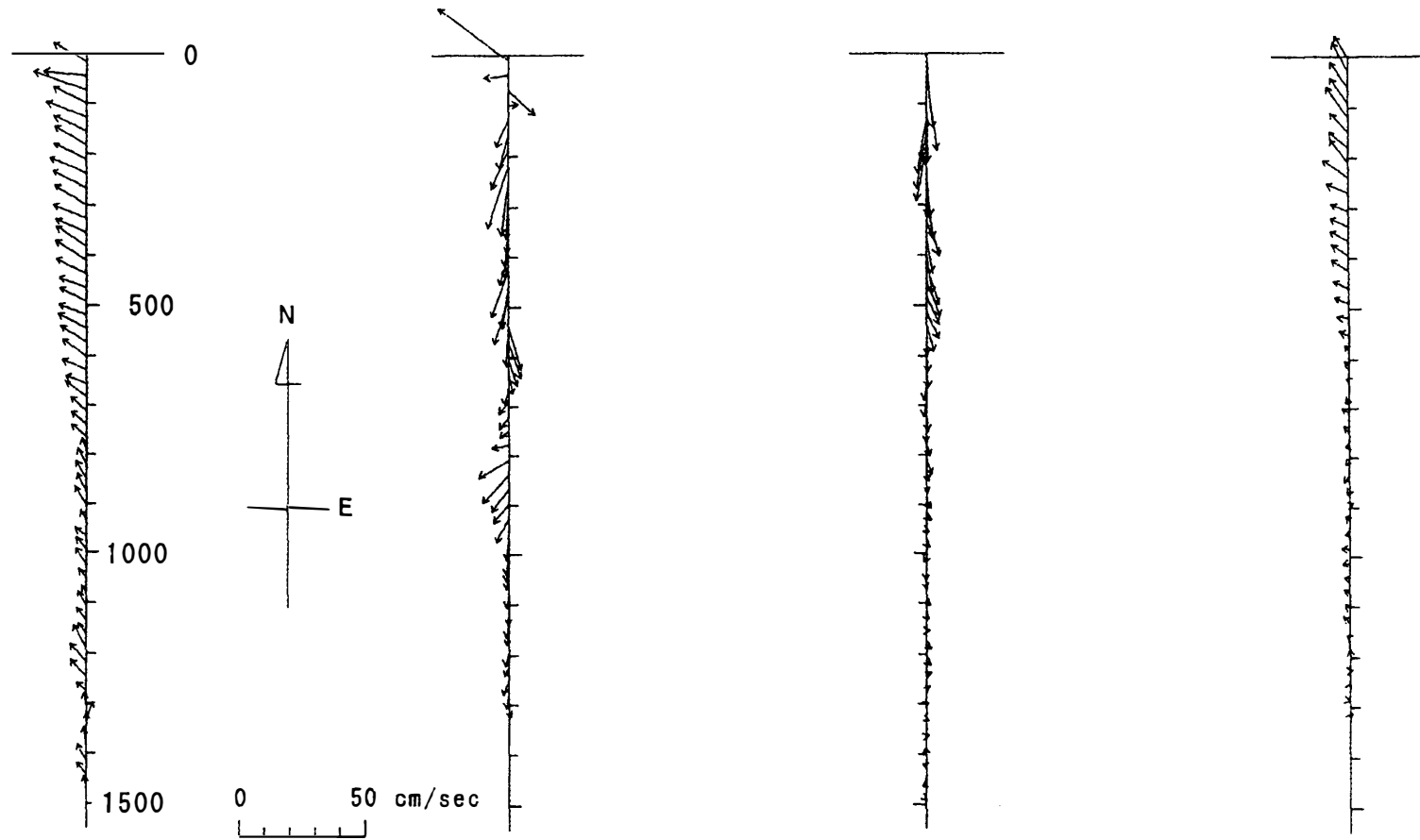


Fig. 5. Vertical profiles of current relative to the deepest layer measured with XCP. Each panel respectively indicates St. 1, St. 3, St. 5 and the southernmost station in order from the left-hand side. Length of arrows indicates current speed and direction of arrows indicates horizontal direction (see legends).

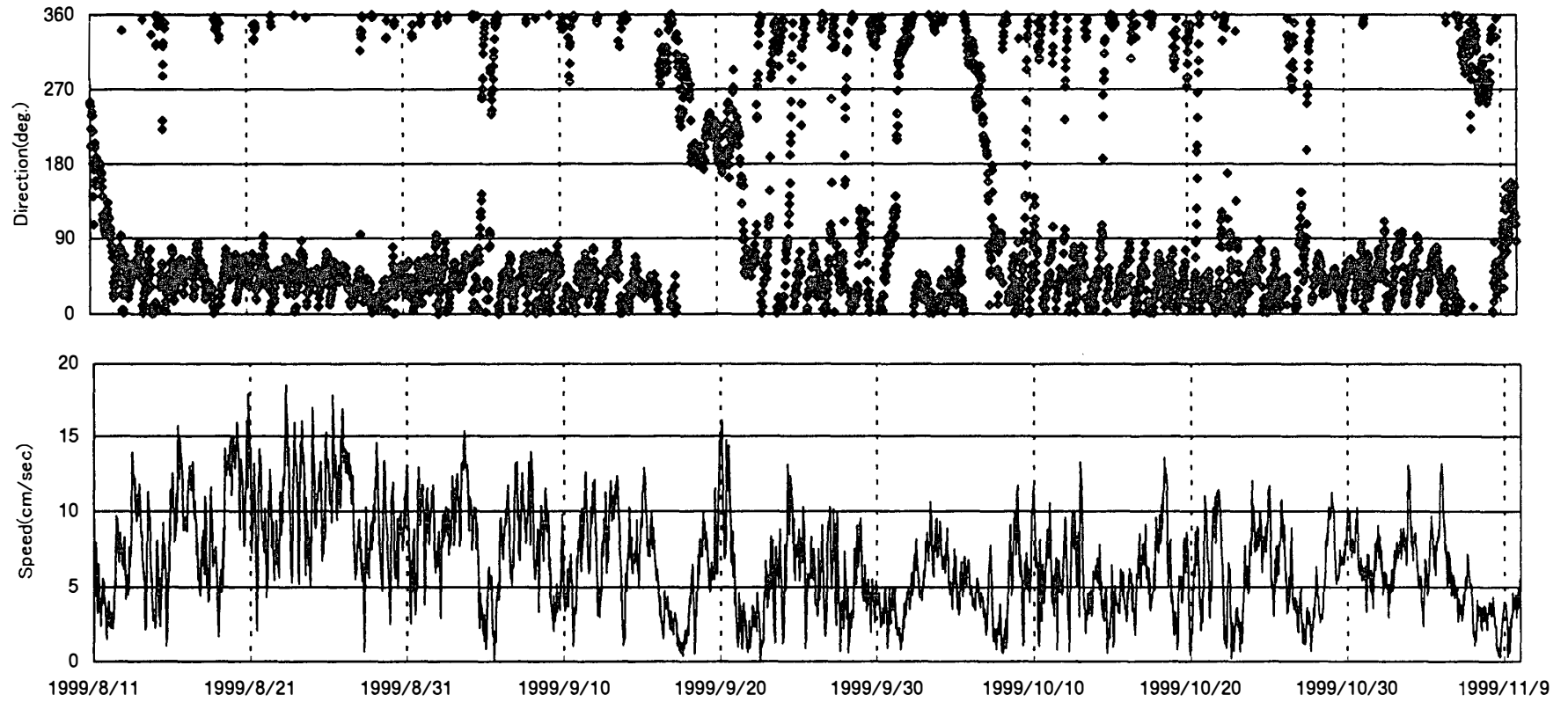


Fig. 6. Current speed and direction under the coastal fast ice off Langhovde (time is LMT (UT+3 hours)).

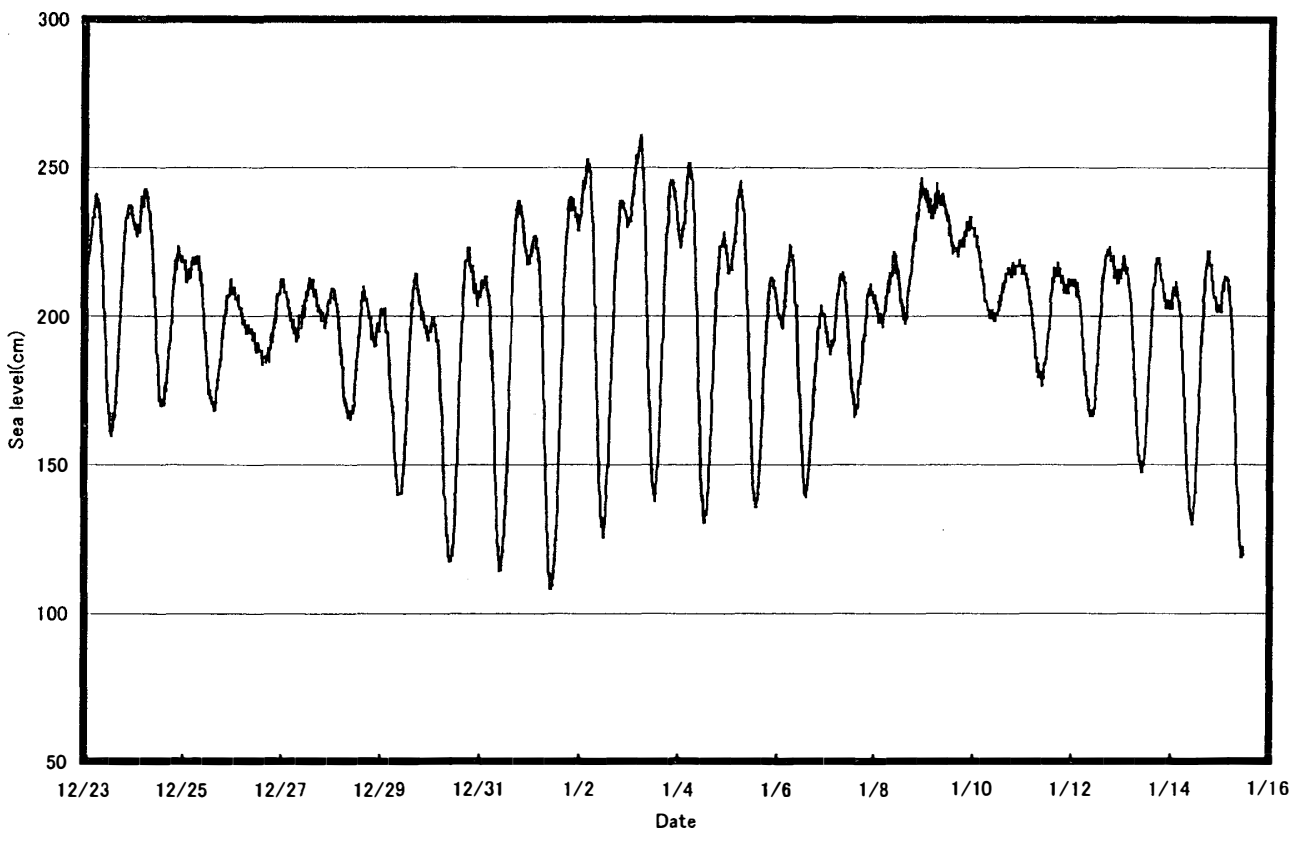
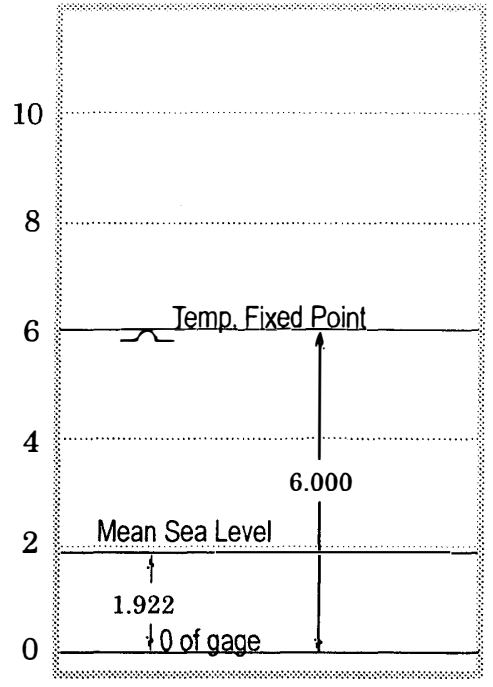
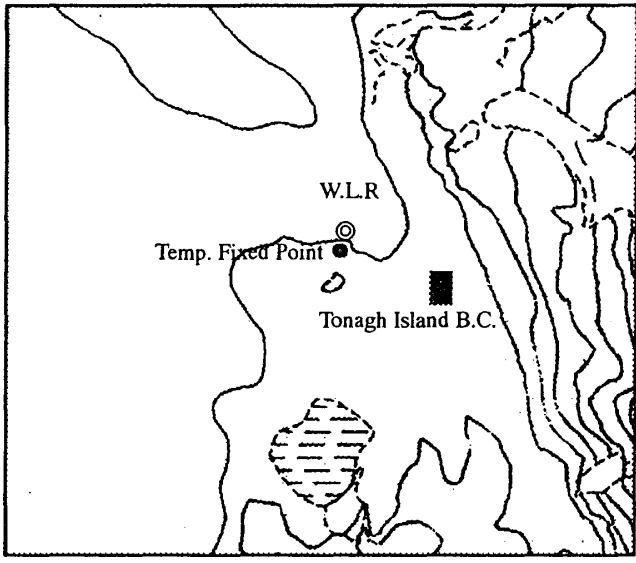


Fig. 7. The location map, relative height and sea level at Tonagh Island in Amundsen Bay.

Table 1. Data of surface water observations on board the icebreaker "Shirase" in 1998-1999.

Date	Time (UT)	Position		Air Temp.	Water Temp.	Salinity	pH	DO2	PO4-	SiO3-	NO2-	NO3-	NH4-
		Lat.	Long.	°C	P				Si	N	N	N	
1998													
Nov. 14													
Left Tokyo													
15	2256	25-35 N	135-08 E	27.5	27.4	34.574	-	207	0.1	1	0.1	0	0.0
16	0650	23-44	134-16	27.7	28.0	34.666	-	205	-	-	-	-	-
16	2256	20-01	132-37	29.5	29.3	34.531	-	211	0.0	0	0.2	0	0.2
17	2256	14-33.5	130-13.8	29.8	29.5	-	-	201	0.1	2	0.0	0	0.5
22	2250	10-08.5	115-27.0	28.5	28.7	33.960	8.21	202	0.1	2	0.0	0	0.6
23	0650	11-54.8 S	115-07.6	27.1	29.2	34.143	8.20	202	0.1	2	0.1	1	0.1
23	2250	15-42.5	114-26.6	27.0	28.7	34.441	8.18	201	0.0	2	0.0	0	-
24	0646	17-36.7	114-05.2	26.8	27.7	34.636	8.17	205	0.1	2	-	0	0.1
24	2250	21-09.9	113-25.5	23.3	25.5	34.844	8.21	214	0.1	2	0.0	0	1.8
25	0645	22-45.6	113-06.7	22.8	24.0	35.163	8.22	219	0.1	4	0.0	0	0.7
25	2246	26-17.3	112-50.0	20.6	22.8	35.240	8.23	223	0.1	3	0.0	0	0.1
26	0646	28-01.2	113-21.2	20.1	21.3	35.463	8.24	226	0.1	3	0.1	0	0.3
28													
Arrived in Fremantle													
Dec. 3													
Left Fremantle													
3	2350	32-52.5	122-50.2	16.7	18.3	35.868	8.24	247	0.1	2	0.0	0	-
4	0455	36-54.2	112-08.6	14.9	15.3	35.289	8.23	270	0.3	1	0.1	2	-
5	0045	41-20.4	110-00.2	13.1	12.3	34.848	8.21	281	0.7	2	0.1	8	0.2
6	0055	46-33.0	109-58.9	10.4	8.9	34.211	8.17	308	0.9	0	0.3	14	-
7	0050	51-43.5	109-59.5	4.0	3.4	33.912	8.15	339	1.6	13	0.2	23	-
8	0045	56-49.8	109-59.0	2.7	1.8	33.935	8.07	352	1.8	22	0.2	27	-
11	0433	61-18.0	80-03.2	0.0	-1.0	33.811	-	-	1.8	48	0.1	28	0.3
18	0245	61-49.5	70-18.1	0.3	-1.2	33.729	8.13	366	1.8	39	0.2	27	0.8
18	1350	61-28.7	65-30.1	-0.3	-0.8	33.639	8.09	370	1.8	36	0.2	27	0.5
19	0350	61-50.3	59-36.2	-0.7	-1.2	33.779	8.11	359	2.0	51	-	28	1.6
Arrived at the ice edge off SYOWA station													
Left the ice edge off SYOWA station													

Date	Time (UT)	Position		Air Temp.	Water Temp.	Salinity	pH	DO2	PO4-	SiO3-	NO2-	NO3-	NH4-
		Lat.	Long.	°C					P	Si	N	N	N
(μ mol/l)													
1999 27	0850	65-00.1	66-12.2	-1.8	0.4	33.733	8.07	348	1.8	47	0.2	27	0.9
Feb. 5	0255	61-28.9	85-03.3	1.7	1.7	33.663	8.07	346	1.6	35	0.2	27	0.5
Mar. 5	0755	61-30.5	87-15.2	2.4	2.0	33.798	8.09	344	1.6	40	0.1	25	0.6
	6 0155	61-48.6	94-45.8	-1.7	1.5	33.923	8.06	343	1.7	43	0.1	27	1.0
	6 0655	61-52.6	95-54.6	-2.2	1.6	33.941	8.06	343	1.7	43	0.1	27	1.3
	7 0055	62-07.4	104-57.1	-2.5	1.3	33.963	8.02	340	2.0	50	0.1	28	1.9
	7 0555	62-13.0	107-10.0	-3.0	1.2	33.931	8.03	342	2.0	52	0.1	30	0.9
	8 0050	62-29.8	115-38.1	-1.0	1.0	33.927	8.02	343	2.1	50	0.3	29	1.3
	8 0552	62-35.0	117-58.7	-0.7	1.3	33.936	8.02	347	2.1	48	0.3	28	1.4
	8 2355	62-50.4	126-01.3	0.4	1.4	33.955	8.06	341	1.7	25	0.2	28	1.1
	9 2250	62-58.4	133-43.3	1.5	2.1	33.835	8.14	336	1.7	10	0.3	28	1.8
	10 0350	62-57.7	135-28.4	2.1	1.9	33.879	8.11	339	1.7	15	0.3	28	0.9
	10 2250	62-59.4	141-58.2	3.7	2.3	33.847	8.09	338	1.9	24	0.3	28	1.6
	11 0350	62-58.8	143-36.6	4.1	2.3	33.889	8.10	339	1.9	30	0.3	29	1.6
	12 2150	61-38.1	150-04.4	2.1	1.9	33.858	8.04	344	1.8	28	0.3	28	0.7
	13 0525	60-47.7	149-58.8	3.4	2.1	33.859	8.05	340	1.8	28	0.3	28	0.7
	13 2145	57-45.2	149-58.4	4.1	2.6	33.865	8.06	340	1.9	25	0.3	29	0.5
	15 0358	56-51.5	150-22.0	5.7	5.4	33.806	8.08	315	1.7	3	0.3	25	0.5
	15 2145	53-04.6	149-58.9	7.3	7.3	33.886	8.10	305	0.9	2	0.2	12	0.5
	16 2145	48-44.1	150-09.3	11.0	11.5	34.316	8.15	282	0.9	1	0.1	10	0.5

Table 2. XBT observation data. "S.L." indicates surface layer depth in meters.

NUMBER	DATE		POSITION		TEMPERATURE ( °C)															S. L. (M)	AIR TEMP. ( °C)
	UT	TIME	LAT.	LONG.	0	10	20	30	50	75	100	125	150	200	250	300	350	400	450		
					500	550	600	650	700	750	800	850	900	950	1000	1100	1200	1300	1400		
					1500	1600	1700	1800													
SP98001	98-12-05	11.8	43-24S	110-01E	11.4	11.4	11.4	11.3	10.8	10.6	10.6	10.5	10.1	10.0	9.9	10.0	10.1	9.9	9.9	30	12.0
					9.6	9.4	9.1	8.6	8.2	7.6	-	-	-	-	-	-	-	-	-	-	-
SP98002	98-12-05	19.7	45-16S	110-00E	8.3	8.3	8.3	8.2	8.1	8.3	8.0	8.2	8.3	7.8	7.5	7.0	6.2	5.8	6.2	0	10.2
					6.5	6.0	5.4	4.5	4.1	3.9	-	-	-	-	-	-	-	-	-	-	-
SP98003	98-12-06	11.7	48-43S	110-01E	7.7	7.7	7.4	7.5	7.3	7.3	7.5	7.4	7.2	6.8	6.4	5.5	4.9	5.0	4.7	0	8.7
					4.4	4.1	3.9	3.5	3.3	3.2	-	-	-	-	-	-	-	-	-	-	-
SP98004	98-12-06	19.7	50-31S	109-59E	4.2	4.2	4.2	4.1	3.9	3.9	3.2	3.0	2.7	2.4	2.5	2.6	2.6	2.6	2.5	96	5.9
					2.5	2.5	2.4	2.5	2.4	2.4	-	-	-	-	-	-	-	-	-	-	-
SP98005	98-12-07	09.9	53-21S	110-00E	2.8	2.8	2.8	2.8	2.8	2.4	2.3	1.3	1.0	1.2	1.9	2.1	2.0	2.1	2.3	0	3.5
					2.4	2.3	2.4	2.3	2.4	2.3	-	-	-	-	-	-	-	-	-	-	-
SP98006	98-12-07	13.7	54-09S	109-58E	2.9	2.9	2.9	2.9	2.6	1.9	1.6	2.1	1.7	2.2	2.4	2.1	2.1	2.2	2.2	40	3.0
					2.2	2.2	2.3	2.3	2.3	2.2	-	-	-	-	-	-	-	-	-	-	-
SP98007	98-12-07	17.8	55-05S	109-58E	1.8	1.8	1.8	1.8	1.8	1.6	1.3	0.4	0.8	1.7	2.0	2.0	2.2	2.2	2.2	0	2.3
					2.1	2.1	2.1	2.1	2.1	2.0	-	-	-	-	-	-	-	-	-	-	-
SP98008	98-12-07	23.9	56-37S	109-59E	1.7	1.6	1.6	1.6	1.6	1.0	0.2	0.1	0.1	1.5	1.9	2.0	2.1	2.1	2.2	0	2.8
					2.1	2.1	2.1	2.1	2.1	2.0	-	-	-	-	-	-	-	-	-	-	-
SP98009	98-12-08	01.7	57-03S	109-58E	1.8	1.8	1.8	1.8	1.8	1.8	0.8	0.5	0.3	1.3	1.8	2.0	2.1	2.1	2.1	0	2.7
					2.2	2.2	2.2	2.1	2.1	2.1	-	-	-	-	-	-	-	-	-	-	-
SP98010	98-12-08	09.8	58-16S	109-25E	0.6	0.6	0.6	0.6	0.5	0.1	-0.3	-0.2	-0.1	1.7	1.9	1.9	1.9	2.0	2.0	0	1.7
					2.1	2.0	2.0	2.0	2.0	1.9	-	-	-	-	-	-	-	-	-	-	-
SP98011	98-12-08	13.8	58-55S	108-18E	0.1	0.1	0.1	0.1	0.2	-0.1	-0.7	-0.7	0.5	1.7	1.9	2.0	2.0	2.0	2.0	0	0.8
					2.0	1.9	1.9	1.9	1.9	1.8	-	-	-	-	-	-	-	-	-	-	-
SP98012	98-12-08	17.8	59-22S	106-45E	0.0	0.0	0.0	0.0	-0.1	-1.5	-1.6	-1.3	-1.0	1.7	1.9	1.9	1.9	1.9	1.8	0	0.4
					1.9	1.9	1.8	1.8	1.8	1.7	-	-	-	-	-	-	-	-	-	-	-
SP98013	98-12-08	21.7	59-53S	105-12E	-0.3	-0.3	-0.3	-0.3	-0.3	-1.1	-1.5	-1.2	1.4	1.7	1.9	1.8	1.9	1.9	1.9	0	0.0
					1.9	1.9	1.9	1.8	1.8	1.8	-	-	-	-	-	-	-	-	-	-	-
SP98014	98-12-09	05.9	60-00S	102-07E	-0.1	-0.1	-0.2	-0.3	-0.5	-0.9	-0.2	0.9	1.4	1.9	2.0	2.0	2.0	2.0	2.0	0	0.7
					1.9	1.9	1.9	1.8	1.7	1.8	-	-	-	-	-	-	-	-	-	-	-
SP98015	98-12-09	11.8	59-59S	98-51E	-0.1	-0.1	-0.1	-0.2	-0.6	-1.3	-1.2	-0.2	0.6	1.2	1.4	1.4	1.6	1.7	1.6	0	0.1
					1.6	1.6	1.5	1.5	1.5	1.5	-	-	-	-	-	-	-	-	-	-	-
SP98016	98-12-17	13.8	62-46S	74-32E	-0.6	-0.9	-1.1	-1.3	-1.6	-0.3	1.3	1.6	1.7	1.9	1.9	2.0	2.0	1.9	1.9	57	0.7
					1.9	1.9	1.8	1.8	1.8	1.7	-	-	-	-	-	-	-	-	-	-	-

NUMBER	DATE TIME		POSITION		TEMPERATURE ( °C)															S. L. (M)	AIR TEMP. ( °C)
					DEPTH (M)																
			LAT.	LONG.	0	10	20	30	50	75	100	125	150	200	250	300	350	400	450		
					500	550	600	650	700	750	800	850	900	950	1000	1100	1200	1300	1400		
					1500	1600	1700	1800													
SP98017	99-03-06	01.7	61-48S	94-45E	1.6	1.6	1.5	1.6	0.7	-0.7	-0.6	0.2	0.6	0.9	1.3	1.4	1.5	1.5	1.5	47	1.7
					1.5	1.5	1.4	1.4	1.3	1.4	-	-	-	-	-	-	-	-	-		
SP98018	99-03-06	06.7	61-52S	95-54E	1.3	1.3	1.3	1.3	1.3	-0.5	-0.7	-0.2	0.5	1.2	1.3	1.4	1.4	1.4	1.4	52	2.2
					1.3	1.3	1.2	1.2	1.2	1.2	-	-	-	-	-	-	-	-	-		
SP98019	99-03-06	11.8	61-58S	99-08E	1.4	1.4	1.4	1.5	1.0	-0.5	-0.7	-0.3	0.4	1.0	1.2	1.4	1.4	1.4	1.4	46	3.5
					1.4	1.3	1.3	1.3	1.2	1.2	-	-	-	-	-	-	-	-	-		
SP98020	99-03-06	16.7	61-58S	101-16E	1.5	1.5	1.5	1.5	1.5	-0.3	-0.4	0.1	0.9	1.6	1.6	1.7	1.7	1.6	1.8	61	3.2
					1.8	1.7	1.7	1.7	1.6	1.6	-	-	-	-	-	-	-	-	-		
SP98021	99-03-07	00.7	62-07S	104-54E	1.2	1.2	1.2	1.3	1.4	-0.5	-0.6	-0.2	0.2	0.8	1.2	1.3	1.4	1.4	1.4	57	2.5
					1.3	1.3	1.3	1.3	1.2	1.2	-	-	-	-	-	-	-	-	-		
SP98022	99-03-07	05.8	62-13S	107-06E	1.1	1.0	1.1	1.1	1.0	0.7	-0.1	0.6	0.9	1.3	1.5	1.6	1.6	1.7	1.6	67	3.0
					1.6	1.5	1.5	1.5	1.5	1.4	-	-	-	-	-	-	-	-	-		
SP98023	99-03-07	10.8	62-17S	109-19E	0.9	0.9	0.9	1.1	1.3	-0.4	-0.4	0.3	0.5	1.2	1.3	1.4	1.3	1.5	1.5	30	2.8
					1.5	1.5	1.4	1.4	1.3	1.3	-	-	-	-	-	-	-	-	-		
SP98024	99-03-07	17.1	62-21S	112-08E	1.1	1.1	1.1	1.1	1.1	0.2	-0.4	0.1	0.9	1.5	1.6	1.6	1.7	1.7	1.7	65	2.3
					1.6	35.6	35.6	35.6	-2.2	-2.2	-	-	-	-	-	-	-	-	-		
SP98025	99-03-08	00.7	62-29S	115-38E	1.0	1.0	1.0	1.0	1.0	-0.5	0.5	1.1	1.4	1.6	1.7	1.7	1.7	1.7	1.7	60	1.0
					1.6	35.6	35.6	35.6	-2.2	-2.2	-	-	-	-	-	-	-	-	-		
SP98026	99-03-08	05.7	62-34S	117-55E	1.2	1.2	1.3	1.2	1.2	-0.2	-0.5	0.8	1.4	1.7	1.7	1.7	1.7	1.7	1.7	67	0.7
					1.7	1.6	1.6	1.6	1.6	1.5	-	-	-	-	-	-	-	-	-		
SP98027	99-03-08	10.8	62-38S	120-06E	0.9	0.9	0.9	0.9	1.0	-0.8	-0.2	1.0	1.5	1.7	1.7	1.7	1.7	1.7	1.7	66	0.6
					1.7	1.6	1.6	1.6	1.5	1.5	-	-	-	-	-	-	-	-	-		
SP98028	99-03-08	15.8	62-43S	122-23E	0.9	1.0	0.9	0.9	0.5	-0.3	0.7	1.3	1.3	1.5	1.8	1.7	1.9	1.8	1.9	42	1.2
					1.8	1.9	2.3	1.9	1.7	1.6	-	-	-	-	-	-	-	-	-		
SP98029	99-03-08	23.8	62-50S	125-58E	1.4	1.4	1.4	1.3	1.3	-0.9	0.2	1.2	1.7	1.9	1.9	1.9	1.9	1.9	1.9	65	0.5
					1.8	1.8	1.8	1.8	1.7	1.7	-	-	-	-	-	-	-	-	-		
SP98030	99-03-13	20.5	58-00S	150-02E	3.6	3.6	3.6	3.6	3.6	3.0	0.0	1.5	1.8	2.0	2.1	2.2	2.1	2.1	2.0	55	4.1
					2.2	2.1	2.0	2.0	1.9	1.9	-	-	-	-	-	-	-	-	-		
SP98031	99-03-15	01.8	57-12S	150-27E	4.6	4.5	4.5	4.5	4.5	2.4	1.7	1.9	2.1	2.4	3.0	2.6	2.6	2.4	2.4	62	5.5
					2.3	2.4	2.3	2.3	2.4	2.3	-	-	-	-	-	-	-	-	-		
SP98032	99-03-15	05.7	56-31S	150-08E	4.8	4.8	4.8	4.7	4.5	4.1	2.8	1.1	0.6	0.3	0.8	2.2	2.1	2.2	2.2	36	5.7
					2.2	2.2	2.1	2.1	2.2	2.2	-	-	-	-	-	-	-	-	-		
SP98033	99-03-15	07.8	56-10S	149-59E	5.2	5.2	5.2	5.1	5.1	4.7	3.2	0.8	0.4	0.3	1.9	2.2	2.2	2.2	2.3	98	4.8
					2.3	2.3	2.3	2.3	2.2	2.2	-	-	-	-	-	-	-	-	-		



NUMBER	DATE TIME		POSITION		TEMPERATURE ( °C)															S. L. (M)	AIR TEMP. ( °C)		
					DEPTH (M)																		
					0	10	20	30	50	75	100	125	150	200	250	300	350	400	450				
500	550	600	650	700	750	800	850	900	950	1000	1100	1200	1300	1400									
					1500	1600	1700	1800															
SP98034	99-03-15	09.8	55-48S	149-59E	4.0	4.0	3.9	3.9	3.6	3.4	1.4	0.3	0.7	1.8	2.0	2.1	2.1	2.1	2.1	90	4.2		
					2.1	2.1	2.0	2.0	1.9	1.9	-	-	-	-	-	-	-	-	-	-	-	-	
SP98035	99-03-15	15.8	54-32S	149-59E	8.6	8.6	8.6	8.6	8.6	8.7	8.8	8.6	8.5	8.5	8.5	8.5	8.3	7.7	7.2	0	7.7		
					6.5	6.0	6.1	5.9	5.3	4.8	-	-	-	-	-	-	-	-	-	-	-	-	
SP98036	99-03-15	19.7	53-33S	149-59E	9.3	9.3	9.3	9.3	9.3	9.5	9.5	8.4	8.5	8.3	7.8	7.5	7.5	6.6	6.5	55	7.1		
					6.3	4.8	5.6	5.3	4.8	4.4	-	-	-	-	-	-	-	-	-	-	-	-	
SP98037	99-03-15	21.7	53-04S	149-58E	7.2	7.2	7.2	7.2	6.4	6.1	6.0	5.6	5.2	5.4	5.3	5.1	4.4	5.1	4.7	39	7.3		
					4.3	4.0	3.8	3.7	3.6	3.4	-	-	-	-	-	-	-	-	-	-	-	-	
SP98038	99-03-15	23.8	52-35S	150-00E	7.6	7.6	7.6	7.6	7.5	7.4	6.8	6.3	5.5	4.8	4.0	3.7	4.1	3.9	3.8	0	6.7		
					3.6	3.4	3.1	3.1	3.0	2.9	-	-	-	-	-	-	-	-	-	-	-	-	
SP98039	99-03-16	01.8	52-04S	150-02E	10.1	10.2	10.1	10.1	10.1	10.1	9.8	8.9	8.6	8.6	8.6	8.6	8.5	8.5	8.5	0	7.7		
					8.3	8.0	7.5	7.0	6.4	5.9	-	-	-	-	-	-	-	-	-	-	-	-	
SP98040	99-03-16	07.8	51-25S	150-21E	10.8	10.8	10.8	10.8	10.8	9.3	8.5	8.4	8.5	8.6	8.3	7.8	7.8	7.8	6.4	59	8.2		
					6.6	6.3	5.8	5.7	5.2	4.7	-	-	-	-	-	-	-	-	-	-	-	-	
SP98041	99-03-16	09.8	51-03S	150-38E	10.9	10.9	10.9	10.9	10.5	9.1	8.4	8.3	8.7	8.0	7.8	7.3	7.3	7.1	7.1	47	8.2		
					5.3	5.4	5.9	5.4	5.1	4.4	-	-	-	-	-	-	-	-	-	-	-	-	
SP98042	99-03-16	11.8	50-36S	150-57E	9.8	9.8	9.8	9.7	9.7	8.9	8.3	7.4	7.4	7.0	6.8	6.2	6.2	6.0	5.2	50	8.8		
					5.2	5.0	4.6	4.5	4.1	4.0	-	-	-	-	-	-	-	-	-	-	-	-	
SP98043	99-03-16	15.7	50-02S	150-14E	10.3	10.3	10.3	10.3	10.3	10.0	9.4	9.5	9.6	9.4	9.3	8.9	8.6	8.3	8.3	59	9.2		
					8.0	7.6	6.9	6.3	5.8	5.6	-	-	-	-	-	-	-	-	-	-	-	-	
SP98044	99-03-16	19.7	49-12S	149-59E	11.3	11.3	11.2	11.3	11.2	10.3	9.3	9.3	9.0	9.0	9.1	9.1	9.1	9.0	8.9	60	10.5		
					8.8	8.7	8.5	8.2	7.9	7.5	-	-	-	-	-	-	-	-	-	-	-	-	
SP98045	99-03-16	21.7	48-44S	150-09E	11.5	11.6	11.5	11.5	10.2	9.6	9.1	9.2	9.3	8.9	8.8	8.8	8.8	8.7	8.6	40	11.0		
					8.4	7.9	7.4	7.0	6.8	6.3	-	-	-	-	-	-	-	-	-	-	-	-	
SP98046	99-03-16	23.7	48-19S	149-49E	11.9	11.9	11.9	11.9	11.9	10.0	9.1	8.7	8.9	8.7	8.5	8.6	8.7	8.5	8.2	62	11.5		
					8.0	7.7	7.3	7.0	6.4	6.2	-	-	-	-	-	-	-	-	-	-	-	-	
SP98047	99-03-17	01.9	47-55S	149-57E	11.7	11.7	11.7	11.7	11.7	10.0	8.9	8.4	8.2	8.1	8.0	8.0	7.8	7.4	7.1	53	12.3		
					6.8	6.6	6.4	6.0	5.6	5.1	-	-	-	-	-	-	-	-	-	-	-	-	

Table 3. XCTD observation data.

station	JA400001	JA400002	JA400003	JA400004	JA400005	JA400006	JA400007	JA400008								
date	1998/12/5	1998/12/5	1998/12/6	1998/12/6	1998/12/7	1998/12/7	1998/12/7	1998/12/7								
time(UT)	11:39	21:43	13:48	21:43	11:48	15:54	19:58	22:16								
latitude	44-21.0S	46-15.0S	49-44.0S	51-26.8S	53-45.5S	54-38.0S	55-38.3S	56-11.0S								
longitude	110-01.1E	109-58.7E	110-00.2E	110-00.0S	109-59.8E	109-59.5E	109-58.7E	109-59.7E								
depth	temp.	salinity	temp.	salinity	temp.	salinity	temp.	salinity	temp.	salinity	temp.	salinity	temp.	salinity		
0	10.1	34.64	8.3	34.09	4.3	33.87	3.3	33.88	2.4	33.93	1.7	33.88	1.6	33.89	1.6	33.85
10	10.1	34.66	8.3	34.10	4.2	33.90	3.3	33.90	2.4	33.94	1.7	33.89	1.6	33.91	1.6	33.89
20	10.1	34.67	8.0	34.13	4.0	33.90	3.3	33.91	2.4	33.95	1.7	33.91	1.6	33.92	1.6	33.90
30	10.1	34.67	8.0	34.13	3.8	33.92	3.2	33.91	2.4	33.95	1.7	33.91	1.6	33.93	1.6	33.90
50	10.2	34.71	7.7	34.14	3.8	33.92	3.0	33.93	2.4	33.95	1.6	33.91	1.6	33.93	1.6	33.92
75	10.2	34.77	7.4	34.10	3.7	33.92	2.9	33.93	1.9	33.97	1.2	33.92	1.3	33.95	1.1	33.93
100	10.2	34.77	7.6	34.22	3.5	33.93	2.3	33.93	1.9	33.98	0.6	33.94	0.8	33.95	0.6	33.96
125	10.1	34.76	8.5	34.49	2.9	33.95	1.7	33.96	1.1	34.01	0.3	33.96	0.4	33.98	0.4	33.98
150	10.0	34.77	8.2	34.44	2.7	33.96	1.6	34.00	0.9	34.07	0.3	34.02	0.2	34.00	0.3	34.02
200	9.9	34.77	8.0	34.43	2.4	34.01	1.5	34.07	1.3	34.18	1.2	34.22	1.3	34.25	1.3	34.27
250	9.9	34.77	7.5	34.36	2.4	34.08	2.1	34.21	1.9	34.30	1.8	34.38	1.8	34.39	1.8	34.40
300	9.7	34.74	7.2	34.31	2.4	34.16	2.0	34.27	2.0	34.38	2.0	34.44	1.9	34.46	1.9	34.46
400	9.7	34.76	6.8	34.30	2.5	34.28	2.3	34.41	2.2	34.50	2.0	34.53	2.0	34.56	2.1	34.56
500	9.0	34.63	5.9	34.29	2.4	34.39	2.2	34.49	2.2	34.55	2.1	34.59	2.1	34.62	2.1	34.60
600	8.5	34.58	5.4	34.32	2.4	34.47	2.3	34.56	2.3	34.47	2.1	34.58	2.1	34.63	2.2	34.52
700	7.5	34.52	4.5	34.27	2.3	34.53	2.3	34.62	2.2	34.56	2.1	34.59	2.1	34.62	2.2	34.52
800	-	-	3.8	34.25	2.3	34.59	-	-	2.2	34.60	2.1	34.60	-	-	2.0	34.62
900	-	-	-	-	-	-	-	-	-	-	2.1	34.61	-	-	-	-
1000	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

station	JA400009	JA400010	JA400011	JA400012	JA400013	JA400014	JA400015	JA400016								
date	1998/12/8	1998/12/8	1998/12/8	1998/12/8	1998/12/8	1998/12/9	1998/12/9	1998/12/9								
time	3:50	11:55	15:49	19:44	23:59	10:01	13:48	18:58								
latitude	57-33.5S	58-32.2S	59-08.0S	59-36.4S	60-00.0S	60-00.1S	60-00.0S	60-00.3S								
longitude	109-58.5E	108-45.0E	107-34.2E	105-59.3E	104-14.5E	99-51.3E	97-45.4E	94-54.0E								
depth	temp.	salinity	temp.	salinity	temp.	salinity	temp.	salinity	temp.	salinity	temp.	salinity	temp.	salinity		
0	1.2	33.94	0.6	33.94	0.2	33.84	-0.1	33.82	-0.3	33.90	-0.3	33.85	-0.2	33.91	-0.2	33.78
10	1.2	33.96	0.6	33.96	0.2	33.87	-0.1	33.84	-0.3	33.92	-0.3	33.87	-0.2	33.93	-0.2	33.80
20	1.2	33.97	0.6	33.97	0.2	33.88	-0.1	33.85	-0.3	33.94	-0.3	33.89	-0.2	33.95	-0.2	33.81
30	1.2	33.97	0.6	33.97	0.2	33.88	-0.1	33.86	-0.4	33.94	-0.3	33.89	-0.3	33.96	-0.2	33.81
50	1.1	33.98	0.6	33.97	0.2	33.89	-0.1	33.86	-0.5	33.96	-0.7	33.92	-0.6	33.99	-0.3	33.82
75	1.0	33.99	0.6	34.00	-0.5	34.00	-0.7	33.88	-1.3	34.05	-1.1	34.06	-1.3	34.17	-0.6	33.85
100	0.6	34.00	-0.3	34.05	-0.4	34.04	-1.4	34.04	-1.3	34.13	-0.6	34.16	-0.9	34.26	-1.2	33.98
125	0.2	34.02	-0.5	34.05	-0.8	34.06	-0.9	34.09	-1.1	34.21	-0.2	34.27	-0.4	34.36	-1.1	34.10
150	0.0	34.06	-0.1	34.12	1.0	34.37	-0.1	34.19	0.0	34.34	0.4	34.38	0.5	34.48	-0.7	34.18
200	1.4	34.31	1.4	34.41	1.7	34.53	1.7	34.49	1.6	34.56	1.3	34.53	1.0	34.57	0.8	34.39
250	1.8	34.42	1.3	34.51	1.9	34.60	1.8	34.55	1.6	34.60	1.6	34.61	1.7	34.66	1.3	34.51
300	2.0	34.49	1.9	34.59	1.9	34.63	1.7	34.58	1.6	34.64	1.7	34.64	1.6	34.68	1.6	34.60
400	2.1	34.59	1.9	34.65	1.9	34.68	1.7	34.66	1.7	34.70	1.8	34.69	1.6	34.71	1.8	34.65
500	2.1	34.64	1.9	34.69	1.9	34.71	1.8	34.69	1.8	34.73	1.7	34.71	1.7	34.75	1.8	34.70
600	2.1	34.68	1.9	34.72	1.9	34.74	1.8	34.69	1.7	34.75	1.7	34.72	1.7	34.76	1.8	34.71
700	2.0	34.71	1.9	34.74	1.8	34.76	1.8	34.70	1.6	34.76	1.5	34.72	1.6	34.77	1.8	34.73
800	2.0	34.73	1.8	34.75	1.8	34.76	1.7	34.71	1.6	34.78	1.5	34.73	-	-	-	-
900	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
1000	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

station	JA400017	JA400018	JA400019	JA400020	JA400021	JA400022	JA400023	JA400024								
date	1998/12/9	1998/12/10	1998/12/10	1998/12/10	1998/12/10	1998/12/11	1998/12/11	1998/12/11								
time(UT)	22:46	1:50	6:53	18:51	22:56	4:55	5:04	5:49								
latitude	60-01.9S	59-59.3S	60-01.7S	60-36.0S	61-04.7S	61-18.0S	61-18.0S	61-18.1S								
longitude	92-41.7E	91-01.1E	88-21.0E	83-16.0E	81-01.1E	80-04.6E	80-05.5E	80-08.3E								
depth	temp.	salinity	temp.	salinity	temp.	salinity	temp.	salinity	temp.	salinity	temp.	salinity	temp.	salinity		
0	0.1	33.82	-0.6	33.85	-0.2	33.81	-1.2	33.85	-1.0	33.77	-1.2	33.81	-1.2	33.79	-1.2	33.80
10	0.1	33.83	-0.6	33.86	-0.2	33.82	-1.2	33.86	-1.0	33.77	-1.2	33.81	-1.2	33.80	-1.2	33.81
20	0.1	33.83	-0.6	33.88	-0.2	33.81	-1.2	33.88	-1.0	33.78	-1.2	33.82	-1.2	33.81	-1.2	33.81
30	0.1	33.84	-0.6	33.88	-0.2	33.82	-1.2	33.87	-1.0	33.78	-1.2	33.83	-1.2	33.82	-1.2	33.81
50	0.0	33.85	-0.6	33.91	-0.2	33.82	-1.3	33.89	-1.1	33.80	-1.4	33.91	-1.4	33.87	-1.2	33.81
75	-0.5	33.88	-1.1	34.12	-0.4	33.83	-1.4	34.16	-0.7	34.20	0.0	34.26	0.2	34.28	-1.1	34.11
100	-0.6	33.96	-0.9	34.23	-0.5	34.03	0.5	34.45	0.7	34.43	0.8	34.38	0.9	34.37	0.9	34.36
125	-0.2	34.08	-0.5	34.32	-0.2	34.08	1.3	34.59	1.4	34.53	1.3	34.47	1.3	34.45	1.3	34.42
150	0.6	34.24	0.3	34.44	-0.3	34.25	1.7	34.66	1.7	34.60	1.5	34.50	1.5	34.48	1.6	34.47
200	1.7	34.43	0.7	34.53	1.0	34.40	1.8	34.71	1.8	34.65	1.7	34.56	-	-	1.8	34.55
250	1.8	34.52	1.4	34.64	1.5	34.52	1.8	34.73	1.8	34.67	1.8	34.61	-	-	1.9	34.59
300	1.9	34.57	1.6	34.68	1.7	34.59	1.8	34.73	1.8	34.71	-	-	-	-	1.9	34.63
400	1.8	34.65	1.4	34.69	1.8	34.66	1.8	34.75	1.9	34.73	-	-	-	-	1.9	34.67
500	1.7	34.69	1.7	34.75	1.8	34.69	1.7	34.76	1.8	34.75	-	-	-	-	1.9	34.69
600	1.8	34.72	1.7	34.76	1.7	34.70	1.6	34.77	1.7	34.76	-	-	-	-	1.8	34.71
700	1.8	34.73	1.5	34.75	1.7	34.71	1.6	34.78	1.7	34.77	-	-	-	-	1.8	34.72
800	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1.7	34.72
900	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1.6	34.73
1000	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1.5	34.72

station	JA400025	JA400026	JA400027	JA400028	JA400029	JA400030	JA400031	JA400032								
date	1998/12/11	1998/12/11	1998/12/17	1998/12/18	1998/12/18	1998/12/18	1998/12/18	1998/12/19								
time(UT)	11:52	19:21	18:50	2:50	7:47	13:46	19:51	3:48								
latitude	62-01.0S	63-40.8S	62-18.9S	61-50.3S	61-34.2S	61-28.5S	61-32.6S	61-49.8S								
longitude	79-39.9E	78-42.0E	73-13.7E	70-22.7E	68-08.0E	65-31.0E	63-04.0E	59-40.0E								
depth	temp.	salinity	temp.	salinity	temp.	salinity	temp.	salinity	temp.	salinity	temp.	salinity	temp.	salinity		
0	-1.2	33.71	-1.6	33.79	-1.5	15.93	-1.3	33.71	-1.3	33.73	-1.2	33.61	-1.4	33.63	-1.5	33.83
10	-1.2	33.72	-1.6	33.81	-1.5	17.34	-1.3	33.72	-1.3	33.74	-1.2	33.64	-1.4	33.65	-1.5	33.84
20	-1.2	33.72	-1.6	33.82	-1.3	33.65	-1.3	33.74	-1.3	33.75	-1.2	33.65	-1.4	33.66	-1.6	33.84
30	-1.2	33.72	-1.6	33.93	-1.2	33.75	-1.4	33.77	-1.3	33.76	-1.2	33.66	-1.4	33.66	-1.6	33.85
50	-1.7	33.94	-1.7	34.11	-1.5	33.86	-1.6	33.87	-1.4	33.77	-1.2	33.66	-1.5	33.68	-1.7	33.92
75	-1.4	34.09	-1.8	34.23	-1.1	34.17	-1.4	34.06	-1.8	34.01	-1.4	33.70	-1.7	33.93	-1.7	34.09
100	0.1	34.30	-1.6	34.30	1.3	34.49	0.0	34.25	0.1	34.30	-1.4	33.88	-1.4	34.05	0.7	34.43
125	1.1	34.43	-1.3	34.36	1.6	34.56	0.5	34.34	1.5	34.49	-1.1	33.94	-0.7	34.15	1.5	34.52
150	1.6	34.51	-0.9	34.39	1.7	34.60	1.3	34.50	1.7	34.54	-0.8	34.01	0.4	34.34	1.6	34.56
200	1.7	34.57	0.3	34.54	1.8	34.65	1.7	34.60	1.8	34.59	1.1	34.32	1.6	34.54	1.7	34.61
250	1.8	34.61	0.3	34.56	1.9	34.68	1.8	34.65	1.9	34.63	1.8	34.48	1.8	34.61	1.8	34.64
300	1.9	34.63	0.6	34.63	1.9	34.69	1.9	34.68	1.9	34.66	2.0	34.55	1.8	34.64	1.7	34.66
400	1.9	34.68	1.1	34.69	1.9	34.72	2.0	34.73	1.9	34.70	1.9	34.61	1.9	34.68	1.8	34.70
500	1.9	34.70	1.0	34.69	1.9	34.70	1.9	34.75	2.0	34.67	2.0	34.67	1.9	34.71	1.7	34.73
600	1.9	34.70	1.0	34.72	2.0	34.53	1.9	34.78	1.9	34.72	2.0	34.71	1.8	34.73	1.7	34.67
700	1.8	34.70	0.9	34.71	2.0	34.49	1.8	34.79	1.9	34.75	1.9	34.73	1.7	34.74	1.8	34.58
800	1.7	34.70	0.8	34.72	2.0	34.43	-	-	1.8	34.76	-	-	1.7	34.75	1.7	34.52
900	-	-	-	-	2.0	34.35	-	-	-	-	-	-	-	-	1.7	34.14
1000	-	-	-	-	2.0	34.26	-	-	-	-	-	-	-	-	-	-

station	JA400033	JA400034	JA400035	JA400036	JA400037	JA400038	JA400039	JA400040								
date	1998/12/19	1998/12/19	1998/12/19	1998/12/20	1999/2/28	1999/2/28	1999/2/28	1999/2/28								
time(UT)	8:48	14:49	20:01	3:53	5:57	12:18	15:46	18:57								
latitude	61-56.2S	62-39.0S	63-43.5S	64-50.2S	65-09.2S	65-08.9S	65-10.2S	65-09.4S								
longitude	57-18.6E	55-00.1E	53-32.7E	51-51.7E	77-24.1E	77-27.4E	77-21.8E	77-28.8E								
depth	temp.	salinity	temp.	salinity	temp.	salinity	temp.	salinity	temp.	salinity	temp.	salinity				
0	-1.4	33.69	-1.5	33.61	-1.6	33.76	-1.7	33.79	0.8	33.52	0.8	33.52	0.8	33.53	0.8	33.52
10	-1.4	33.71	-1.6	33.62	-1.6	33.78	-1.7	33.82	0.8	33.53	0.8	33.54	0.8	33.55	0.8	33.53
20	-1.4	33.72	-1.7	33.75	-1.6	33.80	-1.7	33.94	0.8	33.54	0.8	33.56	0.8	33.57	0.8	33.55
30	-1.5	33.72	-1.7	33.83	-1.7	33.88	-1.8	33.97	0.8	33.57	0.8	33.57	0.8	33.58	0.8	33.57
50	-1.7	33.84	-1.8	33.92	-1.8	34.10	-1.7	33.98	-1.3	34.14	-1.2	34.12	-1.0	34.06	-1.3	34.14
75	-1.8	34.07	-1.8	34.01	-0.4	34.35	-1.8	34.22	-1.2	34.30	-1.3	34.29	-1.4	34.33	-1.3	34.32
100	-1.7	34.13	-1.3	34.12	1.0	34.53	-1.0	34.41	-0.4	34.40	-0.7	34.40	-0.8	34.42	0.0	34.45
125	1.1	34.47	0.9	34.42	1.1	34.57	-0.2	34.53	0.4	34.49	0.6	34.55	-0.2	34.51	0.9	34.56
150	1.6	34.54	1.4	34.49	1.4	34.63	-0.1	34.56	0.5	34.53	1.0	34.59	0.5	34.58	0.7	34.56
200	1.7	34.60	1.6	34.57	1.5	34.68	0.0	34.61	0.7	34.58	1.2	34.66	0.8	34.63	1.3	34.65
250	1.8	34.64	1.7	34.62	1.6	34.72	0.4	34.64	1.1	34.65	1.3	34.69	1.1	34.69	1.4	34.69
300	1.8	34.67	1.7	34.65	1.6	34.73	0.3	34.64	1.1	34.66	1.4	34.71	1.0	34.70	1.4	34.70
400	1.8	34.72	1.7	34.69	1.5	34.75	0.3	34.67	1.1	34.68	1.4	34.74	1.1	34.73	1.4	34.73
500	1.8	34.75	1.6	34.71	1.5	34.77	0.3	34.69	1.2	34.64	1.4	34.76	1.1	34.75	1.3	34.74
600	1.8	34.70	1.6	34.73	1.4	34.78	0.3	34.71	1.2	34.52	1.3	34.76	1.1	34.76	1.2	34.73
700	1.7	34.73	1.5	34.73	1.3	34.77	0.3	34.71	1.4	34.39	1.2	34.76	1.1	34.77	1.1	34.72
800	-	-	1.4	34.73	1.2	34.78	0.3	34.72	1.4	34.21	1.1	34.75	0.9	34.76	1.1	34.72
900	-	-	-	-	-	-	0.2	34.71	1.5	34.05	0.9	34.75	0.9	34.76	1.0	34.72
1000	-	-	-	-	-	-	0.1	34.72	1.6	33.92	0.9	34.75	0.8	34.76	0.9	34.72

station	JA400041	JA400042	JA400043	JA400044	JA400045	JA400046	JA400047	JA400048								
date	1999/2/28	1999/3/1	1999/3/12	1999/3/12	1999/3/13	1999/3/13	1999/3/13	1999/3/13								
time(UT)	23:56	3:42	1:52	18:50	2:09	7:23	9:50	12:27								
latitude	65-11.7S	65-12.0S	63-02.5S	62-04.0S	61-04.9S	60-30.0S	60-01.5S	59-30.0S								
longitude	77-23.9E	77-25.3E	150-00.5E	150-08.7E	149-52.1E	150-02.0E	149-59.6E	149-59.5E								
depth	temp.	salinity	temp.	salinity	temp.	salinity	temp.	salinity	temp.	salinity	temp.	salinity				
0	0.8	33.59	0.8	33.59	1.3	33.80	1.4	33.83	1.6	33.80	1.5	33.88	1.5	33.84	1.6	33.87
10	0.8	33.60	0.8	33.59	1.3	33.81	1.4	33.84	1.6	33.82	1.5	33.89	1.5	33.87	1.6	33.88
20	0.8	33.61	0.8	33.61	1.3	33.83	1.4	33.86	1.6	33.84	1.5	33.89	1.5	33.88	1.6	33.88
30	0.8	33.62	-0.1	33.76	1.3	33.84	1.4	33.86	1.6	33.86	1.5	33.90	1.5	33.89	1.6	33.89
50	-1.3	34.17	-1.3	34.22	1.3	33.84	1.5	33.86	1.6	33.87	1.5	33.89	1.5	33.91	1.6	33.89
75	-1.1	34.34	-1.1	34.38	-0.7	34.19	0.4	33.97	-0.2	34.23	-0.1	34.06	-0.6	34.26	-0.4	34.29
100	-0.4	34.45	-0.5	34.44	0.9	34.46	0.3	34.36	1.1	34.41	0.1	34.38	0.5	34.44	1.4	34.57
125	0.3	34.52	0.0	34.54	1.3	34.53	1.3	34.53	1.7	34.50	1.2	34.55	1.0	34.55	1.6	34.60
150	0.8	34.58	0.8	34.61	1.6	34.60	1.7	34.59	1.8	34.54	1.7	34.63	1.6	34.64	1.8	34.63
200	1.5	34.68	1.5	34.71	1.9	34.66	1.7	34.64	2.0	34.59	1.9	34.66	1.9	34.71	1.9	34.67
250	1.1	34.66	1.1	34.69	1.9	34.68	1.8	34.67	2.0	34.64	1.9	34.69	1.9	34.73	1.9	34.69
300	1.2	34.65	1.3	34.74	1.9	34.69	1.9	34.70	2.0	34.68	1.9	34.71	1.9	34.75	1.9	34.70
400	1.2	34.68	1.3	34.76	1.9	34.73	1.9	34.73	2.1	34.73	1.9	34.73	1.9	34.77	1.8	34.73
500	1.2	34.69	1.2	34.78	1.8	34.75	1.8	34.74	2.0	34.70	1.8	34.75	1.9	34.69	1.7	34.75
600	1.2	34.68	1.1	34.77	1.8	34.76	1.8	34.76	2.2	34.49	1.8	34.73	2.0	34.56	1.8	34.66
700	1.2	34.66	1.1	34.78	1.7	34.77	1.7	34.77	2.2	34.45	1.8	34.72	1.9	34.55	1.8	34.61
800	1.1	34.64	1.1	34.78	1.7	34.77	1.7	34.78	2.0	34.58	1.7	34.73	1.9	34.55	1.8	34.57
900	1.1	34.57	1.0	34.78	1.6	34.77	1.6	34.79	2.1	34.50	1.6	34.75	1.8	34.56	1.7	34.62
1000	1.0	34.51	0.8	34.78	-	-	-	-	1.5	34.76	1.7	34.62	1.5	34.71		

station	JA400049	JA400050	JA400051	JA400052	JA400053	JA400054	JA400055	JA400056								
date	1999/3/13	1999/3/13	1999/3/14	1999/3/14	1999/3/14	1999/3/14	1999/3/14	1999/3/14								
time(UT)	15:16	17:59	0:29	5:54	11:05	13:09	18:06	22:40								
latitude	59-00.0S	58-30.0S	57-22.6s	57-27.1S	57-23.9S	57-28.5S	57-25.7S	57-30.9S								
longitude	149-59.1E	150-00.1E	150-03.5e	150-12.9E	150-04.1E	150-09.7E	150-14.1E	150-29.3E								
depth	temp.	salinity	temp.	salinity	temp.	salinity	temp.	salinity	temp.	salinity						
0	1.8	33.87	2.5	33.88	4.5	33.76	4.6	33.79	4.5	33.77	4.6	33.76	4.5	33.76	4.6	33.80
10	1.8	33.88	2.5	33.91	4.5	33.77	4.6	33.80	4.5	33.78	4.6	33.77	4.5	33.77	4.6	33.81
20	1.8	33.90	2.5	33.92	4.5	33.77	4.6	33.80	4.5	33.79	4.6	33.78	4.5	33.79	4.6	33.80
30	1.8	33.91	2.5	33.91	4.5	33.78	4.6	33.81	4.5	33.80	4.6	33.78	4.5	33.79	4.6	33.81
50	1.8	33.90	2.5	33.92	4.5	33.79	4.5	33.80	4.2	33.81	4.6	33.79	3.9	33.81	4.5	33.81
75	0.0	34.13	2.2	33.92	2.3	33.82	1.0	33.90	2.3	33.88	2.7	33.86	2.2	33.89	1.9	33.87
100	0.0	34.44	0.1	34.44	0.8	33.90	0.7	33.93	1.5	33.91	1.8	34.01	1.0	33.94	0.7	33.91
125	1.2	34.59	0.9	34.54	0.7	33.94	1.0	34.02	0.8	33.94	2.4	34.12	2.4	34.13	0.7	33.98
150	1.6	34.65	1.4	34.60	1.4	34.08	1.3	34.11	0.4	33.96	2.5	34.23	2.6	34.22	1.0	34.06
200	1.8	34.69	1.8	34.65	2.0	34.22	2.0	34.27	2.5	34.27	2.5	34.30	2.4	34.29	2.0	34.27
250	1.9	34.72	1.9	34.68	2.1	34.31	2.1	34.34	2.5	34.33	2.4	34.38	2.1	34.31	2.1	34.34
300	1.8	34.72	1.8	34.69	2.2	34.36	2.0	34.41	2.5	34.39	2.4	34.43	2.4	34.38	2.2	34.41
400	1.8	34.75	1.8	34.72	2.3	34.49	2.4	34.54	2.4	34.50	2.4	34.55	2.3	34.48	2.1	34.48
500	1.8	34.76	1.8	34.73	2.5	34.46	2.4	34.59	2.4	34.55	2.3	34.61	2.5	34.36	2.5	34.50
600	1.7	34.77	1.8	34.72	2.6	34.31	2.4	34.51	2.3	34.55	2.3	34.63	2.4	34.45	2.8	34.13
700	1.6	34.77	1.7	34.71	2.6	34.33	-	-	-	-	2.2	34.66	2.3	34.50	2.7	34.13
800	1.5	34.77	1.6	34.71	-	-	-	-	-	-	2.1	34.70	-	-	2.8	34.08
900	1.4	34.77	1.6	34.71	-	-	-	-	-	-	2.1	34.72	-	-	2.8	34.03
1000	1.4	34.76	1.5	34.71	-	-	-	-	-	-	2.1	34.75	-	-	2.8	33.96

station	JA400057	JA400058	JA400059	JA400060	JA400061	JA400062	JA400063	JA400064								
date	1999/3/15	1999/3/15	1999/3/15	1999/3/15	1999/3/16	1999/3/16	1999/3/17	1999/3/17								
time(UT)	3:48	11:44	13:49	17:49	13:47	17:48	9:34	13:30								
latitude	56-51.5S	55-26.9S	55-02.6S	54-03.3S	50-19.3S	49-41.3S	47-00.0S	46-00.0S								
longitude	150-22.0E	150-03.1E	150-00.5E	150-00.0E	150-38.3E	150-00.5E	150-23.9E	150-32.6E								
depth	temp.	salinity	temp.	salinity	temp.	salinity	temp.	salinity	temp.	salinity						
0	5.1	33.75	3.8	33.78	8.3	34.01	8.9	34.21	10.2	34.18	10.2	34.20	11.9	34.28	14.3	34.63
10	5.1	33.77	3.8	33.81	8.4	34.03	8.9	34.23	10.2	34.20	10.2	34.22	11.9	34.29	14.3	34.64
20	5.1	33.79	3.7	33.82	8.4	34.04	8.9	34.24	10.2	34.21	10.2	34.23	11.9	34.30	14.3	34.66
30	5.1	33.80	3.7	33.83	8.6	34.10	8.9	34.25	10.2	34.22	10.2	34.24	11.9	34.31	14.3	34.66
50	5.1	33.80	3.5	33.83	8.4	34.09	8.8	34.25	10.1	34.22	10.2	34.24	11.8	34.33	13.1	34.87
75	4.0	33.89	3.4	33.83	8.4	34.09	8.8	34.25	9.4	34.27	9.6	34.34	10.0	34.36	11.6	34.85
100	3.0	33.97	3.3	33.83	8.1	34.08	8.8	34.25	8.3	34.34	9.5	34.60	9.0	34.38	11.1	34.87
125	2.8	33.99	2.2	33.86	6.9	33.98	8.6	34.39	8.3	34.43	9.5	34.65	8.5	34.39	10.7	34.84
150	2.4	34.00	0.1	33.99	6.9	34.21	8.5	34.47	8.4	34.47	9.5	34.66	8.3	34.41	10.6	34.86
200	2.0	34.09	1.1	34.29	5.5	34.12	8.5	34.50	8.2	34.47	9.4	34.65	8.1	34.44	9.7	34.73
250	2.4	34.20	1.7	34.41	5.7	34.23	8.5	34.51	8.1	34.46	9.3	34.64	8.0	34.43	9.3	34.67
300	2.4	34.29	2.0	34.47	5.0	34.17	8.5	34.51	8.0	34.47	9.2	34.64	8.1	34.46	9.1	34.65
400	2.5	34.39	2.1	34.56	4.5	34.24	8.0	34.45	6.8	34.31	9.0	34.61	7.8	34.44	8.7	34.61
500	2.6	34.49	2.1	34.60	4.3	34.34	7.2	34.34	6.3	34.32	8.5	34.51	7.1	34.33	8.5	34.60
600	2.4	34.53	2.1	34.64	3.3	34.31	6.1	34.27	5.7	34.24	7.6	34.32	6.9	34.23	7.9	34.54
700	2.4	34.59	2.1	34.67	3.1	34.40	5.6	34.28	5.1	34.19	6.8	34.29	6.0	34.18	7.0	34.47
800	2.3	34.63	2.0	34.70	2.8	34.44	-	-	4.4	34.19	-	-	-	-	-	-
900	2.3	34.70	2.0	34.73	-	-	-	-	3.8	34.23	-	-	-	-	-	-
1000	2.2	34.72	2.0	34.74	-	-	-	-	-	-	-	-	-	-	-	-

station	JA400065	
date	1999/3/17	
time(UT)	17:23	
latitude	45-00.0S	
longitude	150-40.0E	
depth	temp	salinity
0	14.2	34.55
10	14.2	34.55
20	14.2	34.56
30	14.2	34.57
50	14.0	34.68
75	10.3	34.63
100	10.0	34.67
125	9.7	34.67
150	9.1	34.59
200	8.8	34.56
250	8.6	34.55
300	8.5	34.54
400	8.3	34.52
500	8.3	34.45
600	7.8	34.31
700	7.1	34.21
800	-	-
900	-	-
1000	-	-

Table 4. Serial observation data.

Station 1

Meteorological observation

Date	: December 5, 1998	Weather Time(UT)	: 06:00	Wind Direction	: WNW
Time(UT)	: 06:06	Weather	: bc	Velocity	: 8m/s
Latitude	: 43-32.0S	Air Temperature(dry)	: 13.2°C	Wave	: WNW/3
Longitude	: 110-00.4E	Humidity	: 91%	Swell	: W /3
Depth	: 4400 m	Atmospheric Pressure	: 1016.6hPa	Visibility	: 20km

Observed										Interpolated				
Depth (m)	T (°C)	S	pH	DO2	P04-P	SI03-Si	N02-N	N03-N	NH4-N	Depth (m)	T (°C)	S	$\sigma_t$	$\Delta D$
				( $\mu\text{mol/l}$ )										
0	11.900	34.760	8.15	286	0.8	2	0.2	9	0.4	0	11.900	34.760	26.440	0.000
31	11.332	---	8.16	289	0.8	2	0.2	9	0.4	50	11.068	34.746	26.580	
50	11.068	34.746	8.16	291	0.8	2	0.2	9	0.5	150	9.918	34.722	26.770	
77	10.615	---	---	---	---	---	---	---	---	200	9.899	34.733	26.780	
101	10.311	34.784	8.14	283	0.9	2	0.5	10	0.4	250	10.047	34.778	26.790	
123	10.172	---	---	---	---	---	---	---	---	300	10.075	34.789	26.790	
150	9.918	34.722	8.13	100	0.9	3	0.5	11	0.4	400	9.932	34.769	26.800	
198	9.894	34.731	8.13	283	1.0	3	0.3	12	0.2	500	9.595	34.736	26.830	
248	10.044	34.777	8.13	279	0.9	3	0.1	11	0.3	600	9.158	34.670	26.850	
300	10.075	34.789	8.13	282	0.9	3	0.1	11	0.3	700	8.399	34.571	26.900	
401	9.929	34.769	8.12	274	1.0	3	0.0	13	0.3	800	7.404	34.556	27.030	
499	9.599	34.736	8.09	261	1.1	4	0.0	15	0.3	1000	5.354	34.426	27.200	
599	9.163	34.671	8.09	258	1.2	5	0.0	17	0.3	1500	2.971	34.475	27.490	
697	8.427	34.574	8.05	239	1.5	8	0.0	20	0.2					
798	7.425	34.483	8.02	224	1.7	13	0.0	24	0.2					
897	6.346	---	---	---	---	---	---	---	---					
997	5.381	34.384	7.97	212	2.1	25	0.0	30	0.1					
1242	3.598	---	---	---	---	---	---	---	---					
1491	2.987	34.471	7.90	187	2.5	62	0.0	35	0.1					
1655	2.717	34.539	7.87	191	2.5	68	0.0	35	0.1					

Station 2

Meteorological observation

Date : : December 6, 1998      Weather Time(UT) : : 06:00      Wind Direction : : WNW  
 Time(UT) : : 05:54      Weather : : o      Velocity : : 7m/s  
 Latitude : : 47-42.7S      Air Temperature(dry) : : 9.1°C      Wave : : WNW/3  
 Longitude: : 110-01.3E      Humidity : : 97%      Swell : : SW /3  
 Depth : : 3700 m      Atmospheric Pressure : : 999.3hPa      Visibility : : 5km

O b s e r v e d										I n t e r p o l a t e d				
Depth (m)	T (°C)	S	pH	D02	P04-P	SI03-Si	NO2-N	NO3-N	NH4-N	Depth (m)	T (°C)	S	$\sigma_t$	$\Delta D$
				( $\mu\text{mol/l}$ )										
0	6.800	33.946	8.12	318	1.4	9	0.1	21	0.4	0	6.800	33.946	26.640	0.000
28	5.968	33.960	8.12	322	1.4	7	0.1	21	0.3	10	6.384	33.951	26.700	0.014
49	5.926	---	---	---	---	---	---	---	---	20	6.073	33.956	26.740	0.027
71	5.866	34.008	8.12	321	1.4	7	0.1	21	0.7	125	6.010	34.134	26.890	
97	5.933	---	---	---	---	---	---	---	---	150	5.758	34.108	26.900	
121	6.014	34.138	8.12	303	1.4	6	0.1	21	0.2	200	5.126	34.046	26.930	
148	5.780	34.111	8.10	305	1.4	7	0.1	21	0.2	250	5.207	34.089	26.950	
198	5.122	34.044	8.11	314	1.5	8	0.2	22	0.4	300	5.071	34.152	27.020	
247	5.212	34.085	8.09	305	1.6	9	0.2	23	0.2	400	5.221	34.202	27.040	
301	5.069	34.153	8.05	272	1.7	13	0.0	26	0.1	500	3.824	34.186	27.180	
399	5.225	34.202	8.03	263	1.8	16	0.0	27	0.2	600	3.326	34.224	27.260	
497	3.841	34.185	8.00	260	2.0	24	0.0	30	0.2	700	2.925	34.258	27.320	
600	3.326	34.224	7.97	245	2.2	32	0.0	33	0.1	800	2.829	34.323	27.380	
697	2.934	34.257	7.95	235	2.3	44	0.0	34	0.1	1000	2.446	34.454	27.520	
794	2.844	34.320	7.93	100	2.3	49	0.0	35	0.1	1200	2.511	34.572	27.610	
891	2.510	34.367	7.92	210	2.4	57	0.0	36	0.1	1500	2.416	34.678	27.700	
994	2.444	34.450	7.91	197	2.5	66	0.0	36	0.3					
1241	2.524	34.590	7.90	194	2.4	75	0.0	35	0.1					
1454	2.431	34.665	7.91	191	2.0	78	0.0	33	0.1					
1606	2.387	34.702	7.92	195	2.2	80	0.0	33	0.1					



Station 3

Meteorological observation

Date	: December 7, 1998	Weather Time (UT)	: 06:00	Wind Direction	: W
Time (UT)	: 05:54	Weather	: bc	Velocity	: 12m/s
Latitude	: 52-54.5S	Air Temperature (dry)	: 4.0°C	Wave	: W /3
Longitude	: 110-00.9E	Humidity	: 86%	Swell	: WNW/3
Depth	: 3420 m	Atmospheric Pressure	: 980.8hPa	Visibility	: 20km

O b s e r v e d										I n t e r p o l a t e d				
Depth (m)	T (°C)	S	pH	D02	P04-P	SI03-Si	N02-N	N03-N	NH4-N	Depth (m)	T (°C)	S	$\sigma_t$	$\Delta D$
				(μ mol/l)										
0	4.000	33.900	8.09	337	1.7	12	0.2	24	--	0	4.000	33.900	26.930	0.000
26	3.609	33.895	8.10	339	1.6	11	0.2	24	--	10	3.811	33.897	26.950	0.011
45	3.525	33.897	8.10	340	1.5	12	0.2	24	--	20	3.666	33.895	26.960	0.022
72	3.298	33.904	8.09	335	1.7	13	0.1	25	--	30	3.586	33.895	26.970	0.033
99	3.241	33.905	8.09	336	1.7	14	0.2	24	--	50	3.487	33.898	26.980	0.055
123	2.702	33.924	8.06	333	1.9	18	0.2	26	--	75	3.283	33.904	27.010	0.082
150	2.198	33.933	8.05	333	1.9	21	0.2	27	--	100	3.225	33.905	27.010	0.109
200	2.145	33.993	8.03	317	2.0	29	0.1	29	--	125	2.661	33.925	27.080	0.134
250	1.711	34.010	8.02	319	2.0	28	0.1	29	--	150	2.198	33.933	27.120	0.159
301	2.621	34.201	7.96	250	2.3	37	0.0	32	--	200	2.145	33.993	27.180	0.205
400	2.534	34.307	7.93	223	2.4	50	0.0	34	--	250	1.711	34.010	27.220	0.250
497	2.295	34.383	7.90	208	2.4	60	0.0	35	--	300	2.620	34.200	27.300	0.291
598	2.311	34.471	7.89	195	2.4	68	0.0	35	--	400	2.534	34.307	27.400	0.367
694	2.316	34.539	7.88	191	2.4	73	0.0	35	--	500	2.295	34.386	27.480	0.434
794	2.326	34.595	7.88	188	2.4	76	0.0	34	--	600	2.311	34.473	27.550	0.495
893	2.292	34.641	7.89	187	2.3	79	0.0	34	--	700	2.316	34.543	27.600	0.551
991	2.223	34.673	7.89	194	2.3	81	0.0	33	--	800	2.324	34.598	27.650	0.602
1234	2.125	34.724	7.91	199	2.2	84	0.0	31	--	1000	2.218	34.675	27.720	0.696
1431	1.977	34.740	7.92	202	2.2	88	0.0	31	--	1200	2.142	34.719	27.760	0.781

Station 4

Meteorological observation

Date	: December 8, 1998	Weather Time(UT)	: 06:00	Wind Direction	: NNW
Time(UT)	: 05:48	Weather	: bc	Velocity	: 10m/s
Latitude	: 58-01.3S	Air Temperature(dry)	: 2.7°C	Wave	: NNW/4
Longitude	: 110-00.7E	Humidity	: 78%	Swell	: NW /3
Depth	: 4600 m	Atmospheric Pressure	: 976.4hPa	Visibility	: 20km

O b s e r v e d										I n t e r p o l a t e d				
Depth (m)	T (°C)	S	pH	D02	P04-P	SI03-Si	N02-N	N03-N	NH4-N	Depth (m)	T (°C)	S	σ <sub>t</sub>	ΔD
				(μmol/l)										
0	4.000	33.928	8.04	382	1.9	32	0.2	28	0.3	0	4.000	33.928	26.960	0.000
29	0.490	33.929	8.07	362	1.9	32	0.2	27	0.3	10	2.344	33.928	27.110	0.010
49	0.384	33.938	8.07	362	1.9	32	0.2	27	0.3	20	1.094	33.929	27.200	0.020
72	-0.600	33.954	8.06	362	2.0	37	0.2	28	0.4	30	0.461	33.929	27.240	0.028
102	-0.800	33.986	8.05	359	2.0	39	0.2	29	0.2	50	0.348	33.939	27.250	0.045
124	-0.848	34.005	8.04	355	2.1	40	0.2	30	0.3	75	-0.630	33.957	27.310	0.065
150	-0.690	34.076	8.02	333	2.2	46	0.2	31	0.2	100	-0.794	33.984	27.340	0.084
200	1.295	34.397	7.92	219	2.4	67	0.0	35	0.2	125	-0.842	34.006	27.360	0.102
249	1.839	34.487	7.90	197	2.4	73	0.0	34	0.2	150	-0.690	34.076	27.410	0.119
300	1.947	34.544	7.89	189	2.4	77	0.0	35	0.2	200	1.295	34.397	27.560	0.149
398	1.983	34.625	7.90	191	2.4	81	0.0	34	0.1	250	1.842	34.488	27.600	0.176
497	1.950	34.676	7.91	191	2.3	84	0.0	33	0.1	300	1.947	34.544	27.630	0.200
594	1.945	34.695	7.91	194	2.2	84	0.0	32	0.1	400	1.983	34.626	27.700	0.246
696	1.903	34.718	7.92	198	2.2	87	0.0	32	0.1	500	1.950	34.677	27.740	0.287
795	1.851	34.728	7.92	200	2.2	88	0.0	32	0.1	600	1.943	34.696	27.750	0.325
894	1.777	34.736	7.93	205	2.2	90	0.0	32	0.1	700	1.901	34.719	27.780	0.362
993	1.757	34.743	7.94	205	2.1	92	0.0	31	0.1	800	1.848	34.728	27.790	0.398
1237	1.555	34.744	7.94	210	2.1	98	0.0	32	0.1	1000	1.751	34.743	27.810	0.468
1484	1.350	34.737	7.93	213	2.2	104	0.0	32	0.1	1200	1.586	34.744	27.820	0.535
1623	1.232	34.733	7.92	212	2.2	108	0.0	32	0.1	1500	1.337	34.737	27.830	0.634

Station 5

Meteorological observation

Date	: December 9, 1998	Weather Time(UT)	: 01:00	Wind Direction	: SW
Time(UT)	: 00:54	Weather	: bc	Velocity	: 7m/s
Latitude	: 59-59.1S	Air Temperature(dry)	: 1.0°C	Wave	: SW /2
Longitude	: 103-53.7E	Humidity	: 86%	Swell	: WNW/3
Depth	: 4400 m	Atmospheric Pressure	: 973.5hPa	Visibility	: 15km

O b s e r v e d										I n t e r p o l a t e d				
Depth (m)	T (°C)	S	pH	D02	P04-P	SI03-Si	N02-N	N03-N	NH4-N	Depth (m)	T (°C)	S	σ <sub>t</sub>	ΔD
				(μmol/l)										
0	0.100	33.921	8.03	359	2.0	48	0.2	29	—	0	0.100	33.921	27.250	0.000
17	-0.117	33.909	8.04	360	2.0	48	0.2	29	—	10	-0.031	33.911	27.250	0.008
30	-0.256	33.913	8.04	362	2.0	48	0.2	28	—	20	-0.152	33.910	27.260	0.017
48	-0.343	33.916	8.05	362	2.0	48	0.2	28	—	30	-0.256	33.913	27.260	0.025
73	-0.725	33.957	8.05	360	2.0	49	0.2	29	—	50	-0.368	33.917	27.270	0.041
99	-1.052	34.086	8.02	335	2.1	53	0.2	31	—	75	-0.755	33.965	27.330	0.061
123	-0.485	34.188	7.99	302	2.2	58	0.1	32	—	100	-1.028	34.090	27.440	0.078
148	0.340	34.304	7.95	264	2.3	63	0.0	33	—	125	-0.422	34.197	27.500	0.094
198	1.491	—	7.91	208	2.4	75	0.0	34	—	150	0.400	34.620	27.800	0.105
248	1.634	34.567	7.90	198	2.3	80	0.0	34	—	250	1.641	34.569	27.680	
297	1.805	34.623	7.90	191	2.3	82	0.0	34	—	300	1.803	34.624	27.710	
395	1.753	34.667	7.91	198	2.3	85	0.0	33	—	400	1.752	34.668	27.750	
497	1.737	34.696	7.92	198	2.2	87	0.0	32	—	500	1.737	34.697	27.770	
596	1.740	34.718	7.92	203	2.2	88	0.0	32	—	600	1.738	34.719	27.790	
695	1.661	34.729	7.93	205	2.1	90	0.0	32	—	700	1.658	34.729	27.800	
795	1.592	34.735	7.93	206	2.1	92	0.0	31	—	800	1.589	34.735	27.810	
892	1.523	34.738	7.94	212	2.1	95	0.0	31	—	1000	1.412	34.736	27.830	
991	1.420	34.736	7.93	210	2.1	98	0.0	31	—	1200	1.243	34.731	27.830	
1239	1.210	34.730	7.93	214	2.2	105	0.0	31	—	1500	0.992	34.719	27.840	
1485	1.004	34.720	7.92	215	2.2	112	0.0	32	—					
1881	0.690	34.704	7.92	219	2.3	122	0.0	32	—					

Station 6

Meteorological observation

Date	: March 9, 1999	Weather Time(UT)	: 05:00	Wind Direction	: N
Time(UT)	: 05:00	Weather	: bc	Velocity	: 8m/s
Latitude	: 62-55.0S	Air Temperature(dry)	: 1.6°C	Wave	: N /3
Longitude	: 128-16.3E	Humidity	: 89%	Swell	: NNE/3
Depth	: 4250 m	Atmospheric Pressure	: 978.1hPa	Visibility	: 20km

O b s e r v e d										I n t e r p o l a t e d				
Depth (m)	T (°C)	S	pH	D02	PO4-P	SI03-Si	N02-N	N03-N	NH4-N	Depth (m)	T (°C)	S	$\sigma_t$	$\Delta D$
				( $\mu\text{mol/l}$ )										
0	1.700	33.947	8.10	341	1.8	21	0.3	27	0.6	0	1.700	33.947	27.170	0.000
30	1.617	33.946	8.09	341	1.8	21	0.2	27	0.5	10	1.673	33.946	27.170	0.009
51	1.555	33.949	8.09	343	1.8	22	0.2	27	0.5	20	1.645	33.946	27.180	0.018
76	-0.888	34.125	8.04	324	2.4	56	0.1	32	--	30	1.617	33.946	27.180	0.027
101	0.040	34.334	7.97	258	2.4	70	0.3	35	0.3	50	1.558	33.948	27.180	0.045
125	1.322	34.520	7.90	203	2.5	80	0.0	37	0.2	75	-0.790	34.117	27.450	0.064
149	1.676	34.571	7.89	191	2.5	83	0.0	37	0.3	100	-0.010	34.326	27.580	0.078
200	1.893	34.628	7.89	185	2.4	86	0.0	36	0.3	125	1.322	34.520	27.660	0.090
248	1.926	34.653	7.89	195	2.4	86	0.0	36	0.2	150	1.681	34.572	27.680	0.101
299	1.888	34.666	7.89	189	2.4	88	0.0	35	0.2	200	1.893	34.628	27.700	0.122
399	1.845	34.690	7.90	191	2.3	89	0.0	34	0.2	250	1.925	34.654	27.720	0.142
500	1.816	34.710	7.91	195	2.3	91	0.0	34	0.2	300	1.888	34.666	27.730	0.162
599	1.795	34.724	7.94	199	2.3	92	0.0	33	0.4	400	1.845	34.690	27.760	0.199
697	1.741	34.732	7.94	200	2.2	94	0.0	33	0.2	500	1.816	34.710	27.780	0.235
795	1.673	34.736	7.94	202	2.2	96	0.0	33	0.2	600	1.795	34.724	27.790	0.270
895	1.601	34.741	7.94	206	2.2	98	0.0	33	0.3	700	1.739	34.732	27.800	0.305
995	1.515	34.740	7.94	206	2.2	102	0.0	33	0.3	800	1.669	34.736	27.810	0.338
1241	1.325	34.736	7.94	212	2.2	108	0.0	33	0.2	1000	1.511	34.740	27.820	0.404
1487	1.139	34.727	7.93	211	2.2	114	0.0	33	0.2	1200	1.356	34.737	27.830	0.467
1981	0.784	34.708	7.91	218	2.3	125	0.0	34	0.2	1500	1.129	34.727	27.840	0.561
2472	0.452	34.693	7.88	224	2.3	135	0.0	34	0.3	2000	0.771	34.707	27.850	0.712
2993	0.194	34.683	7.86	230	2.3	139	0.0	35	0.3	2500	0.434	34.692	27.850	0.854

Station 7

Meteorological observation

Date	: March 14, 1999	Weather Time(UT)	: 06:00	Wind Direction	: NW
Time(UT)	: 06:00	Weather	: c	Velocity	: 13m/s
Latitude	: 57-27.4S	Air Temperature(dry)	: 5.4°C	Wave	: NW /5
Longitude	: 150-13.8E	Humidity	: 87%	Swell	: NW /3
Depth	: 3300 m	Atmospheric Pressure	: 1005.4hPa	Visibility	: 30km

O b s e r v e d										I n t e r p o l a t e d				
Depth (m)	T (°C)	S	pH	D02	P04-P	SI03-Si	NO2-N	NO3-N	NH4-N	Depth (m)	T (°C)	S	$\sigma_t$	$\Delta D$
				( $\mu\text{mol/l}$ )										
0	4.800	33.788	8.08	324	1.8	3	0.3	26	0.4	0	4.800	33.788	26.760	0.000
30	4.649	33.784	8.08	324	1.8	3	0.3	27	0.4	10	4.739	33.786	26.760	0.013
51	4.644	33.784	8.08	324	1.8	3	0.3	27	0.5	20	4.693	33.785	26.770	0.026
74	1.510	—	—	—	—	—	—	—	—	30	4.649	33.784	26.770	0.039
99	0.964	33.897	8.06	333	2.1	21	0.2	30	0.1	50	4.649	33.784	26.770	0.064
125	0.737	33.938	8.04	327	2.1	25	0.0	31	0.1	100	0.952	33.898	27.180	
150	1.160	34.008	8.02	100	2.2	30	0.0	32	0.1	125	0.737	33.938	27.230	
200	2.013	34.219	7.95	242	2.4	48	0.0	36	0.1	150	1.160	34.008	27.260	
250	1.999	34.288	7.91	226	2.5	56	0.0	37	0.3	200	2.013	34.219	27.370	
300	2.090	34.344	7.89	212	2.5	62	0.0	38	0.1	250	1.999	34.288	27.420	
400	2.453	34.507	7.88	187	2.5	73	0.0	37	0.2	300	2.090	34.344	27.460	
500	2.415	34.574	7.88	184	2.5	78	0.0	37	0.2	400	2.453	34.507	27.560	
597	2.379	34.617	7.88	183	2.4	81	0.0	36	0.1	500	2.415	34.574	27.620	
698	2.256	34.653	7.88	184	2.4	84	0.0	36	0.1	600	2.378	34.618	27.660	
796	2.198	34.679	7.89	186	2.4	86	0.0	35	0.1	700	2.254	34.654	27.700	
895	2.180	34.711	7.92	190	2.3	88	0.0	34	0.2	800	2.197	34.680	27.720	
993	2.091	34.725	7.93	194	2.3	90	0.0	34	0.1	1000	2.085	34.725	27.770	
1237	1.887	34.730	7.92	197	2.3	94	0.0	34	0.2	1200	1.919	34.728	27.780	
1404	1.704	34.746	7.93	202	2.3	100	0.0	33	0.2					

Station 8

Meteorological observation

Date	: March 16, 1999	Weather Time(UT)	: 03:00	Wind Direction	: WSW
Time(UT)	: 02:54	Weather	: bc	Velocity	: 12m/s
Latitude	: 51-57.3S	Air Temperature(dry)	: 8.5°C	Wave	: WSW/5
Longitude	: 150-02.9E	Humidity	: 73%	Swell	: W /5
Depth	: 4380 m	Atmospheric Pressure	: 989.2hPa	Visibility	: 20km

O b s e r v e d										I n t e r p o l a t e d				
Depth (m)	T (°C)	S	pH	D02	P04-P	SI03-Si	N02-N	N03-N	NH4-N	Depth (m)	T (°C)	S	σ t	Δ D
				(μ mol/l)										
0	10.200	34.436	8.16	284	0.9	2	0.2	11	0.4	0	10.200	34.436	26.500	0.000
29	9.928	34.392	8.17	288	1.0	2	0.2	12	0.4	10	10.066	34.414	26.500	0.015
45	9.930	34.393	8.16	290	1.0	2	0.2	12	0.4	20	9.965	34.398	26.510	0.031
75	9.954	34.400	8.17	289	1.0	2	0.2	12	0.4	30	9.928	34.392	26.510	0.046
101	9.990	34.432	8.16	285	0.9	2	0.2	12	0.5	50	9.934	34.394	26.510	0.077
125	9.631	34.409	8.15	286	1.0	2	0.3	13	0.4	75	9.954	34.400	26.510	0.116
148	8.941	34.529	8.12	279	1.1	4	0.0	15	0.3	100	9.989	34.431	26.530	0.154
199	8.785	34.548	8.13	279	1.1	4	0.0	15	0.1	125	9.631	34.409	26.570	0.192
249	8.857	34.592	8.13	276	1.1	4	0.0	15	0.1	150	8.923	34.530	26.780	0.227
302	8.722	34.573	8.12	277	1.1	4	0.0	16	0.2	200	8.786	34.549	26.820	0.291
401	8.562	34.560	8.11	277	1.2	4	0.0	16	0.2	250	8.855	34.592	26.840	0.355
501	8.467	34.555	8.09	263	1.3	6	0.0	18	0.2	300	8.726	34.574	26.850	0.418
599	7.089	34.353	8.06	263	1.5	9	0.0	22	0.1	400	8.564	34.560	26.860	0.545
701	6.453	34.353	8.03	238	1.7	14	0.0	25	0.2	500	8.469	34.555	26.870	0.673
794	5.859	34.356	8.00	228	1.9	19	0.0	28	0.2	600	7.083	34.353	26.920	0.799
891	4.769	---	---	---	---	---	---	---	---	700	6.459	34.353	27.000	0.918
995	3.856	34.279	7.98	231	2.2	32	0.0	32	0.1	1000	3.829	34.281	27.250	
1239	3.038	34.381	7.93	206	2.4	51	0.0	34	0.2	1200	3.126	34.361	27.390	
1375	2.783	34.454	7.91	191	2.4	63	0.0	36	0.2					

Station 9

Meteorological observation

Date	: March 17, 1999	Weather Time(UT)	: 03:00	Wind Direction	: W
Time(UT)	: 03:00	Weather	: bc	Velocity	: 12m/s
Latitude	: 47-50.0S	Air Temperature(dry)	: 12.7°C	Wave	: W /5
Longitude	: 150-04.5E	Humidity	: 88%	Swell	: W /6
Depth	: 2400 m	Atmospheric Pressure	: 1011.0hPa	Visibility	: 20km

O b s e r v e d										I n t e r p o l a t e d				
Depth (m)	T (°C)	S	pH	D02	P04-P	SI03-Si	N02-N	N03-N	NH4-N	Depth (m)	T (°C)	S	$\sigma_t$	$\Delta D$
				(μmol/l)										
0	12.000	34.330	8.15	281	0.8	0	0.1	9	0.2	0	12.000	34.330	26.090	0.000
29	11.960	34.316	8.15	278	0.8	0	0.1	9	0.3	10	11.985	34.323	26.090	0.019
49	11.946	34.317	8.15	280	0.8	0	0.1	9	0.2	20	11.972	34.319	26.090	0.039
75	10.249	34.335	8.12	282	1.0	1	0.1	12	—	30	11.959	34.316	26.090	0.058
99	9.015	34.350	8.10	282	1.2	3	0.4	14	—	50	11.937	34.318	26.090	0.097
125	8.400	34.354	8.09	284	1.2	4	1.3	15	0.6	75	10.249	34.335	26.410	0.142
150	8.023	34.365	8.09	283	1.2	4	0.0	17	0.1	100	8.981	34.350	26.630	0.180
203	7.873	34.383	8.08	280	1.3	5	0.0	18	0.2	125	8.400	34.354	26.730	0.215
251	7.703	34.380	8.06	278	1.3	5	0.0	18	0.1	150	8.023	34.365	26.790	0.248
300	7.605	34.377	8.06	275	1.4	6	0.0	19	0.2	200	7.883	34.382	26.830	0.312
399	7.164	34.336	8.04	267	1.5	8	0.0	21	0.1	250	7.706	34.380	26.850	0.375
498	6.663	34.336	8.01	249	1.7	12	0.0	24	0.1	300	7.605	34.377	26.860	0.437
599	6.238	34.373	7.97	225	1.8	18	0.0	26	0.3	400	7.159	34.336	26.890	0.561
698	5.476	34.347	7.95	222	1.9	22	0.0	29	0.2	500	6.653	34.336	26.960	0.681
796	4.697	34.330	7.94	220	2.1	28	0.0	30	0.1	600	6.231	34.373	27.050	0.795
894	4.266	34.345	7.92	214	2.2	35	0.0	31	0.1	700	5.460	34.347	27.130	0.902
993	3.716	34.345	7.91	211	2.3	41	0.0	33	0.1	800	4.669	34.331	27.200	1.001
1100	3.401	34.393	7.90	199	2.4	51	0.0	34	0.1	1000	3.684	34.346	27.320	1.181

## Station A

## Meteorological observation

Date : December 10, 1998      Weather Time(UT) : 12:00      Wind Direction : SW  
 Time(UT) : 11:54      Weather : bc      Velocity : 9m/s  
 Latitude : 59-59.4S      Air Temperature(dry) : -0.8°C      Wave : SW /3  
 Longitude : 86-00.0E      Humidity : 79%      Swell : W /3  
 Depth : 4260 m      Atmospheric Pressure : 989.9hPa      Visibility : 15km

O b s e r v e d										I n t e r p o l a t e d				
Depth (m)	T (°C)	S	pH	D02	P04-P	SI03-Si	N02-N	N03-N	NH4-N	Depth (m)	T (°C)	S	$\sigma_t$	$\Delta D$
				(μmol/l)										
0	-0.500	33.926	8.09	355	1.9	56	0.1	29	0.6	0	-0.500	33.926	27.280	0.000
31	-0.775	---	---	---	---	---	---	---	---	50	-0.783	33.925	27.290	
50	-0.783	33.925	8.09	354	2.0	56	0.1	29	0.6	100	-0.040	34.309	27.570	
73	-1.165	---	8.06	330	2.1	61	0.1	30	0.6	125	0.312	34.411	27.640	
100	-0.040	34.309	7.99	260	2.3	70	0.0	33	0.3	150	0.329	34.461	27.670	
121	0.302	34.403	7.97	241	2.3	75	0.0	34	0.3	200	0.662	34.536	27.720	
149	0.324	34.459	7.97	236	2.3	78	0.0	33	0.2	250	1.397	34.625	27.740	
211	0.768	34.553	7.96	225	2.4	83	0.0	34	0.3	300	1.622	34.673	27.760	
250	1.397	34.625	7.95	206	2.4	84	0.0	34	0.2	400	1.490	34.692	27.790	
300	1.622	34.673	7.95	200	2.3	86	0.0	33	0.4	500	1.560	34.717	27.800	
401	1.490	34.692	7.95	207	2.3	89	0.0	33	0.2	600	1.317	34.710	27.810	
500	1.560	34.717	7.96	206	2.2	91	0.0	32	0.2	700	1.284	34.720	27.820	
600	1.317	34.710	7.96	212	2.3	95	0.0	32	0.2	800	1.219	34.721	27.830	
697	1.286	34.720	7.96	213	2.3	97	0.0	32	0.3	1000	1.074	34.721	27.840	
796	1.222	34.721	7.96	213	2.3	100	0.0	32	0.3	1200	0.897	34.713	27.840	
895	1.151	34.722	7.96	213	2.2	104	0.0	33	0.3	1500	0.697	34.702	27.850	
995	1.078	34.721	7.96	215	2.3	106	0.0	32	0.2					
1239	0.868	34.712	7.95	217	2.3	114	0.0	33	0.2					
1484	0.708	34.703	7.95	218	2.3	119	0.0	33	0.3					
1744	0.536	34.695	7.94	222	2.4	125	0.0	33	0.3					



Station B

Meteorological observation

Date	: March 4, 1999	Weather Time(UT)	: 11:00	Wind Direction	: NNW
Time(UT)	: 10:42	Weather	: c	Velocity	: 4m/s
Latitude	: 61-17.9S	Air Temperature(dry)	: 1.3°C	Wave	: NNW/1
Longitude	: 80-03.5E	Humidity	: 77%	Swell	: WNW/1
Depth	: 2680 m	Atmospheric Pressure	: 1002.9hPa	Visibility	: 20km

O b s e r v e d										I n t e r p o l a t e d				
Depth (m)	T (°C)	S	pH	D02	P04-P	SI03-Si	N02-N	N03-N	NH4-N	Depth (m)	T (°C)	S	σ t	Δ D
0	1.400	33.711	8.10	347	1.4	35	0.3	25	0.3	0	1.400	33.711	27.010	0.000
19	1.308	33.705	8.09	348	1.6	34	0.3	25	0.3	10	1.347	33.707	27.010	0.011
31	1.294	33.706	8.10	349	1.7	34	0.3	26	0.8	20	1.304	33.705	27.010	0.021
50	-0.575	33.830	8.10	354	1.9	34	0.2	27	0.5	30	1.298	33.706	27.010	0.032
75	-0.449	34.115	8.02	290	2.2	51	0.1	31	0.3	50	-0.575	33.830	27.210	0.051
102	1.322	34.358	7.93	218	2.4	68	0.1	36	0.1	75	-0.449	34.115	27.430	0.070
125	1.688	34.451	7.88	197	2.5	74	0.0	36	0.2	100	1.259	34.344	27.520	0.085
149	1.772	34.486	7.88	193	2.5	77	0.0	36	0.2	125	1.688	34.451	27.580	0.099
201	1.899	34.548	7.88	185	2.4	81	0.0	36	0.2	150	1.775	34.487	27.600	0.112
249	1.952	34.589	7.88	183	2.4	83	0.0	35	0.2	200	1.898	34.547	27.640	0.136
300	2.005	34.621	7.89	182	2.4	84	0.0	35	0.2	250	1.953	34.590	27.670	0.159
399	2.043	34.665	7.92	185	2.3	84	0.0	34	0.2	300	2.005	34.621	27.690	0.181
497	2.029	34.695	7.93	190	2.2	85	0.0	33	0.1	400	2.043	34.665	27.720	0.222
596	1.985	34.717	7.94	193	2.3	86	0.0	32	0.2	500	2.028	34.696	27.750	0.262
697	1.920	34.732	7.95	199	2.2	87	0.0	32	0.1	600	1.982	34.718	27.770	0.299
794	1.857	34.740	7.96	204	2.1	88	0.0	31	0.1	700	1.918	34.732	27.790	0.335
895	1.771	34.749	7.97	205	2.1	90	0.0	31	0.2	800	1.853	34.741	27.800	0.370
994	1.670	34.747	7.96	206	2.1	93	0.0	31	0.2	1000	1.665	34.747	27.820	0.438
1243	1.446	34.744	7.96	211	2.1	99	0.0	31	0.2	1200	1.485	34.745	27.830	0.503
1491	1.218	34.734	7.96	214	2.2	107	0.0	31	0.1	1500	1.210	34.734	27.840	0.598
1983	0.801	34.710	7.94	215	2.2	121	0.0	32	0.2	2000	0.787	34.709	27.850	0.750
2548	0.368	34.686	7.92	221	2.3	138	0.0	33	0.2	2500	0.403	34.688	27.850	0.892

Table 5. Petroleum oil, cadmium and mercury concentration in the surface water.

Station No.	Date	Time		Position		Air. Temp.	Water. Temp.	Petroleum Oil	Cadmium	Mercury
		UT	LMT	Latitude	Longitude	(°C)		(µg/l)		
	1998									
1	11 18	2250*	0750	14 - 33.5 N	130 - 13.8 E	29.8	29.5	0.08	---	---
2	20	1150	1950	2 - 22.3 N	121 - 36.0 E	27.8	29.6	0.07	0.015	0.0012
3	22	2250*	0750	4 - 52.6 S	117 - 30.6 E	27.7	29.4	0.23	0.028	0.0009
4	23	2250*	0750	10 - 08.5 S	115 - 27.0 E	28.5	28.7	0.04	0.012	0.0008
5	24	2250*	0750	15 - 42.5 S	114 - 26.6 E	27.0	28.7	0.06	0.012	0.0006
6	25	2250*	0750	21 - 09.9 S	113 - 25.5 E	23.3	25.5	0.05	0.009	0.0005
7	26	2250*	0750	26 - 17.3 S	112 - 50.0 E	20.6	22.8	0.03	0.014	0.0008
8	12 5	0610	1310	42 - 31.6 S	110 - 01.2 E	13.2	11.9	0.05	0.019	0.0006
9	7	0050	0750	51 - 43.5 S	109 - 59.5 E	4.0	3.4	0.09	0.094	0.0006
10	9	0100	0800	59 - 59.1 S	103 - 53.7 E	1.0	0.1	0.07	0.099	0.0006
11	10	1200	1800	59 - 59.4 S	86 - 00.0 E	-0.8	-0.5	0.03	0.108	0.0011

\* The time of the date of the preceding day.

Table 6. Hourly tidal observation at Syowa Station from February 1998 to January 1999 (time is LMT (UT+3 hours)).

Station : SYOWA STATION  
 Latitude : 69° 00' 28" S  
 Longitude : 39° 34' 13" E  
 Duration : Feb. 1-Feb. 28 1998  
 Unit : CENTIMETER

The zero of the tide gauge  
 relative to the bench mark No. 1040:  
 -4.638m Jan. 25 1998  
 -4.686m Jan. 3 1999

Date	Time																							(24H)		(25H)				
	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	SUM	MEAN	SUM	MEAN		
1	196	183	176	180	194	217	232	245	252	251	235	214	194	177	167	168	178	194	212	228	239	241	236	222	5032	210	5237	209		
2	205	189	177	175	182	199	217	231	243	248	245	234	220	207	199	197	200	211	227	239	251	253	250	237	5236	218	5459	218		
3	224	210	196	184	184	193	202	216	228	235	235	237	229	224	222	220	219	225	235	244	251	254	251	246	5362	223	5598	224		
4	236	222	209	197	191	190	192	198	205	214	221	224	228	230	232	235	236	239	245	248	253	256	252	251	5402	225	5648	226		
5	246	237	228	219	208	200	194	194	194	199	204	212	221	229	242	252	257	261	262	263	263	262	262	261	5573	232	5831	233		
6	258	256	253	245	237	226	212	200	194	191	192	196	206	220	236	249	262	268	267	264	256	255	252	249	5644	235	5894	236		
7	250	251	250	246	241	231	214	194	181	169	164	165	174	191	210	230	248	256	260	257	248	243	237	234	5343	223	5580	223		
8	237	240	244	249	249	241	226	205	183	165	154	150	157	173	198	223	243	258	263	261	254	243	234	231	5281	220	5512	220		
9	230	239	249	255	262	261	244	226	201	173	156	141	145	159	179	204	228	245	256	254	245	232	219	210	5216	217	5425	217		
10	210	217	228	245	253	256	250	230	208	177	153	136	133	141	163	190	216	237	251	252	244	230	214	202	5035	210	5234	209		
11	199	205	220	236	252	261	259	246	225	198	169	148	137	142	161	189	215	238	256	261	254	242	224	209	5149	215	5352	214		
12	203	204	215	234	252	267	269	262	245	217	188	161	144	142	155	179	205	225	246	254	250	237	221	203	5178	216	5370	215		
13	193	191	198	216	237	257	267	262	252	231	205	179	161	154	161	178	204	228	246	258	259	246	229	211	5223	218	5424	217		
14	200	193	194	210	231	253	266	270	263	250	225	199	181	170	170	184	206	228	248	260	262	254	237	219	5374	224	5578	223		
15	204	195	193	204	222	242	258	266	264	254	236	214	195	184	181	190	207	227	245	259	262	255	243	224	5425	226	5634	225		
16	208	196	192	193	207	224	239	250	254	249	237	219	202	192	187	191	201	220	235	247	252	249	238	222	5301	221	5507	220		
17	206	194	184	183	193	208	222	232	240	239	234	222	208	197	194	195	203	215	229	241	245	245	237	222	5187	216	5396	216		
18	209	198	185	181	183	193	204	213	223	226	224	222	213	206	207	209	213	221	231	239	245	244	236	227	5152	215	5367	215		
19	216	205	194	187	185	189	194	199	207	214	217	218	217	217	218	222	225	230	236	243	246	245	243	236	5201	217	5429	217		
20	228	219	210	204	198	196	195	196	200	206	211	216	221	225	232	239	245	248	252	256	256	254	253	251	5413	226	5661	226		
21	248	241	237	228	220	213	207	199	193	194	197	203	212	224	237	248	255	260	259	258	254	251	248	246	5533	231	5777	231		
22	244	241	239	237	231	222	209	196	185	179	177	183	195	211	231	248	258	265	263	259	253	244	239	238	5448	227	5687	227		
23	239	241	245	247	242	236	223	201	181	167	160	162	172	190	216	239	256	268	271	264	254	243	233	228	5377	224	5609	224		
24	232	240	246	254	257	251	238	213	188	168	152	144	152	167	195	224	249	265	270	265	253	237	224	216	5300	221	5518	221		
25	219	228	240	254	264	266	255	235	207	179	154	140	138	153	180	208	235	258	271	268	256	238	219	207	5275	220	5482	219		
26	207	217	232	253	270	282	278	259	233	202	173	149	139	146	166	196	226	253	267	270	259	241	219	200	5338	222	5533	221		
27	194	198	216	237	258	276	284	276	255	226	194	164	147	145	158	183	211	237	256	264	255	236	214	192	5276	220	5455	218		
28	178	174	189	212	237	263	279	281	271	248	218	188	165	157	162	180	205	230	251	262	260	244	222	198	5273	220	5450	218		
1	177																													
MONTHLY MEAN																											221.0cm			

Station : SYOWA STATION  
 Latitude : 69° 00' 28" S  
 Longitude : 39° 34' 13" E  
 Duration : Mar. 1-Mar. 31 1998  
 Unit : CENTIMETER

Date	Time																							(24H)		(25H)				
	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	SUM	MEAN	SUM	MEAN		
1	177	166	174	195	219	247	267	276	276	262	238	212	190	174	170	184	203	225	244	256	257	244	222	196	5273	220	5446	218		
2	172	157	152	162	183	207	229	246	254	250	236	218	198	183	176	184	199	217	235	246	252	245	229	209	5039	210	5229	209		
3	190	171	162	166	179	202	228	250	263	270	266	257	244	233	227	227	234	247	259	266	267	262	247	227	5544	231	5752	230		
4	207	189	171	164	166	180	196	209	221	233	237	235	231	229	228	231	239	246	258	269	271	272	261	250	5395	225	5630	225		
5	234	219	204	192	186	188	194	198	207	213	217	221	222	222	227	229	231	236	242	245	249	247	241	234	5297	221	5522	221		
6	226	217	209	199	191	189	188	190	194	200	207	216	226	234	245	257	260	266	269	271	274	272	271	271	5541	231	5808	232		
7	267	262	258	252	242	228	220	209	199	197	200	202	211	225	235	248	257	263	260	257	255	247	239	237	5673	236	5909	236		
8	236	234	235	235	228	220	207	194	179	171	168	169	180	193	212	232	247	255	255	251	244	233	227	225	5230	218	5455	218		
9	226	231	238	242	244	240	227	211	192	178	167	166	175	189	211	233	250	261	264	259	249	235	226	223	5337	222	5561	222		
10	224	231	244	255	260	259	252	233	209	189	173	165	168	180	202	227	245	257	263	258	245	227	213	206	5387	224	5593	224		
11	206	215	230	245	257	263	256	239	216	192	169	157	155	168	188	213	237	251	257	255	241	224	205	193	5231	218	5419	217		
12	188	198	215	233	250	261	259	247	227	198	176	157	150	160	180	204	227	246	255	255	243	224	205	190	5148	214	5331	213		
13	183	192	208	230	252	269	275	267	248	225	199	177	167	169	184	209	232	253	265	264	253	233	211	195	5361	223	5543	222		
14	183	185	198	220	245	266	276	275	261	240	216	194	178	177	187	207	232	251	264	268	258	239	218	196	5435	226	5617	225		
15	182	178	188	206	230	253	267	273	264	248	226	202	185	177	181	199	223	241	255	260	252	235	213	191	5329	222	5502	220		
16	173	166	169	185	208	233	251	260	259	249	229	209	193	184	186	197	218	236	252	259	256	242	223	198	5236	218	5416	217		
17	180	170	171	180	201	226	244	257	262	257	245	230	216	208	206	216	233	251	264	274	274	263	246	227	5502	229	5708	228		
18	206	194	189	195	210	229	247	261	269	271	265	252	240	233	227	230	244	256	268	278	277	266	251	232	5790	241	6003	240		
19	213	197	188	186	195	209	224	236	245	251	252	244	236	231	229	233	242	252	262	270	271	266	256	243	5631	235	5856	234		
20	226	215	206	201	207	215	228	240	248	257	263	263	264	265	266	270	274	279	287	291	292	286	278	268	6090	254	6344	254		
21	254	242	231	224	221	221	224	230	236	244	251	257	261	267	274	278	281	282	285	286	285	280	274	265	6149	256	6404	256		
22	255	247	240	229	223	216	212	209	207	212	218	227	238	248	257	267	273	274	274	270	267	264	257	256	5840	243	6094	244		
23	255	252	250	246	239	229	218	209	200	198	201	207	221	235	251	267	275	279	277	271	262	254	248	247	5790	241	6039	242		
24	249	254	256	257	256	244	231	215	198	190	185	190	204	224	245	264	280	285	283	272	257	248	239	235	5759	240	5998	240		
25	239	248	260	266	270	266	251	230	206	187	177	174	181	201	225	249	268	277	277	263	249	230	217	212	5624	234	5841	234		
26	217	228	245	262	271	274	264	245	216	188	169	160	161	179	200	228	251	267	268	258	239	217	196	188	5392	225	5582	223		
27	190	205	227	252	271	281	281	266	238	213	186	168	164	178	198	226	250	269	276	268	248	222	196	178	5451	227	5625	225		
28	174	187	209	237	264	284	293	286	265	239	210	185	173	176	194	217	240	260	269	267	249	222	193	169	5462	228	5619	225		
29	157	161	182	209	241	268	286	290	280	260	233	208	191	188	196	218	240	257	269	270	257	231	201	174	5468	228	5624	225		
30	156	151	166	190	219	252	276	289	290	280	259	238	220	210	215	229	249	265	279	282	273	251	222	193	5652	235	5820	233		
31	168	156	154	170	197	225	250	267	276	273	261	250	235	225	223	233	251	266	279	284	282	267	246	220	5657	236	5852	234		
1	196																													
MONTHLY MEAN																													229.5cm	

Station : SYOWA STATION  
 Latitude : 69° 00' 28" S  
 Longitude : 39° 34' 13" E  
 Duration : Apr. 1-Apr. 30 1998  
 Unit : CENTIMETER

Date	Time																							(24H)		(25H)			
	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	SUM	MEAN	SUM	MEAN	
1	196	178	173	180	198	223	245	262	275	282	281	272	264	256	250	256	265	278	288	292	290	280	262	236	5982	249	6195	248	
2	213	194	178	174	182	195	212	229	238	250	253	252	250	249	247	247	253	264	273	281	280	272	260	247	5692	237	5920	237	
3	229	212	198	188	186	191	196	207	217	224	231	237	237	242	246	248	251	257	263	265	267	261	255	246	5554	231	5789	232	
4	235	224	216	206	200	198	196	197	200	206	214	223	229	237	246	251	256	259	260	259	259	254	247	246	5518	230	5759	230	
5	241	234	232	228	219	214	205	200	199	199	203	211	220	230	244	253	259	261	260	256	250	243	239	239	5542	231	5781	231	
6	238	241	246	245	244	240	231	219	211	208	209	214	225	239	256	268	278	279	276	269	259	248	241	239	5824	243	6066	243	
7	242	248	256	260	260	256	245	229	215	205	197	198	207	220	239	255	262	267	264	257	241	227	217	214	5682	237	5901	236	
8	219	229	240	250	257	257	246	229	213	194	184	181	187	201	220	238	251	256	255	243	227	209	194	190	5367	224	5562	222	
9	195	206	226	243	254	261	255	240	221	201	187	179	184	197	219	241	255	266	266	255	237	217	202	193	5399	225	5598	224	
10	198	213	233	255	274	284	284	272	253	231	214	203	201	212	233	254	271	283	282	272	253	229	208	195	5808	242	6000	240	
11	193	204	226	251	272	290	292	285	267	247	227	211	205	212	229	249	266	279	281	271	253	227	202	184	5822	243	5998	240	
12	176	181	201	227	250	272	281	277	266	245	226	208	198	201	215	235	255	268	275	268	252	227	199	180	5584	233	5754	230	
13	170	172	186	213	240	264	280	283	276	261	241	224	210	209	219	235	255	271	278	275	260	236	208	185	5653	236	5823	233	
14	170	166	176	196	222	248	267	276	274	263	250	231	217	213	218	231	250	266	274	275	264	245	216	192	5601	233	5773	231	
15	172	164	168	184	207	232	254	267	272	268	257	242	228	219	222	229	245	260	271	274	269	250	226	203	5582	233	5766	231	
16	184	171	172	182	197	219	241	256	262	265	259	247	237	232	229	236	249	262	272	277	274	259	239	217	5640	235	5839	234	
17	198	184	176	181	193	212	230	246	258	264	266	260	254	250	248	251	259	268	277	280	277	267	251	229	5780	241	5992	240	
18	212	197	184	181	184	195	205	218	229	237	243	245	243	245	245	245	250	258	262	266	264	258	248	234	5548	231	5770	231	
19	222	208	197	191	189	191	198	207	215	225	233	239	244	249	253	254	257	259	260	261	259	255	249	240	5553	231	5786	231	
20	233	225	217	209	203	198	198	199	201	209	220	230	239	249	259	264	265	264	263	262	259	255	253	250	5627	234	5878	235	
21	252	249	247	244	237	228	218	212	209	211	217	229	240	256	268	276	278	277	270	262	258	249	245	248	5878	245	6130	245	
22	252	255	261	260	258	249	235	223	210	202	203	211	223	242	260	269	278	274	264	254	238	226	221	222	5790	241	6020	241	
23	229	241	255	261	266	261	246	228	209	193	185	192	200	216	240	253	262	264	257	240	222	203	192	196	5511	230	5717	229	
24	205	224	243	264	279	278	270	254	229	206	193	189	196	208	228	244	257	259	252	234	207	183	166	157	5423	226	5591	224	
25	168	188	208	235	257	268	266	253	230	205	188	177	178	191	212	231	249	256	254	237	210	180	158	143	5143	214	5288	212	
26	145	164	190	222	251	272	283	281	264	244	224	208	200	211	228	244	258	270	267	252	226	195	163	137	5397	225	5528	221	
27	131	139	163	194	225	252	269	274	265	247	230	213	206	208	220	244	268	276	284	283	260	230	201	174	5457	227	5618	225	
28	161	164	179	211	242	271	294	305	300	290	272	256	240	233	239	255	270	283	286	282	264	237	204	173	5911	246	6061	242	
29	150	137	142	163	186	216	240	257	265	264	256	244	234	228	228	237	254	266	272	274	264	242	215	189	5423	226	5586	223	
30	163	145	143	149	168	192	214	232	247	253	249	245	240	235	232	238	250	261	270	275	270	256	236	214	5378	224	5570	223	
1	192																												
MONTHLY MEAN																										233.4cm			

Station : SYOWA STATION  
 Latitude : 69° 00' 28" S  
 Longitude : 39° 34' 13" E  
 Duration : May. 1-May. 31 1998  
 Unit : CENTIMETER

Date	Time																							(24H)		(25H)				
	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	SUM	MEAN	SUM	MEAN		
1	192	170	163	164	171	189	209	227	241	253	258	260	261	262	262	262	271	279	285	291	288	277	266	249	5748	239	5978	239		
2	231	216	202	196	197	205	214	224	235	246	251	254	255	259	261	256	257	262	262	267	263	257	249	236	5753	240	5976	239		
3	223	210	201	191	187	185	191	197	207	214	225	234	243	254	262	264	266	269	269	270	267	262	256	250	5599	233	5841	234		
4	242	236	231	224	213	210	209	206	208	213	218	226	235	245	253	256	259	256	252	252	247	243	241	242	5617	234	5862	234		
5	245	243	246	246	240	234	228	219	214	214	213	222	231	240	249	256	257	254	247	235	228	221	215	215	5612	234	5835	233		
6	223	227	233	240	239	235	228	215	209	202	201	210	223	233	244	253	257	254	247	233	220	208	203	206	5445	227	5661	226		
7	215	229	241	254	259	257	250	239	224	215	212	213	224	237	248	260	267	264	255	240	223	207	198	198	5628	234	5834	233		
8	206	221	238	254	262	264	260	246	229	214	206	204	212	224	233	248	255	253	243	226	204	182	169	168	5421	226	5596	224		
9	174	189	207	229	245	253	252	241	224	208	197	190	197	211	228	240	250	256	251	233	215	193	177	173	5232	218	5411	216		
10	178	196	220	247	268	279	286	276	261	245	228	219	220	231	246	260	269	274	269	253	228	200	179	165	5695	237	5856	234		
11	161	171	193	219	243	260	267	263	247	231	213	197	194	200	209	228	240	245	242	231	205	178	155	138	5131	214	5260	210		
12	130	139	160	187	213	238	252	258	249	233	218	206	200	198	213	225	238	249	248	238	218	188	163	139	4998	208	5124	205		
13	126	126	141	166	192	219	240	250	247	238	225	211	201	199	206	218	231	242	244	239	224	196	168	144	4893	204	5020	201		
14	127	120	125	146	168	195	219	231	238	235	224	214	203	199	201	210	225	237	243	244	231	209	185	159	4790	200	4928	197		
15	139	129	129	140	163	187	211	228	239	243	236	229	224	216	216	223	235	247	254	257	250	233	211	187	5025	209	5193	208		
16	168	152	146	152	164	186	207	223	236	248	247	241	237	233	230	230	239	246	253	258	253	241	227	205	5222	218	5408	216		
17	186	172	162	160	166	179	195	211	228	238	243	246	247	243	239	239	241	249	256	259	256	249	237	226	5326	222	5537	221		
18	210	197	185	178	175	179	188	199	207	222	231	235	238	241	238	235	232	232	235	236	234	231	227	218	5206	217	5418	217		
19	212	201	193	186	176	173	176	180	187	197	207	217	225	230	231	230	225	222	218	217	216	214	215	215	4962	207	5177	207		
20	215	212	210	206	199	192	185	183	182	188	199	207	221	229	232	232	229	219	211	203	197	196	195	200	4941	206	5146	206		
21	205	211	215	219	213	202	193	182	174	175	179	186	201	215	224	231	229	221	210	198	187	181	184	195	4831	201	5039	202		
22	207	224	237	249	253	247	239	228	216	210	208	215	227	241	253	262	262	251	238	218	198	185	178	184	5429	226	5627	225		
23	198	218	242	261	271	275	269	254	237	222	214	216	224	237	250	260	263	258	241	220	191	170	158	156	5504	229	5674	227		
24	170	192	217	245	264	275	276	265	249	232	218	215	220	230	243	255	262	261	248	226	196	169	148	139	5415	226	5562	222		
25	146	166	187	224	250	269	279	275	262	246	232	221	220	231	245	258	267	270	261	246	215	180	152	135	5437	227	5568	223		
26	131	145	170	204	234	262	280	285	285	276	261	252	247	255	266	278	292	296	291	277	248	211	179	151	5775	241	5909	236		
27	135	136	149	177	203	228	253	264	263	256	244	232	224	221	231	245	258	267	269	260	242	214	182	152	5305	221	5440	218		
28	135	127	135	153	179	206	231	248	257	255	247	240	231	226	227	239	254	264	270	271	260	236	211	182	5284	220	5444	218		
29	160	148	148	159	180	201	227	248	262	267	264	261	258	251	248	256	266	275	284	288	282	267	247	226	5671	236	5877	235		
30	206	187	177	180	191	210	227	244	260	268	268	272	268	262	257	259	264	273	283	287	285	278	264	242	5912	246	6140	246		
31	228	208	194	190	189	199	211	225	237	246	252	253	251	246	245	240	239	247	251	256	256	249	244	231	5586	233	5808	232		
1	222																													
MONTHLY MEAN																													223.6cm	

Station : SYOWA STATION  
 Latitude : 69° 00' 28" S  
 Longitude : 39° 34' 13" E  
 Duration : Jun. 1-Jun. 30 1998  
 Unit : CENTIMETER

Date	Time																							(24H)		(25H)				
	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	SUM	MEAN	SUM	MEAN		
1	222	211	197	192	189	192	200	210	220	229	234	240	242	240	238	236	232	231	234	237	235	235	232	227	5355	223	5576	223		
2	221	216	210	203	200	201	200	205	215	220	229	235	240	243	244	244	239	239	239	235	233	238	239	239	5430	226	5675	227		
3	245	248	246	246	243	235	232	231	231	234	239	245	251	256	257	258	252	246	241	234	227	223	223	223	5765	240	5992	240		
4	227	230	234	234	231	230	222	214	213	212	216	224	232	243	248	250	246	240	233	222	217	212	209	221	5458	227	5688	228		
5	230	242	255	264	267	265	260	253	240	238	241	246	252	258	263	262	261	249	238	219	203	193	186	184	5768	240	5965	239		
6	197	208	221	233	238	240	234	223	214	205	203	205	213	223	231	235	239	233	220	205	188	174	166	168	5117	213	5297	212		
7	180	202	223	242	259	267	266	259	249	237	230	234	239	244	260	265	265	263	251	232	211	189	171	166	5602	233	5780	231		
8	177	192	217	240	259	272	276	266	255	243	231	227	230	234	246	254	260	257	248	224	198	173	152	140	5472	228	5618	225		
9	146	160	182	208	234	252	259	262	250	235	226	220	217	228	240	254	263	264	259	244	219	194	170	153	5338	222	5490	220		
10	152	162	184	211	239	264	279	280	276	263	251	240	235	240	249	263	275	280	279	266	241	214	183	162	5690	237	5846	234		
11	156	158	173	201	229	254	272	281	279	270	259	246	238	237	243	256	268	273	277	267	244	218	188	162	5651	235	5795	232		
12	144	139	145	169	193	216	241	254	261	254	244	234	222	216	222	231	239	252	259	256	241	216	186	161	5193	216	5336	213		
13	142	130	129	144	168	192	216	234	248	249	241	234	226	221	218	226	238	250	259	262	253	236	211	188	5115	213	5281	211		
14	166	148	141	149	163	185	208	227	240	248	249	243	236	230	226	229	237	247	260	263	262	255	235	218	5265	219	5464	219		
15	199	181	169	171	178	195	212	231	246	256	261	263	259	251	245	240	244	251	262	266	265	264	256	239	5602	233	5829	233		
16	227	209	197	190	188	196	208	220	233	244	253	255	251	248	241	233	228	230	237	243	246	245	242	236	5500	229	5731	229		
17	232	219	209	203	198	197	198	206	215	224	234	240	244	242	237	231	221	218	219	220	223	226	229	234	5318	222	5553	222		
18	234	233	228	225	216	212	210	215	215	224	233	237	245	247	243	238	228	216	211	203	201	206	209	219	5349	223	5577	223		
19	228	234	237	239	238	233	224	221	215	217	223	231	238	240	243	239	230	216	201	190	181	179	182	191	5270	220	5474	219		
20	204	222	235	242	247	245	236	227	220	217	220	223	233	237	240	241	234	220	205	184	170	161	158	168	5191	216	5377	215		
21	186	203	226	244	256	261	258	248	236	228	227	227	233	239	250	254	248	239	222	198	174	157	148	150	5312	221	5476	219		
22	165	186	213	236	258	270	271	266	257	245	235	237	242	249	261	265	263	260	245	220	193	169	149	142	5499	229	5649	226		
23	150	170	195	222	248	268	277	278	269	259	246	241	244	252	260	271	275	272	262	240	212	183	154	138	5587	233	5725	229		
24	139	149	172	201	227	252	266	274	269	259	247	238	236	240	251	264	270	276	270	256	230	197	167	143	5493	229	5624	225		
25	131	133	154	175	202	228	251	265	263	258	248	239	229	228	235	248	260	268	269	260	239	211	182	153	5328	222	5463	219		
26	135	131	139	160	184	209	231	248	256	255	245	236	227	225	226	238	253	265	272	268	259	236	209	180	5286	220	5442	218		
27	156	143	144	153	174	200	221	236	247	246	243	234	226	217	216	222	234	249	253	256	254	236	216	190	5167	215	5334	213		
28	167	152	146	152	162	181	203	219	232	237	235	228	223	216	209	212	222	230	243	248	250	242	225	209	5044	210	5235	209		
29	191	176	166	166	171	184	203	217	230	241	238	234	230	222	214	212	214	222	228	235	240	237	229	218	5118	213	5319	213		
30	202	191	183	180	186	200	214	229	241	248	256	258	252	252	250	243	237	242	253	261	263	264	264	257	5624	234	5871	235		
1	247																													
MONTHLY MEAN																													224.9cm	

Station : SYOWA STATION  
 Latitude : 69° 00' 28" S  
 Longitude : 39° 34' 13" E  
 Duration : Jul. 1-Jul. 31 1998  
 Unit : CENTIMETER

Date	Time																							(24H)		(25H)				
	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	SUM	MEAN	SUM	MEAN		
1	247	236	227	217	216	217	219	227	233	236	239	242	237	228	222	213	205	203	205	204	205	206	205	205	5293	221	5496	220		
2	203	200	196	193	194	191	193	199	209	214	223	232	229	228	228	224	216	214	214	212	212	216	220	226	5085	212	5315	213		
3	231	231	236	236	236	235	236	238	236	241	244	249	250	249	247	243	230	224	215	207	204	203	199	206	5527	230	5741	230		
4	214	224	232	237	244	244	238	235	236	229	230	237	240	241	243	241	230	223	211	200	188	184	185	191	5379	224	5585	223		
5	205	224	237	246	258	260	258	255	246	242	247	251	257	259	261	265	260	247	235	218	202	188	185	185	5690	237	5891	236		
6	201	217	233	248	261	266	260	256	245	238	236	235	240	246	250	253	248	240	224	203	183	168	153	148	5451	227	5611	224		
7	160	175	195	219	236	247	250	247	236	223	215	215	218	224	236	240	241	235	225	204	180	156	142	137	5057	211	5198	208		
8	142	158	183	205	232	251	261	259	250	242	232	230	233	238	252	261	268	268	261	240	216	192	168	154	5394	225	5548	222		
9	154	170	191	222	246	268	285	288	282	271	261	253	248	249	264	276	283	286	279	268	240	209	180	159	5833	243	5983	239		
10	150	155	170	197	225	247	267	278	276	267	253	240	234	236	244	257	269	278	278	269	248	222	193	166	5619	234	5772	231		
11	153	151	165	192	218	245	273	294	296	291	279	272	262	254	261	271	287	299	302	299	288	265	229	201	6047	252	6228	249		
12	181	168	168	185	208	234	256	274	281	275	265	254	240	227	226	236	250	261	274	279	268	253	225	201	5690	237	5863	235		
13	173	161	154	160	181	205	227	244	260	262	254	246	236	221	215	221	231	242	256	266	265	253	237	216	5386	224	5580	223		
14	194	174	166	166	174	193	212	226	242	249	249	242	228	218	206	202	209	220	233	245	248	249	238	223	5208	217	5416	217		
15	208	193	180	174	176	183	196	209	222	229	231	227	215	204	194	186	186	190	200	208	219	223	223	219	4896	204	5108	204		
16	212	203	196	188	188	192	201	210	220	229	235	236	226	219	209	203	194	191	195	201	210	217	225	230	5028	209	5258	210		
17	231	230	228	223	221	223	223	227	235	236	242	247	243	236	230	219	209	198	191	192	195	202	207	216	5303	221	5530	221		
18	227	234	237	240	243	236	236	234	233	236	236	240	244	235	234	220	209	194	186	173	169	173	174	183	5226	218	5426	217		
19	200	212	226	237	243	245	242	236	235	234	235	236	240	241	237	231	223	205	189	174	161	152	150	156	5142	214	5314	213		
20	173	190	210	230	239	248	251	248	241	236	236	238	242	246	249	246	239	231	213	189	169	154	142	143	5205	217	5365	215		
21	160	176	196	219	241	254	260	255	248	237	234	232	234	238	246	250	252	245	227	207	179	159	141	133	5223	218	5364	215		
22	141	158	179	205	232	251	258	263	253	243	236	230	229	238	244	256	263	259	252	233	205	177	153	138	5294	221	5431	217		
23	137	145	172	201	229	251	266	270	267	255	244	236	234	236	246	262	270	273	271	258	231	201	173	147	5474	228	5613	225		
24	139	143	159	184	212	237	255	265	261	252	239	225	217	217	227	238	253	261	263	255	236	205	174	146	5264	219	5396	216		
25	132	126	138	160	186	207	231	245	246	239	227	216	206	202	207	224	240	250	260	261	247	224	198	174	5047	210	5199	208		
26	152	142	148	166	192	217	237	254	258	255	245	234	218	213	216	225	245	259	269	274	268	251	228	204	5370	224	5550	222		
27	180	166	162	172	188	212	230	240	248	246	238	226	215	205	197	203	215	229	241	253	249	241	224	205	5185	216	5369	215		
28	183	167	162	165	178	199	216	230	237	239	234	226	212	204	197	199	208	223	236	251	256	252	243	229	5145	214	5361	214		
29	216	208	200	201	207	224	240	252	266	268	267	258	248	236	230	224	226	231	243	257	260	263	257	247	5726	239	5961	238		
30	235	224	220	215	220	230	240	252	260	263	262	260	248	236	230	224	219	219	229	239	239	240	241	240	5686	237	5918	237		
31	233	226	223	220	220	226	229	236	244	249	245	245	236	228	218	211	204	200	207	208	210	213	217	221	5370	224	5592	224		
1	222																													
MONTHLY MEAN																													223.4cm	



Station : SYOWA STATION  
 Latitude : 69° 00' 28" S  
 Longitude : 39° 34' 13" E  
 Duration : Aug. 1-Aug. 31 1998  
 Unit : CENTIMETER

Date	Time																							(24H)		(25H)				
	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	SUM	MEAN	SUM	MEAN		
1	222	219	220	227	225	230	233	237	241	244	244	243	239	233	225	215	206	202	200	196	196	199	204	212	5310	221	5527	221		
2	216	225	232	238	241	243	244	244	249	246	245	248	245	241	235	228	222	210	202	196	190	188	189	193	5412	226	5616	225		
3	204	214	225	235	240	241	240	235	234	232	231	234	232	230	233	228	221	212	200	185	175	167	163	170	5179	216	5362	214		
4	182	197	215	231	243	248	250	243	239	233	229	230	231	235	239	239	234	226	209	191	174	157	152	152	5179	216	5340	214		
5	162	179	201	225	241	253	255	248	238	232	223	219	222	231	238	242	243	236	222	205	178	160	144	139	5136	214	5287	211		
6	151	172	196	226	249	264	276	271	264	253	243	239	239	250	260	269	276	274	262	243	216	189	167	154	5604	234	5759	230		
7	155	170	195	221	248	270	278	280	270	253	239	229	224	232	243	254	263	267	263	243	219	189	156	138	5497	229	5627	225		
8	130	135	157	184	212	239	256	260	257	241	228	215	208	216	228	248	264	273	274	265	242	208	177	152	5273	220	5408	216		
9	136	135	149	174	204	232	254	264	261	253	239	221	210	210	218	236	254	272	280	276	267	243	207	176	5370	224	5533	221		
10	163	153	158	179	207	237	259	275	279	271	257	242	227	219	221	237	256	273	287	293	287	267	239	214	5701	238	5893	236		
11	192	175	173	180	202	225	241	258	263	256	244	226	206	193	189	196	213	234	251	262	265	255	238	216	5351	223	5549	222		
12	198	177	173	175	187	206	223	239	244	244	232	217	199	180	173	170	183	202	215	232	244	245	234	224	5015	209	5225	209		
13	210	193	185	183	188	203	219	230	237	239	233	219	203	188	173	166	169	175	194	209	220	226	230	223	4915	205	5133	205		
14	218	208	206	203	202	214	224	233	240	239	242	231	219	205	188	175	173	170	179	190	200	207	213	215	4994	208	5210	208		
15	215	215	216	219	213	220	229	230	236	237	235	228	220	207	196	180	171	163	162	161	167	177	177	186	4860	203	5056	202		
16	196	202	208	215	216	215	224	225	225	226	224	224	221	214	202	195	188	172	166	162	156	155	161	170	4762	198	4944	198		
17	182	200	210	224	234	237	237	239	238	232	238	232	232	235	232	229	217	194	178	166	166	160	157	164	5071	211	5249	210		
18	178	195	218	234	247	254	257	250	246	239	230	232	233	236	240	239	236	221	204	187	164	147	141	140	5168	215	5315	213		
19	147	167	189	211	228	240	244	241	232	221	216	216	217	224	232	241	242	240	224	207	182	161	144	140	5009	209	5155	206		
20	146	165	187	211	236	252	261	258	246	238	228	221	222	229	242	254	263	260	253	233	207	180	158	143	5293	221	5434	217		
21	142	155	176	201	223	242	255	253	241	227	211	202	201	206	220	236	247	253	248	236	212	183	153	135	5058	211	5186	207		
22	128	137	152	179	205	224	239	239	232	219	201	185	179	187	201	216	235	246	250	242	222	194	166	143	4821	201	4948	198		
23	127	128	143	164	191	211	227	237	233	220	203	190	180	180	190	210	232	249	259	258	246	222	195	172	4866	203	5021	201		
24	155	150	159	181	203	228	245	252	249	238	224	204	191	187	191	207	228	248	261	264	259	238	213	189	5164	215	5338	214		
25	175	167	168	181	206	229	243	253	255	242	226	207	193	186	187	196	215	236	250	259	259	244	224	207	5208	217	5394	216		
26	186	177	178	182	200	223	239	246	248	245	230	210	197	186	179	187	202	223	239	249	252	247	234	220	5181	216	5383	215		
27	202	194	191	198	207	225	240	248	251	248	236	219	201	194	185	186	193	209	226	235	246	247	240	229	5250	219	5470	219		
28	220	209	206	211	218	231	246	256	259	255	249	235	217	204	197	196	197	204	214	230	235	239	239	232	5397	225	5625	225		
29	228	223	221	224	230	241	249	258	262	266	263	250	235	225	216	209	205	209	215	225	230	234	236	237	5590	233	5822	233		
30	233	233	234	234	236	242	247	249	253	253	248	238	233	216	208	204	197	193	192	194	200	201	206	214	5356	223	5571	223		
31	215	220	226	231	235	239	239	239	239	238	236	228	222	217	207	205	199	187	178	176	178	179	185	188	5109	213	5309	212		
1	201																													
MONTHLY MEAN																											216.5cm			

Station : SYOWA STATION  
 Latitude : 69° 00' 28" S  
 Longitude : 39° 34' 13" E  
 Duration : Sep. 1-Sep. 30 1998  
 Unit : CENTIMETER

Date	Time																								(24H)		(25H)		
	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	SUM	MEAN	SUM	MEAN	
1	201	215	226	236	244	248	246	244	242	241	239	235	237	231	233	230	221	211	202	191	184	177	177	185	5297	221	5494	220	
2	198	212	230	242	252	256	252	246	239	235	228	223	227	226	230	229	224	211	198	178	163	150	145	149	5144	214	5305	212	
3	161	178	202	222	239	244	244	237	227	217	209	206	209	216	224	229	232	222	205	184	163	145	135	131	4880	203	5018	201	
4	139	159	187	211	235	250	254	246	240	225	213	209	214	229	240	255	263	266	252	231	207	181	160	154	5220	218	5374	215	
5	154	172	201	230	253	272	276	272	254	237	223	213	212	221	237	255	267	271	263	243	216	184	157	139	5422	226	5553	222	
6	131	143	165	192	219	239	249	248	235	214	195	178	174	184	205	228	248	261	266	256	232	200	171	146	4979	207	5112	204	
7	134	141	157	183	212	236	250	252	240	221	199	182	169	171	191	213	239	261	271	269	255	230	196	174	5044	210	5201	208	
8	156	149	160	180	206	226	247	251	242	226	203	178	163	159	170	192	216	241	259	265	266	244	217	194	5011	209	5186	207	
9	176	162	166	181	198	222	236	244	242	225	201	178	156	144	143	158	182	209	229	248	250	239	226	206	4821	201	5008	200	
10	186	172	170	180	198	212	228	238	237	228	204	178	159	141	131	140	157	179	199	221	232	229	221	211	4651	194	4850	194	
11	200	193	185	190	202	218	231	239	241	237	221	202	179	164	150	148	152	170	189	206	218	229	230	223	4817	201	5037	201	
12	220	221	213	214	223	235	242	250	255	246	241	225	205	191	179	168	164	168	179	191	203	209	213	218	5075	211	5293	212	
13	218	220	225	227	228	237	242	243	245	243	239	231	216	205	191	186	174	168	172	177	180	185	194	208	5053	211	5269	211	
14	216	224	237	243	252	258	258	264	262	266	261	258	256	253	246	241	229	217	209	199	200	196	200	211	5655	236	5878	235	
15	222	234	247	260	265	268	266	266	256	250	249	242	238	238	235	229	224	209	194	181	171	162	162	170	5436	227	5620	225	
16	183	201	219	238	251	258	257	252	246	239	234	234	237	241	246	249	246	240	223	204	184	171	164	167	5383	224	5560	222	
17	177	193	216	233	247	258	253	243	231	222	211	209	213	221	232	244	244	241	226	209	187	167	153	152	5185	216	5344	214	
18	159	174	200	222	241	251	252	245	231	215	204	200	204	216	232	243	255	255	245	229	205	182	157	150	5168	215	5318	213	
19	150	167	193	217	240	253	257	254	241	227	211	209	208	214	238	257	274	281	278	265	242	215	191	178	5462	228	5638	226	
20	177	188	210	231	252	270	274	266	247	224	207	191	187	195	212	237	255	267	270	260	241	215	187	170	5432	226	5596	224	
21	164	168	185	206	231	250	253	249	233	211	194	179	171	179	200	224	247	264	274	274	255	233	209	191	5244	219	5421	217	
22	177	177	193	213	236	252	260	257	242	220	197	177	166	166	176	202	225	245	260	262	252	233	208	191	5184	216	5358	214	
23	174	172	178	197	220	237	244	246	236	214	196	174	158	154	163	184	208	231	245	257	253	240	220	205	5006	209	5194	208	
24	188	183	187	200	222	241	253	256	248	235	213	190	174	165	166	181	204	222	242	253	258	251	237	219	5188	216	5396	216	
25	208	199	200	209	223	241	253	252	247	239	216	195	177	163	158	169	182	204	220	235	240	239	227	218	5111	213	5321	213	
26	209	202	202	206	219	233	242	247	240	234	219	196	177	167	158	159	170	183	200	214	222	223	223	220	4965	207	5174	207	
27	209	209	209	213	225	234	246	248	247	245	233	217	199	187	180	175	177	184	197	207	213	219	221	219	5115	213	5337	213	
28	222	219	225	226	231	236	241	242	242	239	229	217	205	192	186	180	178	184	189	200	206	211	216	222	5140	214	5366	215	
29	227	233	237	243	245	247	250	253	247	245	236	229	220	212	204	199	192	184	181	180	183	185	189	200	5224	218	5431	217	
30	208	217	228	234	237	239	238	237	226	225	224	217	214	212	210	206	200	191	184	177	171	172	176	187	5028	209	5230	209	
1	202																												
MONTHLY MEAN																											214.4cm		

Station : SYOWA STATION  
 Latitude : 69° 00' 28" S  
 Longitude : 39° 34' 13" E  
 Duration : Oct. 1-Oct. 31 1998  
 Unit : CENTIMETER

Date	Time																							(24H)		(25H)				
	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	SUM	MEAN	SUM	MEAN		
1	202	216	235	247	256	261	257	246	240	235	233	231	233	237	244	243	242	232	220	207	196	187	184	192	5475	228	5681	227		
2	206	224	247	263	272	275	265	255	238	227	222	218	223	232	243	247	244	237	221	205	182	163	154	156	5420	226	5587	223		
3	167	188	212	234	248	256	251	236	219	203	194	191	201	213	230	244	251	248	237	215	191	168	150	148	5098	212	5251	210		
4	153	172	198	222	242	254	252	236	217	198	181	177	185	202	225	246	264	269	265	245	219	192	168	153	5136	214	5292	212		
5	155	170	194	218	242	253	255	243	219	195	174	162	162	179	203	231	252	267	272	259	240	209	183	161	5098	212	5253	210		
6	155	163	181	203	226	243	244	237	213	183	157	139	130	144	167	194	227	247	263	261	247	221	196	175	4816	201	4978	199		
7	162	164	177	199	220	240	245	238	219	195	165	139	124	127	146	177	205	234	255	266	259	246	223	203	4827	201	5017	201		
8	190	183	190	209	229	244	253	251	236	212	182	155	132	127	137	159	190	221	246	267	273	266	258	244	5057	211	5292	212		
9	235	227	231	245	269	278	289	291	282	266	237	209	182	170	165	174	198	220	242	258	268	269	264	255	5723	238	5968	239		
10	244	239	236	244	255	267	274	273	266	255	232	204	180	164	150	150	162	177	196	212	222	228	231	226	5286	220	5512	220		
11	226	222	221	224	233	243	251	253	250	245	231	212	194	179	163	158	160	166	177	190	200	208	214	215	5036	210	5256	210		
12	219	222	228	231	235	243	246	245	245	243	235	225	212	201	191	182	179	176	177	182	187	194	202	212	5112	213	5328	213		
13	216	227	234	236	242	243	244	241	243	239	237	234	229	226	223	220	212	205	201	196	199	202	203	212	5362	223	5587	223		
14	224	235	245	255	259	258	254	248	243	238	237	237	237	239	245	244	237	228	218	210	203	199	202	210	5603	233	5821	233		
15	218	233	249	260	267	267	260	247	235	227	221	221	224	230	241	243	240	233	218	202	187	177	174	179	5452	227	5641	226		
16	189	204	221	240	247	248	242	228	219	207	200	201	207	220	235	245	250	249	237	219	204	187	177	179	5256	219	5443	218		
17	187	202	220	237	249	252	244	230	215	195	186	182	189	204	224	242	250	252	244	227	207	188	175	170	5171	215	5349	214		
18	178	193	212	230	244	248	242	228	209	189	175	169	173	191	212	234	252	259	257	244	222	202	184	177	5123	213	5304	212		
19	181	194	214	236	251	260	252	239	217	197	180	169	170	186	208	233	253	266	267	259	244	218	201	190	5286	220	5475	219		
20	189	200	219	238	256	265	260	248	227	202	181	166	162	172	195	220	246	263	270	265	249	229	209	193	5325	222	5511	220		
21	186	190	207	226	244	254	254	242	223	196	171	152	144	149	168	197	225	245	260	263	254	236	217	203	5107	213	5300	212		
22	193	194	209	226	241	255	257	248	234	207	178	159	147	147	161	184	214	237	252	264	259	244	227	213	5151	215	5353	214		
23	202	200	207	222	241	251	257	252	239	216	187	164	150	144	150	170	193	215	237	248	249	242	229	214	5080	212	5284	211		
24	204	198	201	213	227	240	247	243	230	212	185	162	145	133	135	146	168	188	209	226	231	230	221	211	4803	200	5007	200		
25	205	199	197	209	219	232	241	239	230	217	196	173	153	142	138	147	162	179	201	216	225	229	230	223	4802	200	5022	201		
26	220	215	214	220	228	239	245	244	242	231	212	193	176	160	156	154	162	174	189	205	214	222	227	226	4969	207	5197	208		
27	227	228	227	230	236	244	247	247	244	238	226	212	198	187	180	176	178	180	187	197	209	214	220	227	5161	215	5393	216		
28	232	234	236	237	238	243	242	240	237	231	223	218	207	198	192	184	182	181	181	186	190	196	208	216	5132	214	5358	214		
29	226	236	243	245	246	247	243	239	236	231	229	226	222	220	218	213	208	199	192	189	189	189	197	209	5293	221	5513	221		
30	220	233	244	249	252	248	242	233	225	221	218	219	222	226	231	231	225	213	202	190	181	179	181	189	5277	220	5481	219		
31	204	222	239	248	253	250	241	226	214	209	203	210	217	232	243	251	252	244	233	217	199	188	185	192	5373	224	5580	223		
1	207																													
MONTHLY MEAN																											216.1cm			

Station : SYOWA STATION  
 Latitude : 69° 00' 28" S  
 Longitude : 39° 34' 13" E  
 Duration : Nov. 1-Nov. 30 1998  
 Unit : CENTIMETER

Date	Time																							(24H)		(25H)				
	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	SUM	MEAN	SUM	MEAN		
1	207	224	242	254	261	258	245	226	206	192	185	188	198	216	236	251	262	257	247	227	205	187	177	177	5328	222	5515	221		
2	186	204	225	242	249	250	238	214	191	172	158	157	170	192	215	242	258	264	259	244	218	197	181	172	5099	212	5276	211		
3	177	192	212	229	243	244	232	212	183	155	135	128	136	158	188	218	245	260	264	257	236	214	196	183	4896	204	5080	203		
4	183	197	214	233	247	252	245	225	197	167	139	122	121	140	168	201	233	255	271	273	258	243	220	205	5008	209	5209	208		
5	201	207	219	237	251	261	256	240	214	182	149	124	115	122	142	173	207	234	254	265	261	248	234	217	5015	209	5223	209		
6	208	210	218	234	251	259	260	250	230	199	166	136	117	113	125	149	177	206	229	247	253	250	239	228	4956	206	5177	207		
7	221	217	221	238	254	266	270	268	254	230	199	171	147	133	132	147	172	194	217	237	249	250	247	240	5174	216	5407	216		
8	233	229	230	241	252	267	272	271	266	250	226	200	179	163	154	158	171	188	208	226	238	247	247	246	5360	223	5606	224		
9	246	243	240	244	251	259	266	268	265	252	237	217	196	181	170	166	164	174	185	198	210	217	223	227	5298	221	5527	221		
10	229	230	230	229	231	240	243	244	241	237	227	215	204	193	184	177	174	180	181	190	199	208	218	224	5127	214	5358	214		
11	231	238	242	246	245	249	250	249	248	248	245	244	240	236	232	229	227	222	219	224	227	232	238	247	5709	238	5965	239		
12	256	263	269	273	273	267	260	253	250	248	247	245	248	246	245	244	239	229	222	214	209	212	214	220	5846	244	6075	243		
13	229	239	246	251	249	243	235	224	214	212	207	211	214	221	228	234	234	227	216	209	201	198	199	205	5346	223	5561	222		
14	215	229	240	248	250	247	236	223	211	201	199	201	209	223	233	246	251	247	237	224	210	203	199	200	5381	224	5590	224		
15	210	223	234	244	246	243	230	214	197	182	176	179	186	204	220	236	247	248	242	229	214	201	193	194	5191	216	5393	216		
16	203	214	226	238	245	242	230	211	191	172	161	161	168	189	213	233	250	256	253	243	228	213	203	198	5140	214	5347	214		
17	207	220	236	248	256	258	250	230	208	185	172	165	171	190	214	239	261	275	275	265	252	233	219	214	5444	227	5662	226		
18	218	228	244	258	267	270	260	243	217	190	169	159	161	175	199	226	251	267	274	269	257	240	222	212	5476	228	5686	227		
19	211	218	232	246	258	259	254	236	211	184	157	141	136	146	168	196	224	246	257	261	250	237	221	209	5158	215	5360	214		
20	203	209	220	236	248	257	252	238	217	189	163	145	134	140	158	185	214	240	257	265	264	251	239	226	5152	215	5369	215		
21	217	217	227	240	255	264	263	254	235	206	178	154	137	134	146	169	194	218	239	251	253	246	236	224	5158	215	5374	215		
22	216	214	217	231	246	255	257	251	239	214	188	166	147	138	145	160	183	209	229	245	254	254	246	239	5144	214	5377	215		
23	233	229	231	241	252	265	271	267	258	243	217	193	176	164	161	172	189	209	231	248	259	265	263	259	5496	229	5751	230		
24	254	250	249	250	262	273	276	277	270	258	236	214	194	181	173	176	185	200	216	232	244	254	259	256	5641	235	5896	236		
25	255	253	251	252	257	261	265	266	264	253	240	222	206	194	183	181	183	192	203	214	226	238	246	247	5554	231	5803	232		
26	248	249	248	245	247	251	251	255	253	249	246	235	224	214	206	197	196	196	198	205	213	221	231	235	5515	230	5757	230		
27	243	245	245	241	236	235	232	230	227	227	224	220	216	213	211	205	198	192	189	187	193	196	205	217	5226	218	5453	218		
28	226	232	236	234	227	221	214	208	204	203	205	209	213	217	220	223	218	209	202	197	192	194	200	212	5115	213	5340	214		
29	225	239	245	246	244	234	220	209	201	194	197	204	215	228	241	248	247	242	230	216	207	202	202	207	5342	223	5562	222		
30	220	233	241	247	245	235	215	195	180	169	167	177	189	207	229	246	253	251	245	227	213	202	196	197	5177	216	5382	215		
1	205																													
MONTHLY MEAN																													220.1cm	

Station : SYOWA STATION  
 Latitude : 69° 00' 28" S  
 Longitude : 39° 34' 13" E  
 Duration : Dec. 1-Dec. 31 1998  
 Unit : CENTIMETER

Date	Time																								(24H)		(25H)		
	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	SUM	MEAN	SUM	MEAN	
1	205	217	230	236	237	229	208	186	161	143	135	137	151	176	201	226	244	250	248	234	217	202	190	189	4853	202	5050	202	
2	197	210	222	233	238	233	216	190	163	138	121	119	130	153	185	216	242	260	267	261	249	232	219	212	4907	204	5124	205	
3	217	228	242	251	262	257	246	223	191	159	136	123	123	144	170	204	237	259	272	276	266	252	236	224	5200	217	5422	217	
4	222	228	243	253	260	262	255	234	204	169	140	116	109	116	135	168	201	228	250	260	258	251	239	228	5030	210	5250	210	
5	220	226	235	250	264	272	271	257	238	208	176	147	129	129	145	169	200	231	254	270	279	275	267	258	5370	224	5618	225	
6	249	248	254	265	278	286	286	282	263	234	200	168	145	131	133	145	167	192	215	233	244	246	242	234	5338	222	5564	223	
7	226	219	220	229	244	254	260	259	251	231	207	181	156	141	134	140	154	177	197	216	229	239	238	235	5038	210	5271	211	
8	233	226	226	230	239	250	256	263	258	250	232	213	195	180	167	166	174	185	201	216	228	238	241	241	5308	221	5547	222	
9	239	235	232	229	233	240	242	248	249	239	233	219	204	193	182	176	179	183	193	205	215	220	230	233	5249	219	5480	219	
10	231	232	231	228	227	227	230	234	235	234	230	223	219	213	206	205	202	201	203	212	219	223	233	238	5337	222	5577	223	
11	240	242	242	238	233	231	226	224	224	224	223	223	223	223	222	220	219	216	211	213	215	217	222	230	5403	225	5636	225	
12	233	235	238	235	230	225	218	212	208	206	206	208	214	220	223	228	228	225	219	216	216	216	217	225	5301	221	5533	221	
13	232	237	241	241	236	228	216	206	197	192	190	194	203	214	222	230	236	234	226	220	216	212	214	218	5254	219	5480	219	
14	225	233	239	240	236	231	218	202	185	177	175	177	187	202	216	232	241	241	234	226	217	212	209	212	5165	215	5383	215	
15	217	227	234	236	236	230	215	198	182	167	157	160	171	187	209	230	245	249	249	240	230	219	213	213	5113	213	5331	213	
16	218	230	237	244	245	238	223	204	180	162	147	144	154	174	195	218	238	250	252	247	236	222	215	212	5084	212	5301	212	
17	217	226	238	246	249	247	236	213	187	166	148	136	145	162	185	214	238	255	262	260	252	239	227	223	5170	215	5394	216	
18	224	230	244	252	262	262	251	233	208	179	153	141	140	151	176	205	232	253	265	268	260	248	234	225	5297	221	5519	221	
19	222	227	239	253	263	265	259	245	218	186	161	140	131	137	156	183	212	237	254	260	258	248	234	221	5212	217	5428	217	
20	217	216	225	240	252	258	254	246	222	191	162	138	123	124	138	158	187	217	238	253	254	248	236	228	5027	209	5249	210	
21	221	217	224	242	252	260	265	256	240	215	184	156	139	128	132	152	176	198	223	240	246	243	232	223	5065	211	5278	211	
22	213	206	204	213	228	239	242	239	228	209	181	152	131	118	117	126	146	166	191	210	221	224	218	212	4633	193	4841	194	
23	208	200	194	202	217	226	238	242	236	226	208	185	166	152	145	150	163	182	201	220	235	245	244	238	4922	205	5154	206	
24	232	224	219	219	225	236	243	245	246	239	226	204	189	176	162	158	166	177	191	205	219	230	235	233	5100	213	5328	213	
25	228	221	214	209	212	217	223	228	232	230	225	213	202	191	182	175	175	176	187	199	207	217	225	227	5015	209	5242	210	
26	227	221	216	206	204	203	203	209	212	214	216	214	209	205	198	196	193	188	191	196	204	209	217	224	4974	207	5200	208	
27	226	226	220	211	205	200	193	192	194	196	201	204	210	214	215	215	211	204	200	200	197	199	205	213	4950	206	5168	207	
28	218	219	216	212	201	189	180	171	165	166	170	177	190	203	213	221	224	217	213	207	202	201	201	206	4782	199	4994	200	
29	213	217	218	214	206	192	176	159	148	142	146	153	168	187	207	224	236	236	230	224	215	209	208	208	4735	197	4950	198	
30	215	223	227	226	221	210	187	167	150	132	126	135	150	172	197	222	241	250	250	244	235	226	217	218	4842	202	5067	203	
31	225	232	240	243	245	235	213	190	163	138	125	121	131	154	180	211	237	251	260	256	245	236	224	219	4975	207	5197	208	
1	222																												
MONTHLY MEAN																											211.9cm		

Station : SYOWA STATION  
 Latitude : 69° 00' 28" S  
 Longitude : 39° 34' 13" E  
 Duration : Jan. 1-Jan. 31 1999  
 Unit : CENTIMETER

Date	Time																							(24H)		(25H)				
	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	SUM	MEAN	SUM	MEAN		
1	222	228	238	244	246	244	229	201	171	142	121	108	108	128	155	188	221	246	260	265	264	253	241	235	4957	207	5192	208		
2	234	243	255	264	274	279	268	250	221	187	155	133	123	131	150	177	209	237	252	263	264	254	242	233	5297	221	5524	221		
3	227	230	242	257	270	278	278	264	243	210	176	147	132	128	139	163	191	219	244	256	260	255	247	232	5287	220	5511	220		
4	223	221	227	241	255	268	272	265	251	226	193	164	143	132	133	150	176	203	224	242	251	251	240	232	5186	216	5408	216		
5	222	216	218	227	241	255	264	262	255	238	213	184	159	143	141	148	165	187	211	226	237	240	234	224	5111	213	5327	213		
6	216	208	203	206	220	233	244	248	247	236	218	194	175	157	147	149	162	178	199	217	228	234	233	226	4977	207	5196	208		
7	220	209	205	205	212	223	236	245	249	246	237	222	208	194	186	184	188	196	211	225	237	241	241	239	5257	219	5488	220		
8	231	222	216	210	212	219	224	232	238	240	233	224	217	205	196	195	198	201	210	223	231	237	239	238	5292	221	5525	221		
9	233	229	225	219	215	215	218	222	226	227	226	222	220	216	213	211	214	214	217	223	229	231	234	235	5334	222	5566	223		
10	232	224	222	215	206	204	199	197	198	199	200	202	205	209	207	209	210	212	211	211	215	217	220	221	5044	210	5266	211		
11	222	220	216	210	203	195	188	184	181	181	182	187	195	201	211	221	222	223	222	222	221	222	224	226	4977	207	5206	208		
12	229	230	230	227	222	215	202	191	182	178	177	182	191	202	218	225	232	235	233	227	223	222	218	220	5110	213	5335	213		
13	224	225	227	224	219	209	194	178	163	153	149	151	162	178	195	216	226	233	231	227	220	214	209	209	4837	202	5050	202		
14	213	219	223	224	222	215	201	181	164	149	137	137	147	165	187	213	229	240	242	240	229	222	214	213	4827	201	5042	202		
15	215	223	229	233	235	232	216	197	174	152	138	132	136	155	180	209	232	249	257	255	250	238	224	222	4984	208	5208	208		
16	224	231	243	251	257	257	249	226	200	176	154	141	140	154	180	207	235	255	268	269	262	250	236	226	5293	221	5518	221		
17	225	231	242	254	263	73	261	243	215	185	159	137	130	138	157	184	215	239	252	263	259	244	231	221	5020	209	5234	209		
18	214	218	229	243	254	263	260	250	227	197	166	140	126	125	140	165	196	223	245	254	254	248	230	218	5087	212	5296	212		
19	209	208	216	230	245	257	261	256	238	211	180	151	130	125	131	149	178	204	225	242	249	244	229	216	4983	208	5187	207		
20	204	198	200	213	229	245	251	252	244	221	192	166	143	131	128	141	164	191	211	231	241	239	228	218	4882	203	5085	203		
21	203	193	192	200	216	232	246	251	249	238	216	190	169	153	142	150	163	183	204	221	232	236	228	216	4923	205	5128	205		
22	205	192	184	186	195	212	226	235	242	236	223	204	183	170	159	157	167	181	197	215	225	231	230	221	4877	203	5087	203		
23	210	199	189	184	189	201	215	226	234	237	234	224	210	199	191	185	186	196	208	220	230	238	237	231	5073	211	5295	212		
24	222	209	197	190	184	188	196	206	213	219	221	221	214	208	204	199	200	204	209	217	224	227	228	227	5027	209	5248	210		
25	221	212	201	190	182	179	181	183	190	195	201	205	209	213	214	217	217	217	219	220	225	226	225	227	4967	207	5192	208		
26	224	218	209	200	190	179	171	168	168	171	178	185	195	206	215	224	230	231	229	228	228	228	228	228	4934	206	5162	206		
27	228	228	223	214	204	192	177	163	157	152	156	164	175	193	211	227	240	244	243	240	234	230	228	226	4952	206	5182	207		
28	230	234	234	233	227	216	199	181	165	155	151	155	170	191	215	235	258	274	277	273	266	257	251	249	5296	221	5547	222		
29	251	255	258	260	260	249	232	211	184	162	150	146	151	171	196	223	249	267	273	273	265	252	242	237	5418	226	5657	226		
30	239	246	253	261	264	260	248	223	195	166	142	129	131	146	169	198	226	250	263	266	259	249	236	227	5248	219	5474	219		
31	226	231	245	256	268	271	263	246	220	188	160	137	128	136	160	187	216	242	260	266	263	251	238	223	5280	220	5500	220		
1	220																													
MONTHLY MEAN																													212.0cm	

Table 7. Hourly tidal observation at Tonagh Island from December 23, 1998 to January 15, 1999  
(time is LMT (UT+3 hours)).

Station : TONAGH ISLAND  
 Latitude : 67° 05' 14" S  
 Longitude : 50° 15' 18" E  
 Duration : Dec. 1-Dec. 31 1998  
 Unit : CENTIMETER

The zero level of the pressure gauge  
 relative to the temporally fixed point.  
 -6.000m Dec. 23 1998

Date	Time																							(24H)		(25H)				
	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	SUM	MEAN	SUM	MEAN		
1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-			
2	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-			
3	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-			
4	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-			
5	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-			
6	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-			
7	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-			
8	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-			
9	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-			
10	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-			
11	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-			
12	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-			
13	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-			
14	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-			
15	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-			
16	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-			
17	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-			
18	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-			
19	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-			
20	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-			
21	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-			
22	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-			
23	216	217	219	228	233	237	239	238	225	210	197	178	168	162	165	171	181	197	209	221	233	234	237	237	5052	211	5283	211		
24	231	228	231	233	240	240	243	238	231	222	207	191	183	173	170	172	178	189	194	207	216	219	223	220	5079	212	5297	212		
25	218	219	214	213	216	220	218	220	215	210	202	193	183	175	171	168	171	179	183	190	197	201	207	209	4792	200	4792	192		
26	207	208	206	207	203	197	199	194	194	196	192	194	188	188	188	186	186	186	187	194	193	198	207	207	4705	196	4917	197		
27	212	210	208	205	201	199	194	192	193	198	200	201	205	209	212	210	208	206	204	202	201	196	201	205	4872	203	5078	203		
28	206	209	206	204	196	189	179	170	168	166	167	170	179	189	199	205	208	206	201	199	194	190	195	195	4590	191	4792	192		
29	202	202	203	195	186	174	165	154	145	140	140	145	157	174	191	205	209	214	209	207	202	196	197	195	4407	184	4604	184		
30	197	200	197	192	187	174	158	142	127	122	117	122	134	151	177	198	207	219	223	217	217	208	208	206	4300	179	4300	172		
31	206	212	211	211	207	193	179	157	133	122	114	121	134	148	175	197	217	229	237	239	232	228	222	218	4542	189	4762	190		
1	220																													
MONTHLY MEAN																													cm	

Station : TONAGH ISLAND  
 Latitude : 67° 05' 14" S  
 Longitude : 50° 15' 18" E  
 Duration : Jan. 1-Jan. 31 1999  
 Unit : CENTIMETER

Date	Time																							(24H)		(25H)				
	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	SUM	MEAN	SUM	MEAN		
1	220	224	227	223	220	209	192	166	143	123	113	109	117	129	153	174	201	221	232	236	238	236	234	229	4569	190	4803	192		
2	234	241	244	251	251	241	231	205	184	157	135	129	130	144	154	177	197	215	229	237	239	236	233	231	4925	205	5157	206		
3	232	238	248	252	258	260	248	232	211	181	161	145	138	144	154	174	193	215	230	242	246	243	240	229	5114	213	5340	214		
4	226	228	232	240	249	249	246	233	214	191	165	142	133	134	141	153	172	191	209	219	224	226	224	221	4862	203	5079	203		
5	217	216	223	229	238	242	242	236	220	201	180	159	145	138	138	145	161	180	191	206	210	212	209	207	4745	198	4745	190		
6	200	199	196	205	215	220	223	219	209	197	178	163	152	140	142	146	158	168	180	194	199	201	201	196	4501	188	4696	188		
7	195	190	190	192	202	207	213	214	212	205	194	188	176	173	167	169	177	184	194	202	207	211	208	207	4677	195	4880	195		
8	203	200	200	196	204	204	210	215	220	221	216	211	205	199	198	201	209	216	224	230	233	242	243	241	5141	214	5384	215		
9	243	240	237	236	237	240	240	240	238	238	233	233	228	221	223	222	220	225	226	228	232	231	233	230	5574	232	5801	232		
10	227	223	221	216	213	208	205	202	199	201	199	200	205	204	211	212	214	215	213	217	217	217	219	217	5075	211	5075	203		
11	217	214	210	208	200	196	189	184	179	181	179	186	191	197	208	212	216	218	213	211	208	210	208	210	4845	202	5055	202		
12	210	210	207	206	201	192	180	175	168	168	167	172	184	194	203	213	221	222	221	219	213	216	211	216	4789	200	5006	200		
13	217	217	214	213	208	193	181	168	153	151	148	152	163	176	190	206	212	219	217	212	210	205	203	205	4633	193	4838	194		
14	205	207	210	207	202	190	179	160	144	135	130	135	141	162	181	195	211	217	222	217	210	206	204	203	4473	186	4676	187		
15	203	211	212	212	207	198	186	165	145	131	119	120	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
16	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
17	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
18	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
19	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
20	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
21	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
22	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
23	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
24	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
25	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
26	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
27	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
28	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
29	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
30	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
31	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
MONTHLY MEAN																													cm	



Table 8. Tidal harmonic constants at Tonagh Island in Amundsen Bay.

	Amp. cm	Lag( $\kappa$ ) deg.
Mm	3.0	52.3
MSf	8.5	126.8
Q1	6.5	327.3
O1	24.1	351.9
P1	7.4	359.3
K1	22.2	359.3
N2	2.3	167.2
M2	15.6	165.4
S2	15.0	171.8
K2	4.1	171.8
M4	0.6	79.4
MS4	0.6	81.5
Standard deviation		11.2