Cruise ANTARKTIS X/3 of RV "Polarstern": CTD-Report

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Contents

1 Fall in the Ice – the Cruise ANT X/3 of R/V "Polarstern": CTD–report.

One of the scientific aims of the expedition ANT X/3 (Spindler et al. 1993) was the investigation of the Antarctic Slope Front in the Weddell Sea. A grid of 66 CTD–stations was occuped in the Eastern Weddell Sea between the Atka Bight and Kap Norvegia from the 6th of April to the 2nd of May, 1992 (Fig 1.). Table 1 provides the list of all CTD–stations with position, time, maximum depth of the CTD–profile and water depth. It encludes the test station (No. 334) outside the frontal zone. Many other measurements were performed during this cruise. This report restricts itself to CTD data only.

Tab. 1: The list of CTD stations.

No.	φ		λ		Day	Hour	Depth	Water depth
334	-68°	10.58'	-4°	22.08'	6. 4.1992	15:20	4070	4070
355	-70°	22.26'	-7°	20.48'	11. 4.1992	16:31	362	390
357	-70°	6.85'	-7°	22.64'	11. 4.1992	21:01	1389	1464
359	-69°	49.43'	-7°	20.16'	12. 4.1992	2:34	2326	2426
361	-69°	33.58'	-7°	22.11'	12. 4.1992	9:38	961	2533
363	-69°	17.94'	-7°	19.44'	12. 4.1992	14:20	963	3476
365	-69°	2.15'	-7°	19.89'	12. 4.1992	18:03	3015	3116
367	-68°	45.95'	-7°	20.27'	12. 4.1992	23:17	966	3211
369	-68°	30.00'	-7°	20.00'	13. 4.1992	5:39	967	3352
371	-68°	13.94'	-7°	19.60'	13. 4.1992	12:19	983	4122
373	-67°	58.00'	-7°	20.00'	13. 4.1992	17:36	4529	4633
375	-67°	58.00'	-8°	2.00'	14. 4.1992	2:05	4469	4571
377	-68°	13.50'	-8°	1.80'	14. 4.1992	5:46	4234	4344
379	-68°	30.00'	-8°	1.52'	14. 4.1992	12:34	3932	4033
381	-68°	46.00'	-8°	2.50'	14. 4.1992	17:13	3803	3909
383	-69°	2.15'	-8°	2.54'	14. 4.1992	21:12	3452	3571
385	-69°	18.00'	-8°	2.04'	15. 4.1992	0:57	3121	3288
387	-69°	34.00'	-8°	1.80'	15. 4.1992	4:33	2914	2919
389	-69°	50.00'	-8°	2.00'	15. 4.1992	8:25	1796	1928
391	-70°	21.66'	-8°	55.00'	16. 4.1992	10:06	574	570
392	-70°	18.52'	-8°	54.58'	16. 4.1992	13:21	1081	1083
393	-70°	15.27'	-8°	54.85'	16. 4.1992	16:51	1448	1493
394	-69°	59.08'	-8°	59.32'	16. 4.1992	20:58	2008	2085
396	-69°	43.70'	-8°	59.28'	17. 4.1992	3:55	985	2732
398	-69°	28.00'	-8°	57.52'	17. 4.1992	8:11	983	2911
400	-69°	12.16'	-8°	58.75'	17. 4.1992	13:43	985	3566
402	-68°	56.00'	-8°	58.75'	17. 4.1992	18:08	984	4214
404	-68°	39.88'	-9°	0.47'	17. 4.1992	21:37	985	4032
406	-68°	23.89'	-9°	0.09'	18. 4.1992	1:10	985	3606

No.	φ	λ	Day	Hour	Depth	Water depth
408	-68° 8.00'	-9° 0.00'	18. 4.1992	4:36	3120	4580
410	-68° 7.97'	-9° 43.16'	18. 4.1992	12:13	4633	4737
412	-68° 24.00'	-9° 43.16'	18. 4.1992	18:20	3748	4017
414	-68° 40.12'	-9° 42.54'	18. 4.1992	22:51	4137	4190
416	-68° 56.01'	-9° 42.87'	19. 4.1992	3:34	4298	4341
418	-69° 12.12'	-9° 43.17'	18. 4.1992	8:25	3880	3898
420	-69° 28.11'	-9° 43.17'	19. 4.1992	14:36	2815	2872
422	-69° 44.38'	-9° 42.94'	19. 4.1992	20:34	2161	2224
424	-69° 59.57'	-9° 43.52'	20. 4.1992	2:55	1741	1775
425	-70° 8.08'	-9° 42.27'	20. 4.1992	7:06	1635	1686
426	-70° 20.29'	-9° 44.02'	20. 4.1992	14:53	1568	1623
431	-70° 59.24'	-11° 0.09'	21. 4.1992	16:03	350	367
432	-70° 49.47'	-11° 0.41'	21. 4.1992	18:09	484	498
433	-70° 46.77'	-11° 0.04'	23. 4.1992	5:59	950	976
434	-70° 36.24'	-11° 6.33'	23. 4.1992	12:20	1503	1534
435	-70° 25.00'	-11° 6.33'	23. 4.1992	17:04	1964	2011
437	-70° 1.70'	-10° 59.30'	24. 4.1992	0:50	983	2874
439	-69° 46.00'	-11° 0.11'	24. 4.1992	7:40	983	3427
441	-69° 29.66'	-10° 58.76'	24. 4.1992	15:10	983	4085
443	-69° 14.06'	-11° 1.39'	24. 4.1992	19:35	984	4051
445	-68° 58.23'	-10° 59.01'	25. 4.1992	1:22	984	4583
447	-68° 42.00'	-11° 1.00'	25. 4.1992	5:30	4549	4555
449	-67° 45.00'	-12° 0.00'	25. 4.1992	21:13	4883	4929
452	-68° 0.20'	-12° 0.50'	26. 4.1992	18:20	4881	4919
455	-67° 45.00'	-12° 0.61'	27. 4.1992	21:04	4807	4845
458	-69° 6.36'	-12° 2.81'	28. 4.1992	8:53	4418	4469
461	-69° 31.23'	-11° 58.51'	28. 4.1992	22:21	4451	4497
464	-69° 53.97'	-12° 1.49'	29. 4.1992	9:55	986	4224
467	-70° 18.00'	-12° 1.49'	1. 5.1992	6:58	2216	2257
470	-70° 42.04'	-12° 1.22'	1. 5.1992	20:27	1816	1864
471	-70° 50.06'	-12° 59.76'	2. 5.1992	0:28	1624	1666
472	-70° 55.30'	-12° 3.62'	2. 5.1992	3:08	1596	1593
473	-71° 0.16'	-12° 3.34'	2. 5.1992	9:17	1226	1363
474	-71° 5.38'	-12° 1.56'	2. 5.1992	19:38	389	1143
475	-71° 10.00'	-12° 0.00'	2. 5.1992	16:51	294	302

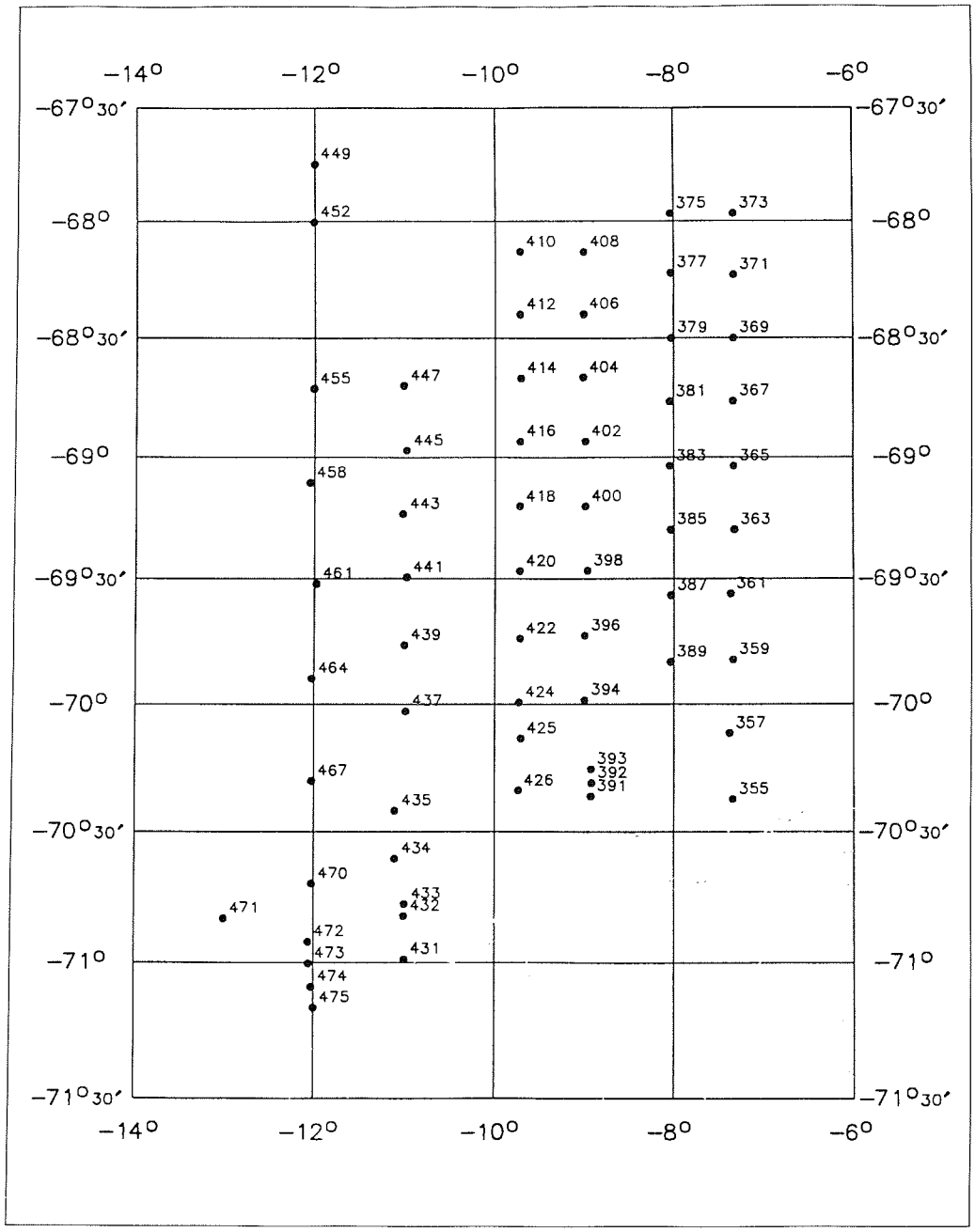

Fig. 1: Positions of CTD stations during ANT X/3 cruise of r/v "Polarstern"

2 Instruments

CTD-measurements were performed with two Salzgitter's Bathysonde units. The first one (stations 334 – 410) was Bathysonde 2000LS S/MT 122, the second (stations 412 – 475) was Bathysonde 2000LS S/MT 121. The sensor accuracies of these instruments, according to Salzgitter GmbH, are listed in Table 2.

Tab. 2: The accuracy of Salzgitter CTDs (according to the manufacturer).

Bathysonde	S/MT 121	S/MT 122
Conductivity / $\frac{\mu S}{cm}$	20	5
Temperature / K	0.01	0.01
Pressure / bar	0.3	0.1

The last calibration of the instruments was done by Ocean Scientific International Ltd. in Wormley, England, in January 1992, about three month prior to the expedition. Estimates on the final precision of the data are provided in section 3.

3 Data Processing

The first part of standard processing of the CTD data was done with the CTD Data Acquisition Software from Sea-Bird Electronics, Inc. The main purpose was to eliminate salinity spikes from the records. Sampling intervals, temperature and conductivity were aligned in time relative to pressure and filtered with a low pass filter. Then the profile data were averaged over 0.5 dbar intervals. After this procedure salinity was computed from conductivity temperature and pressure. Because not all spikes were removed after this procedure temperature and salinity were filtered with a median filter (7 points) and a moving average filter (9 points) once more.

In situ comparisons of CTD data with water samples and reversing thermometer were performed at 8 stations. The salinity of water samples was measured with Guildline Salinometer AUTOSAL 8400A. Average temperature differences between the CTD and the thermometer readings were 0.027 K and 0.079 K for S/MT 121 and S/MT 122 respectively. Conductivity differed 0.004 $\frac{S}{m}$. Therefore individual calibration coefficients were determined for stations 365, 373, 392, 394, 420, 422, 458 and 461. Coefficients for other stations were computed relative to TS-relations from calibrated stations with respect to the position and time of registered profile. Salinity differences here were found between 0.1 psu and 0.002 psu. At last the accuracy of the corrected data set is estimated to be not worse than 0.01 K and 0.01 psu for temperature and salinity respectively. As an example for the final precision of the data one of the measured TS-relation is shown with expected water masses in Fig. 2.

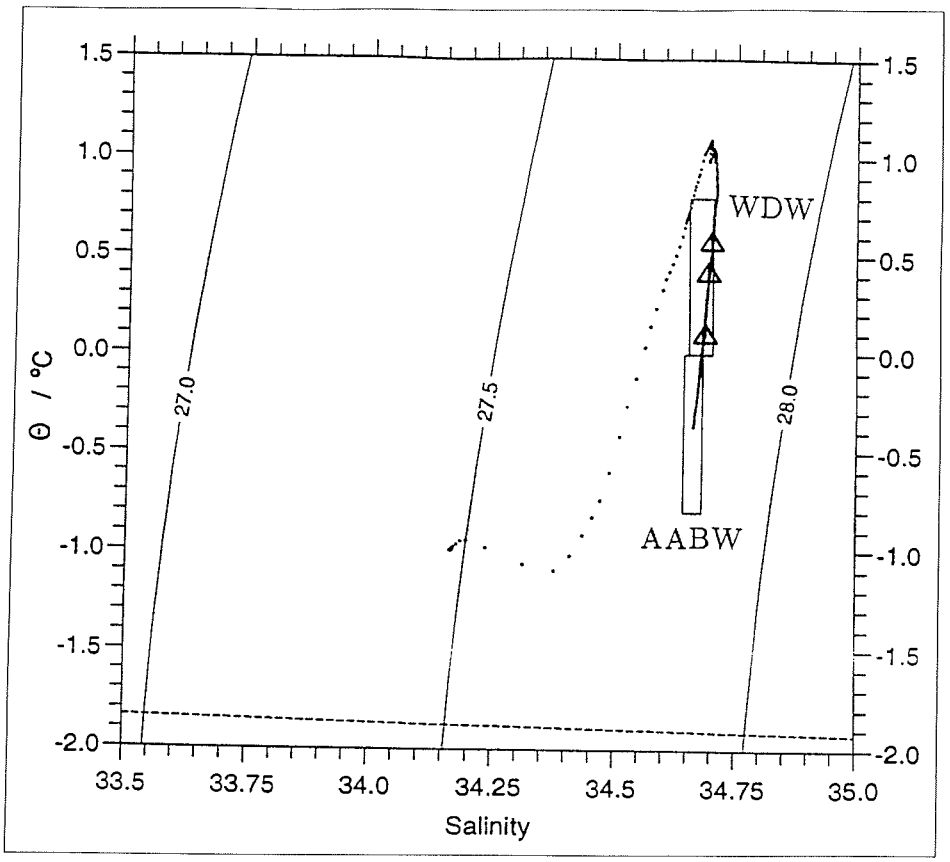

Fig. 2: TS-relation from station 373. Marked expected water masses are WDW – Warm Deep Water, and AABW – Antarctic Bottom Water (after Carmack, 1977 and Hellmer and Bersch, 1985). Triangles show the calibration points.

4 CTD Profiles

On the following pages all CTD profiles are displayed.

(——) – Temperature

(.....) – Salinity

(- - -) – Density

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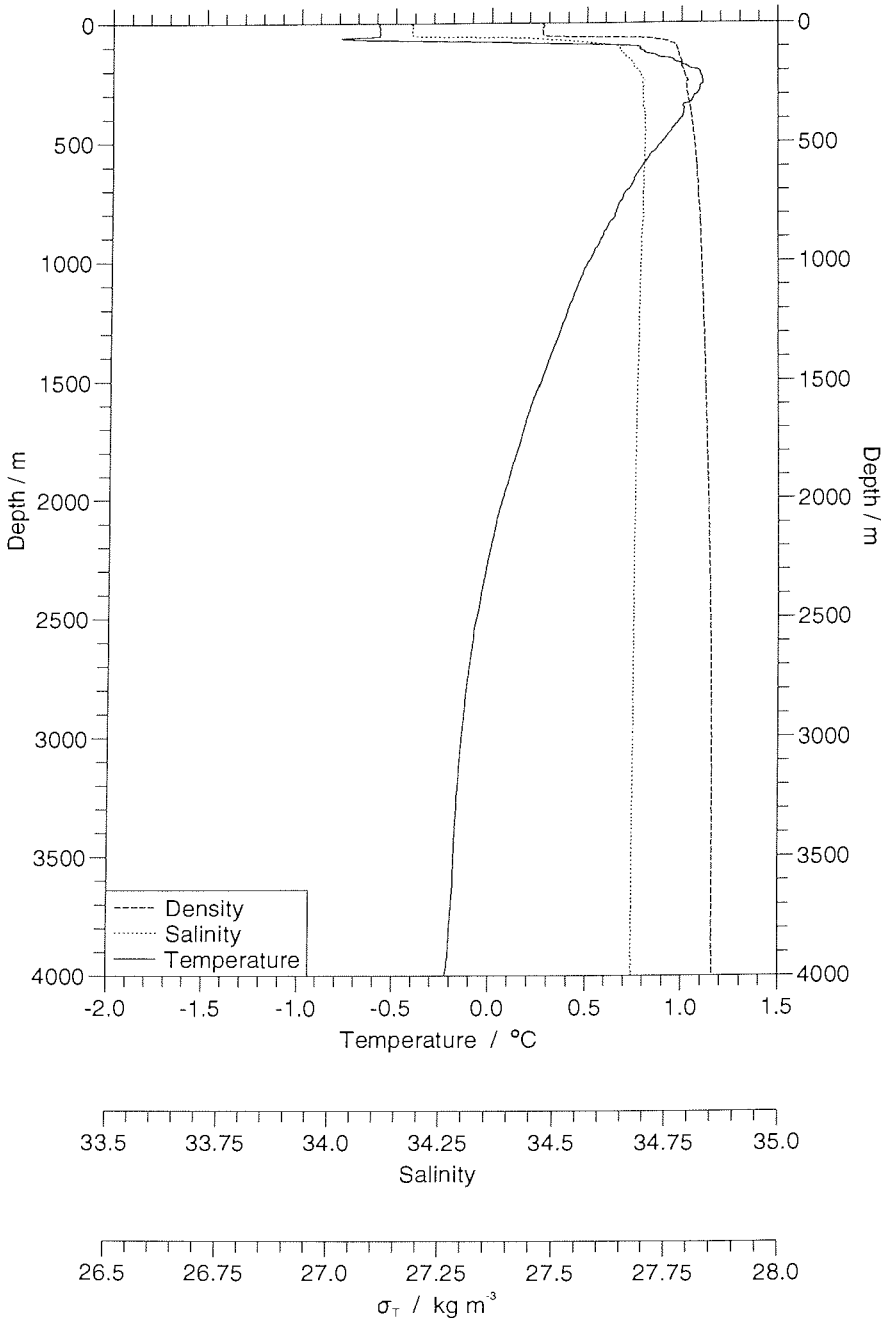

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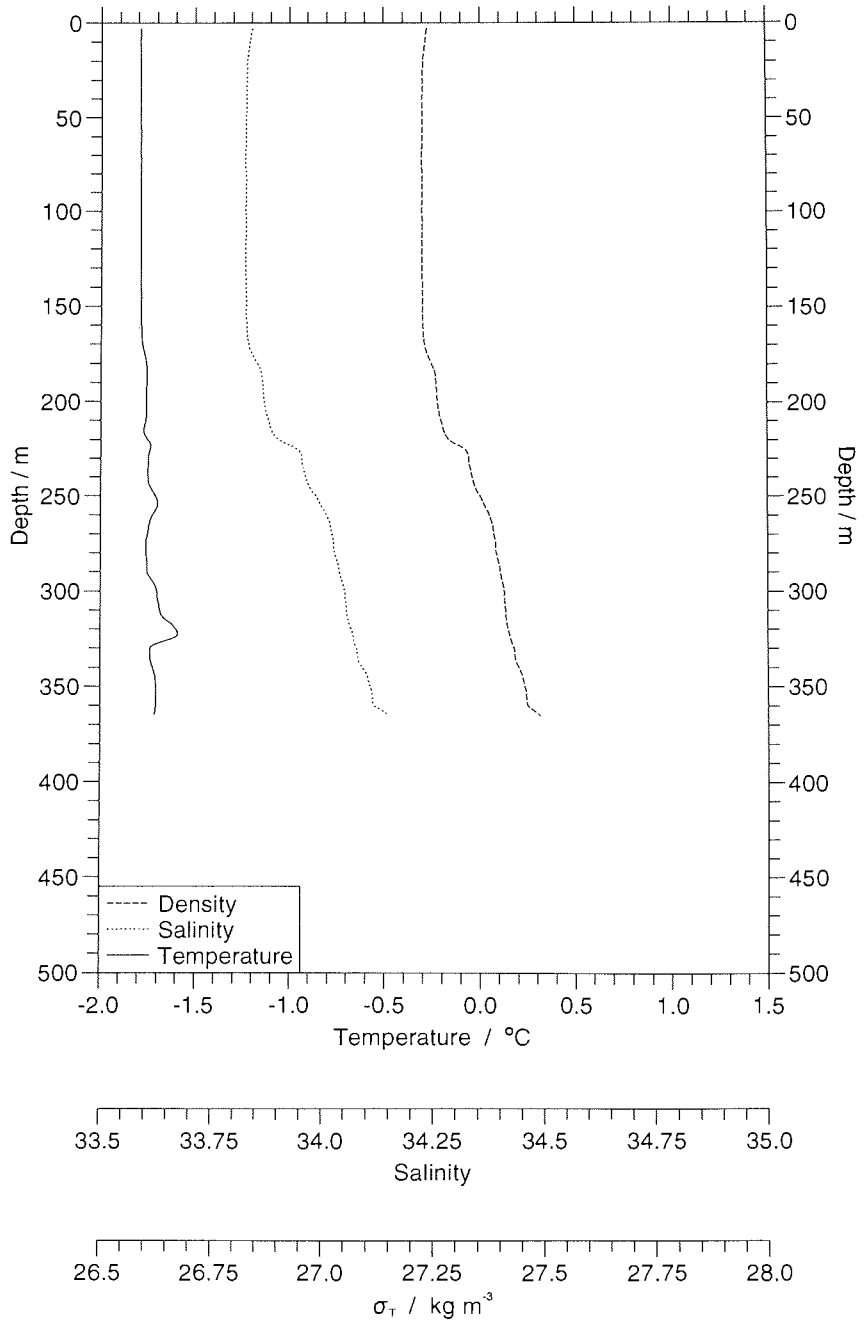

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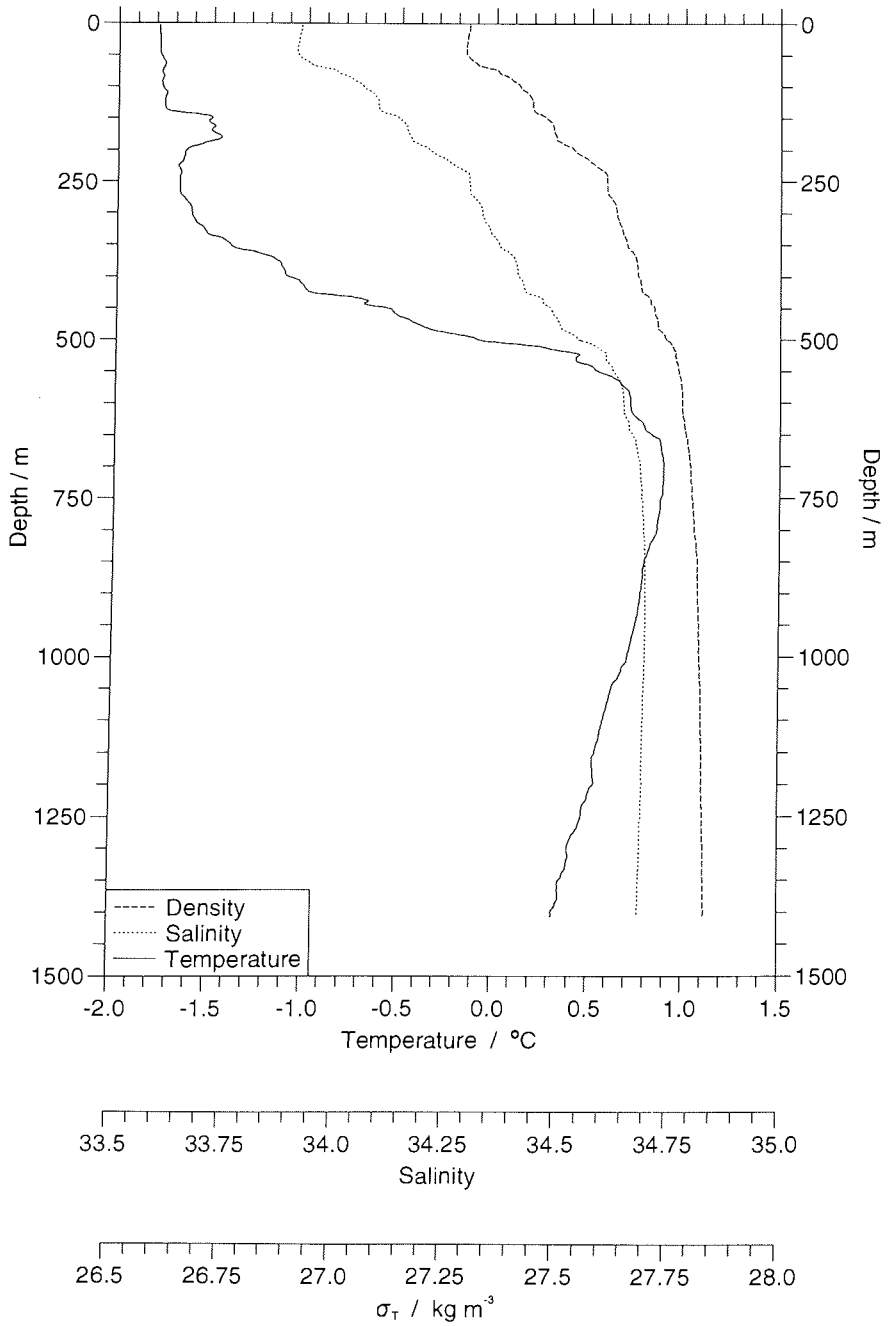

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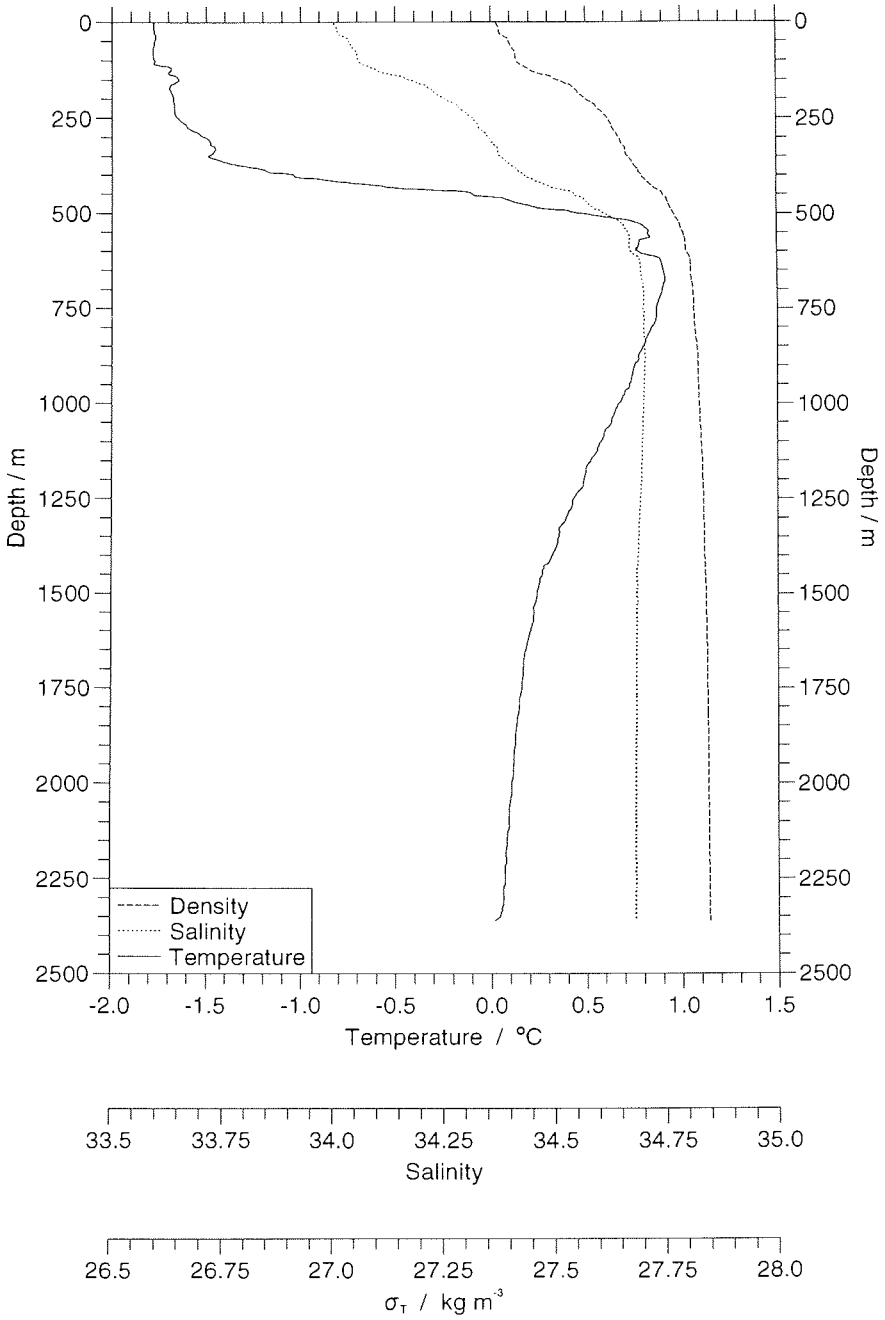

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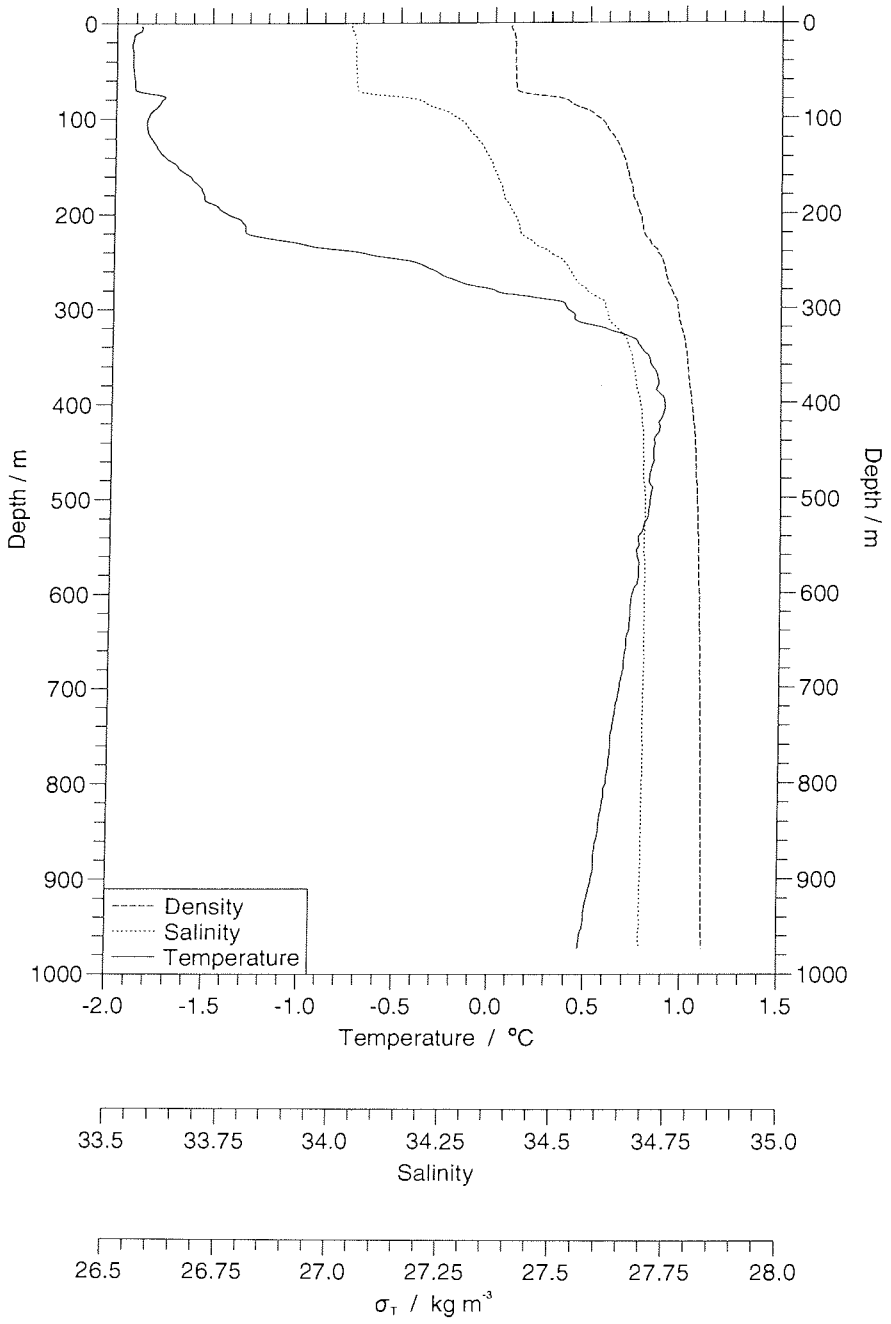

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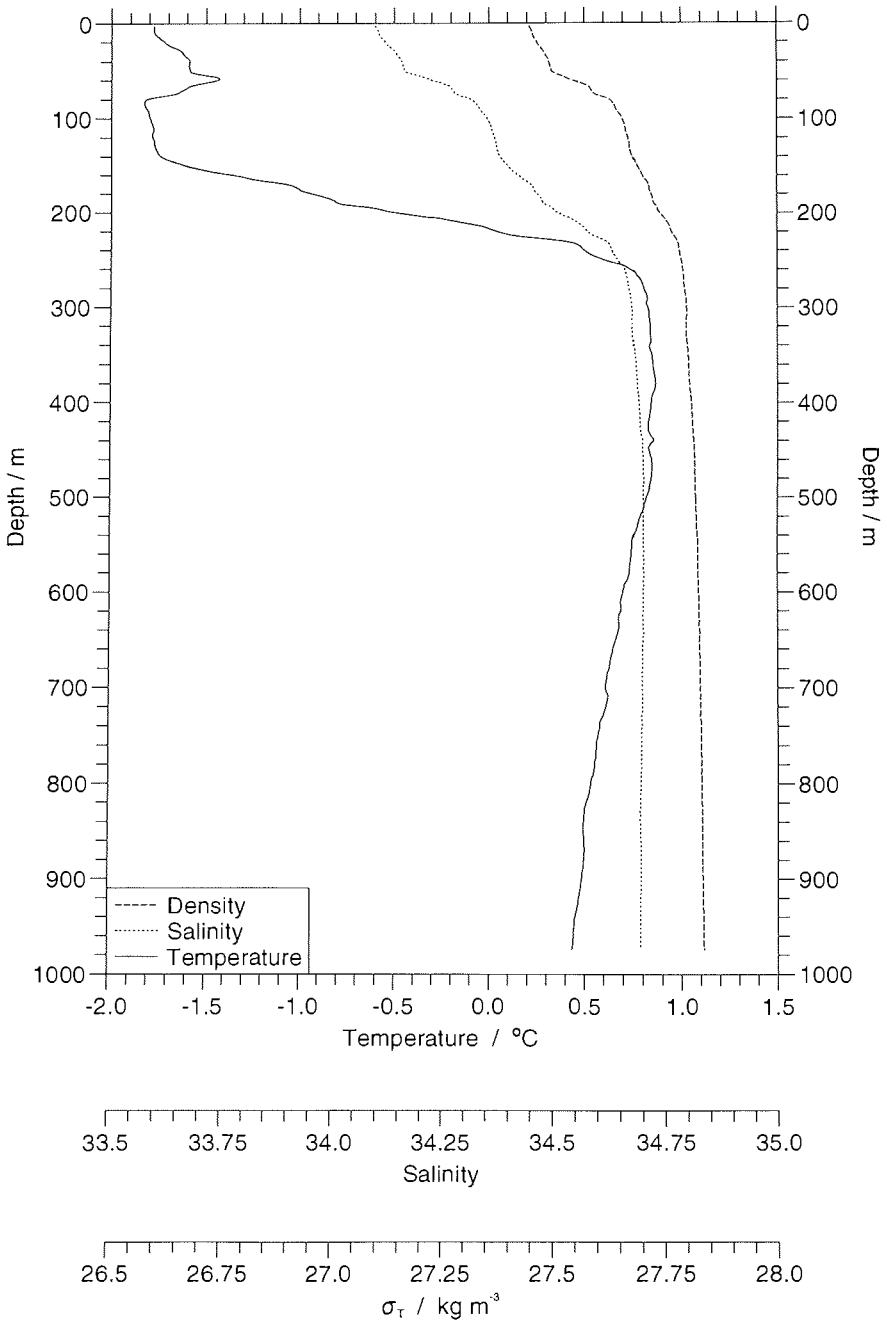

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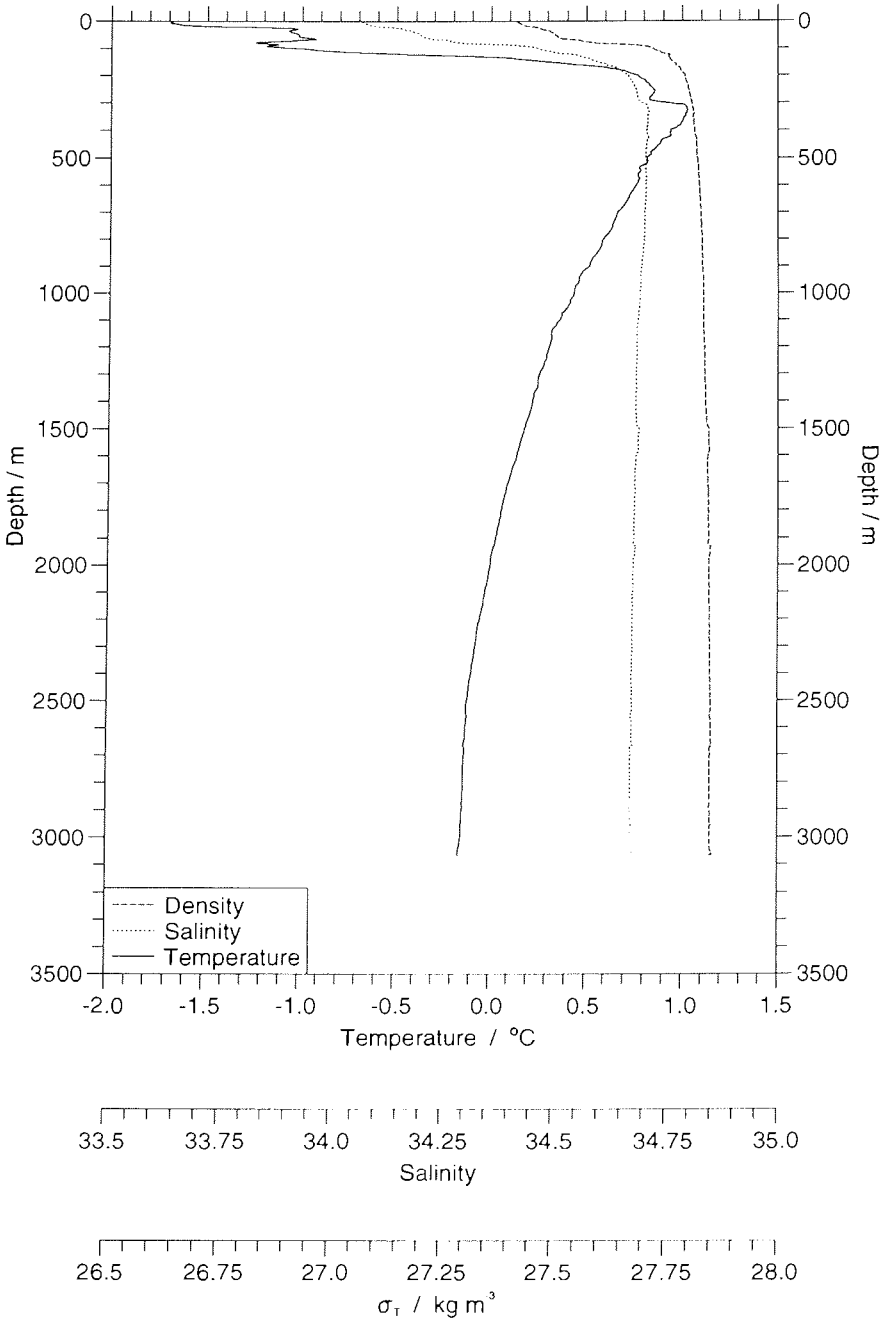

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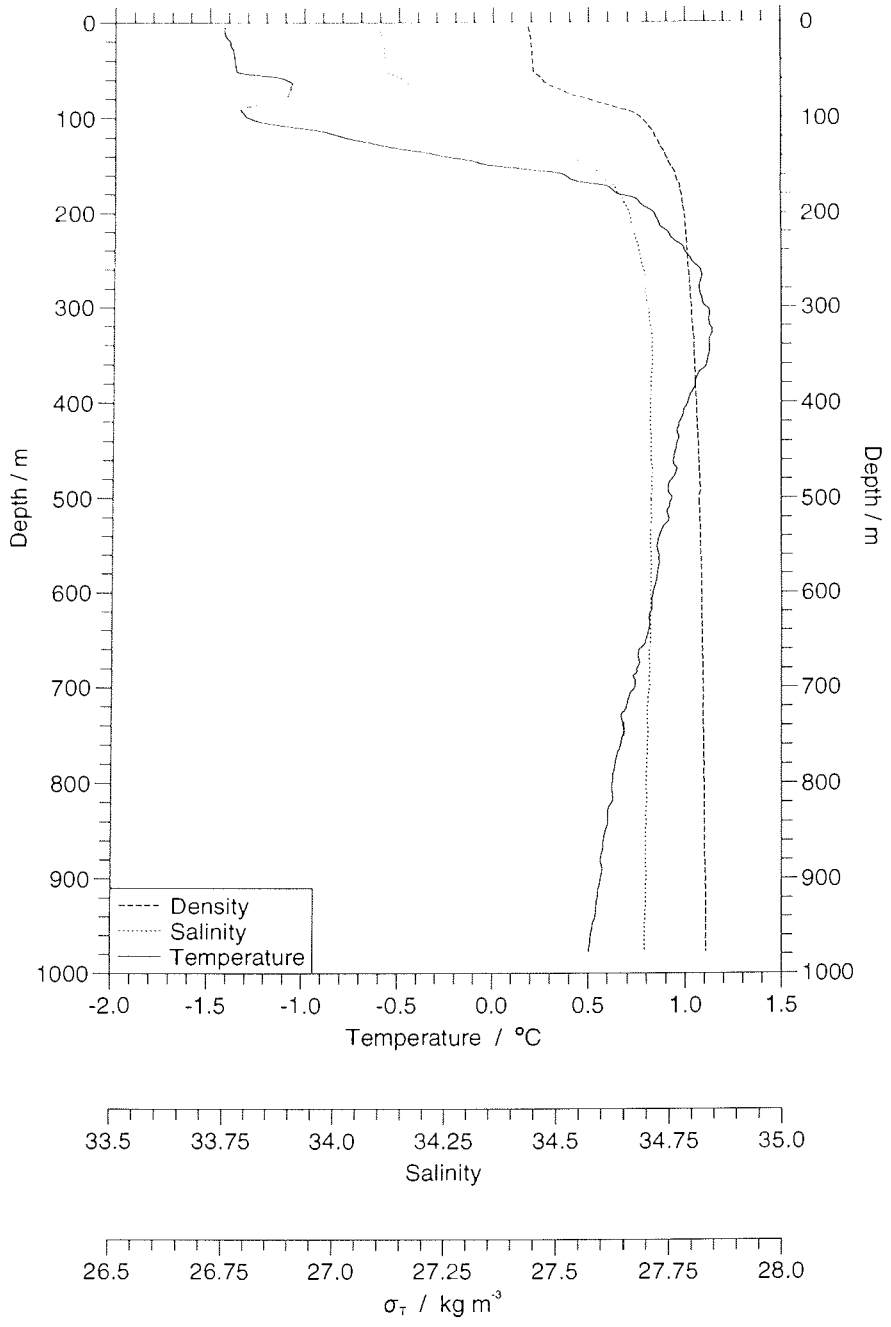

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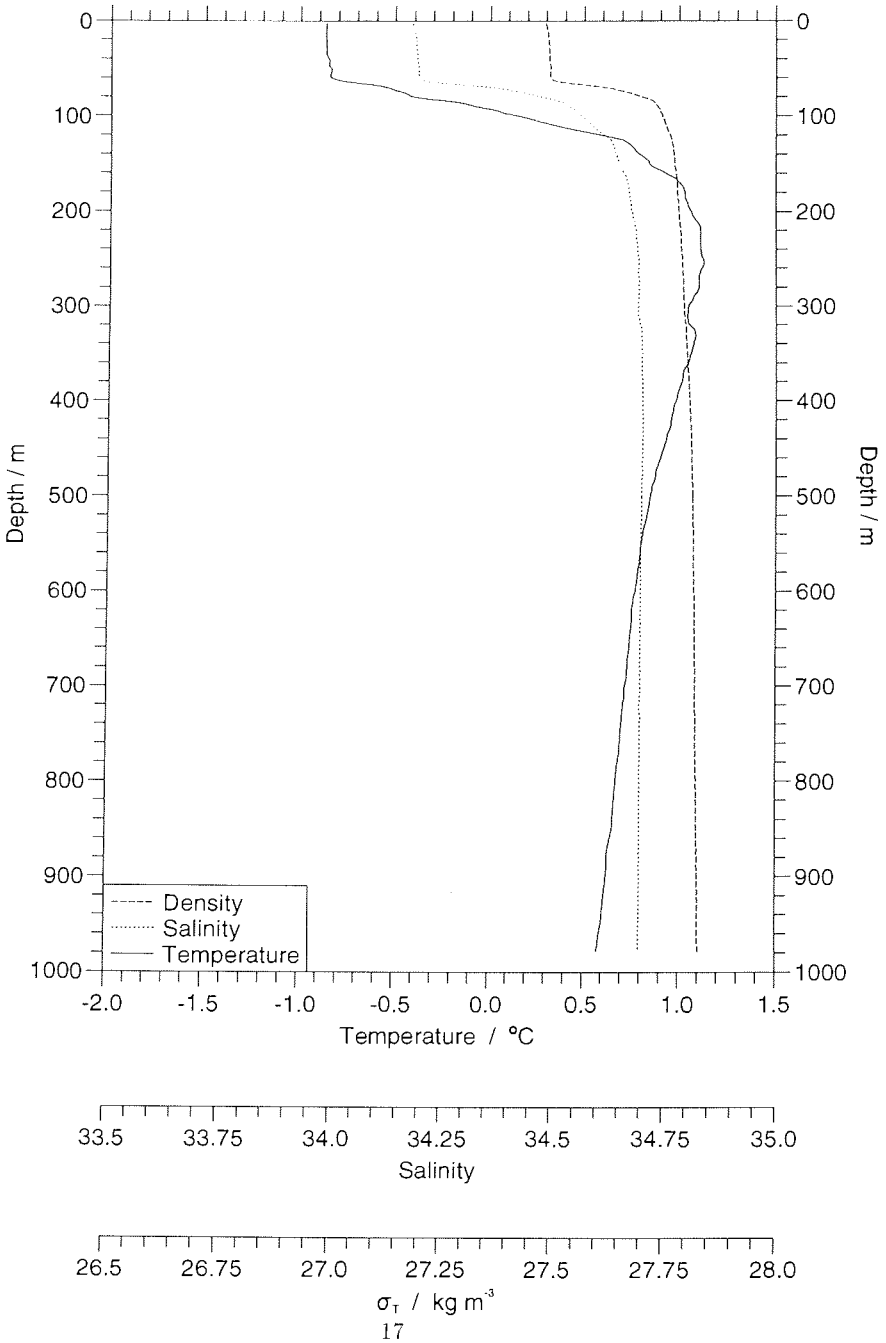

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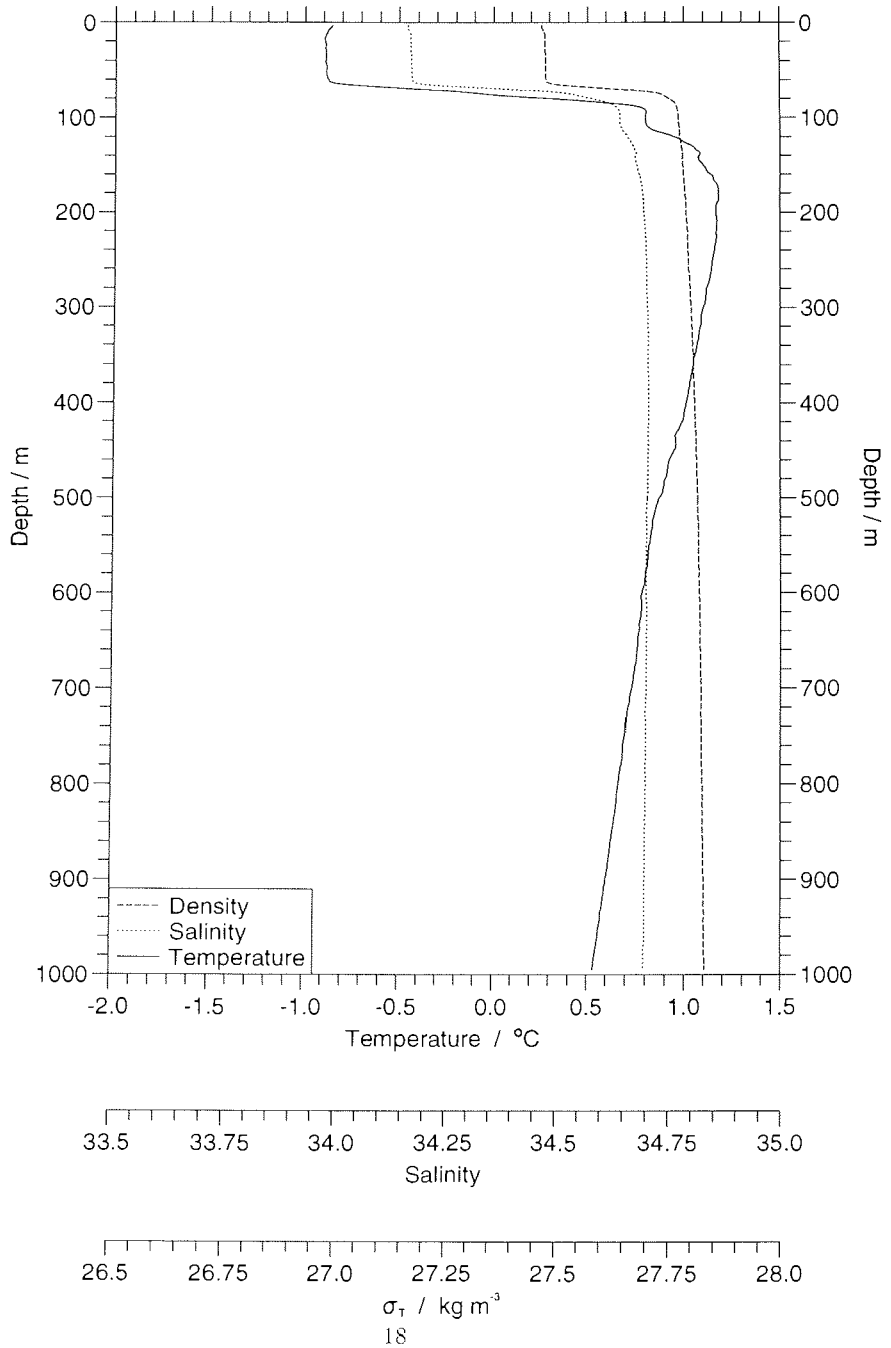

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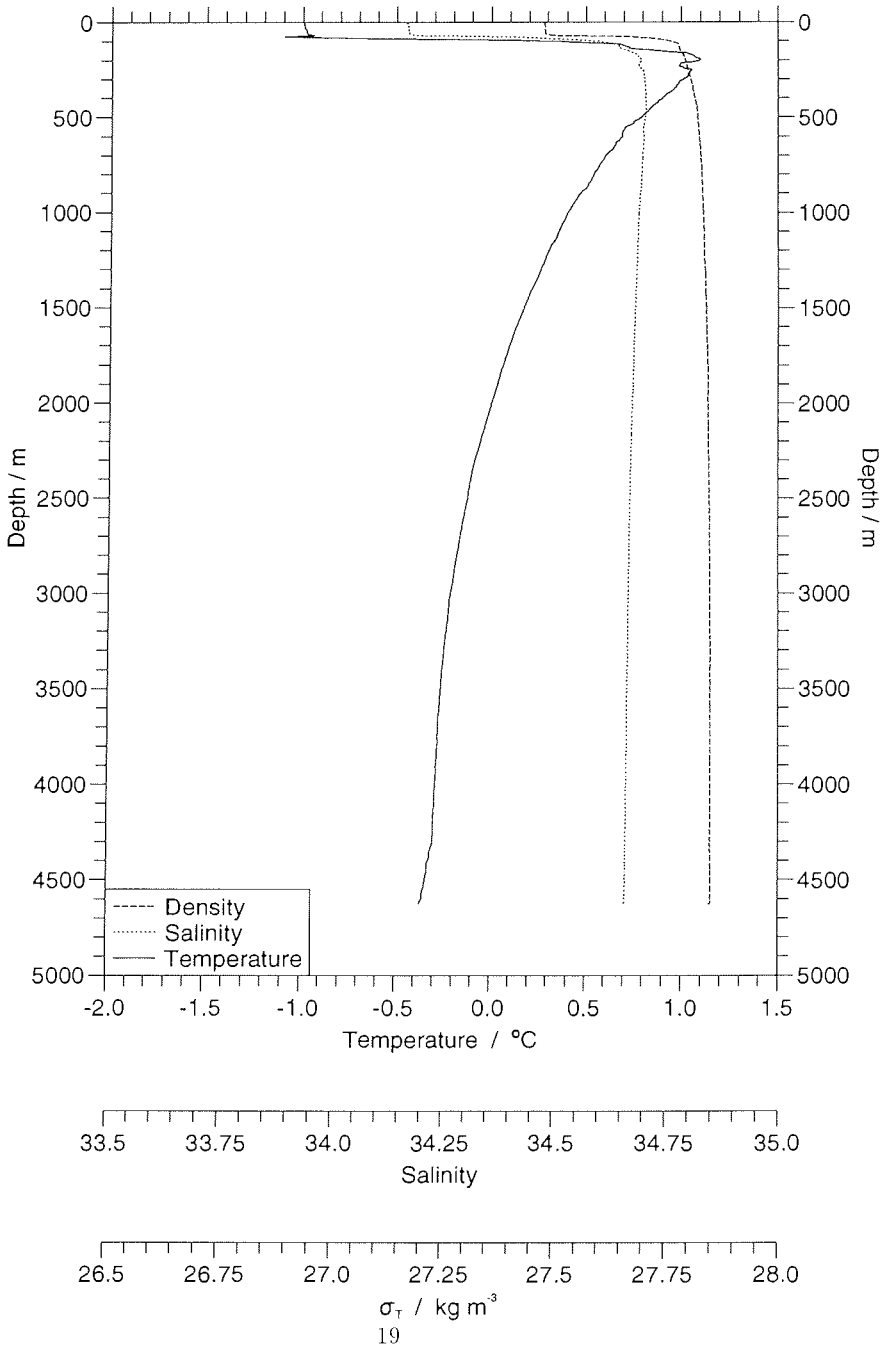

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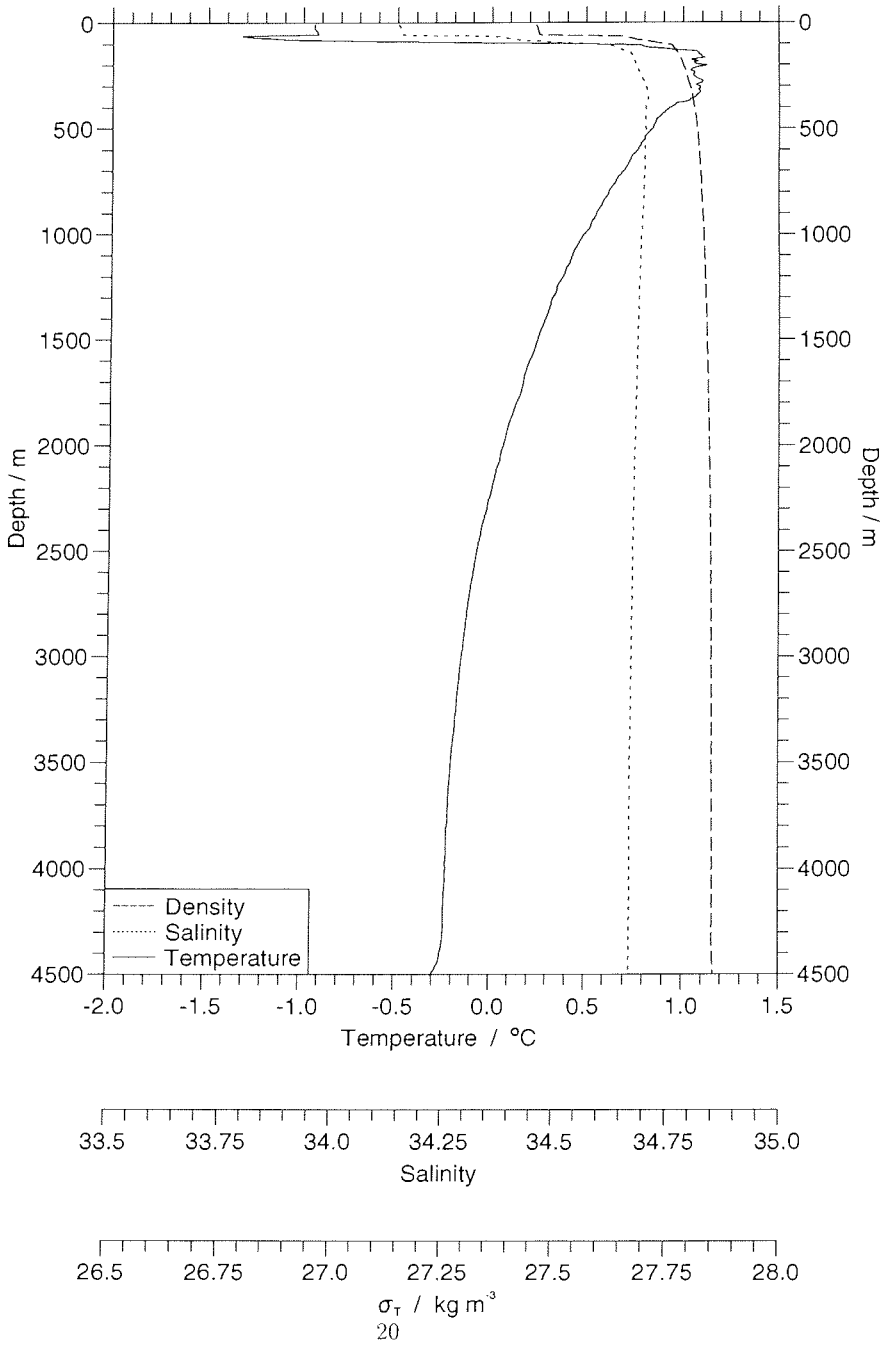

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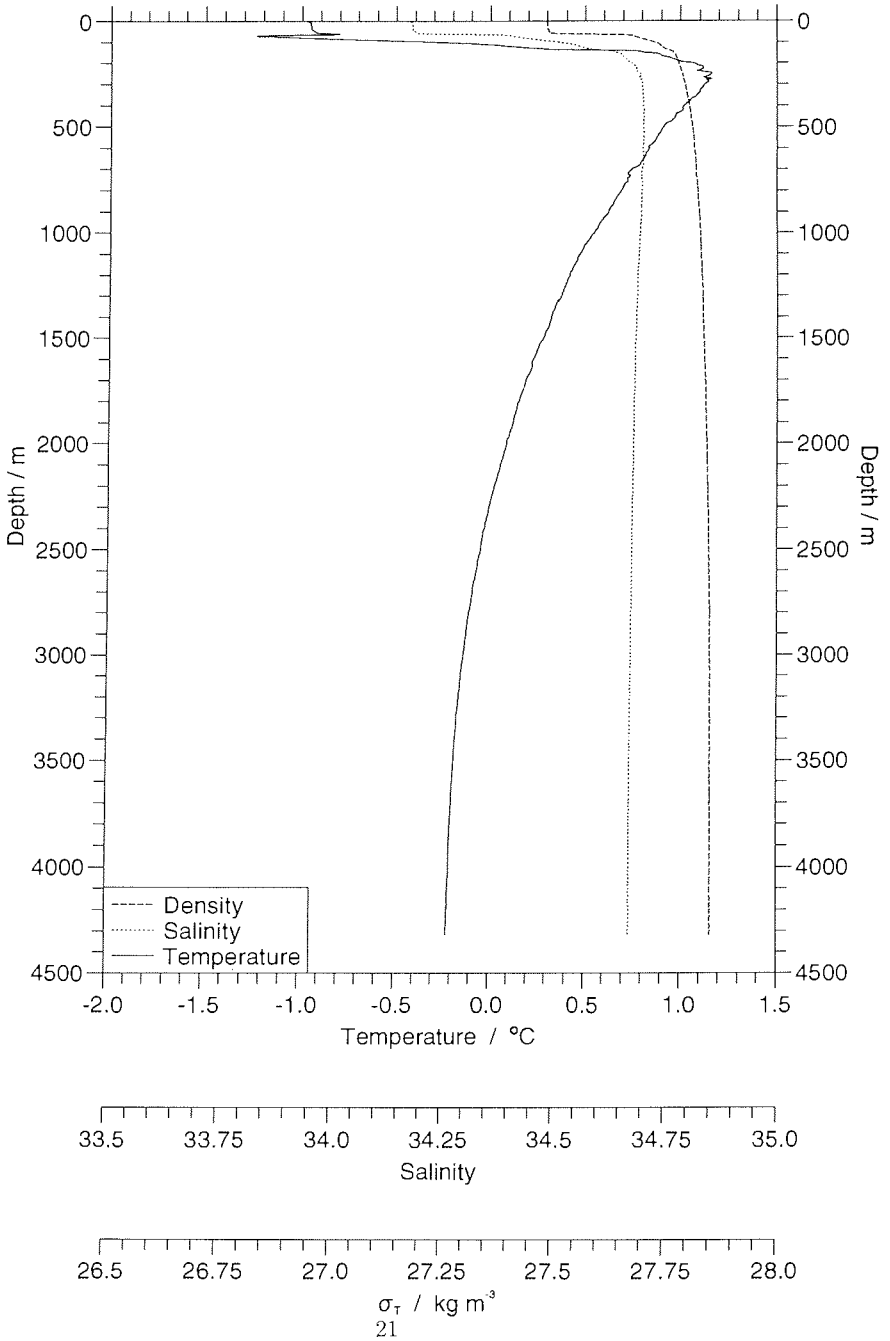

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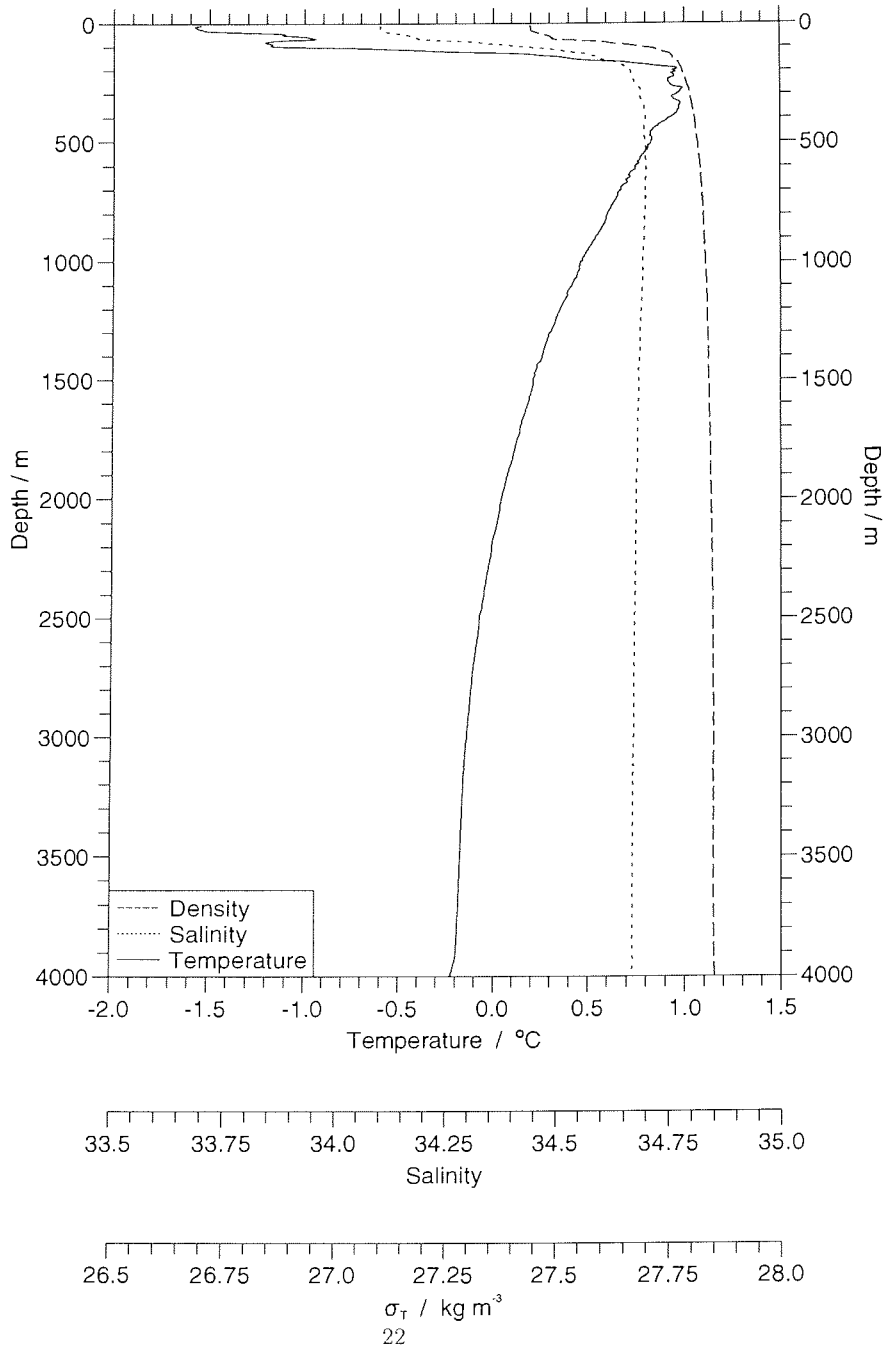

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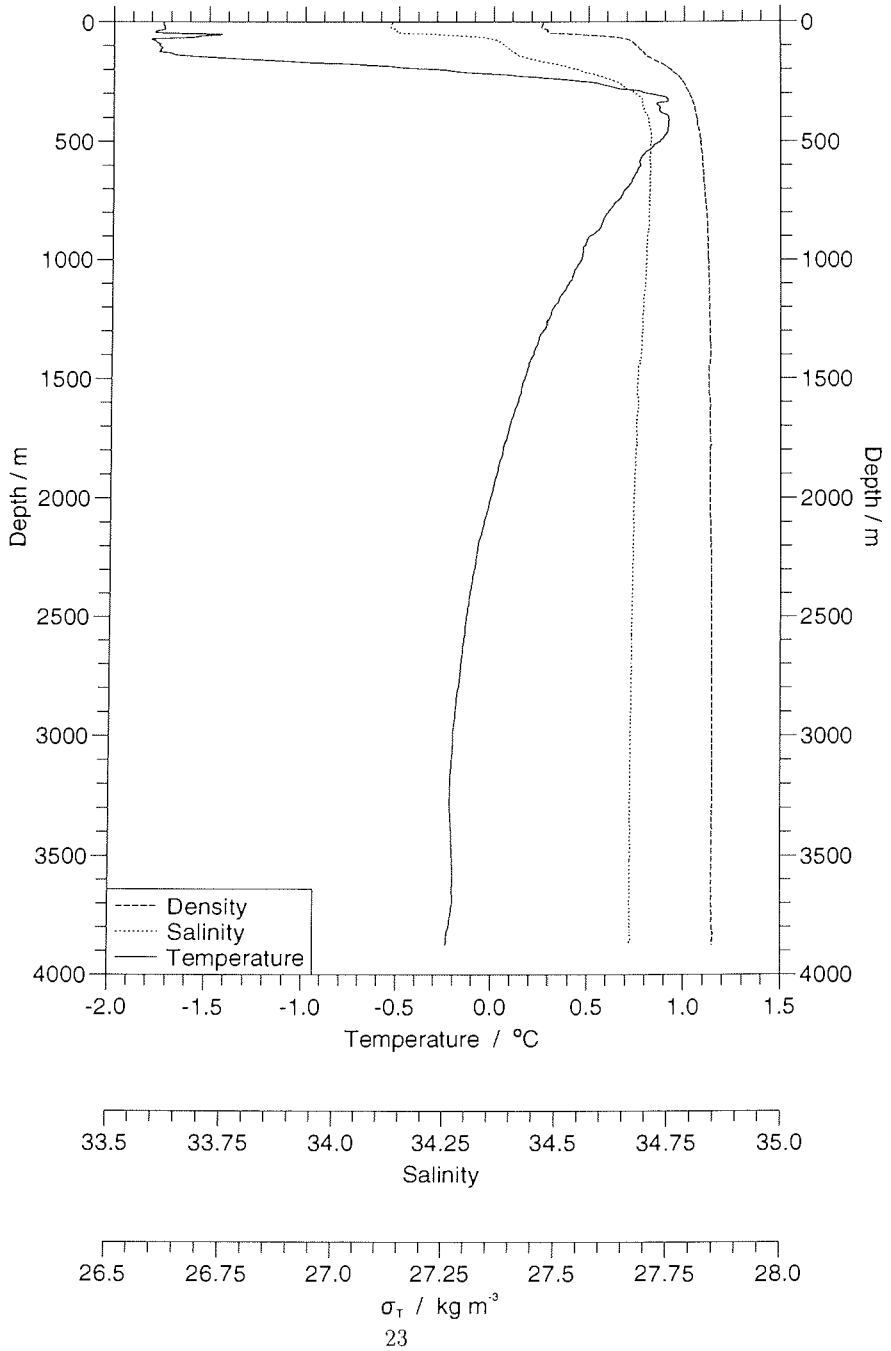

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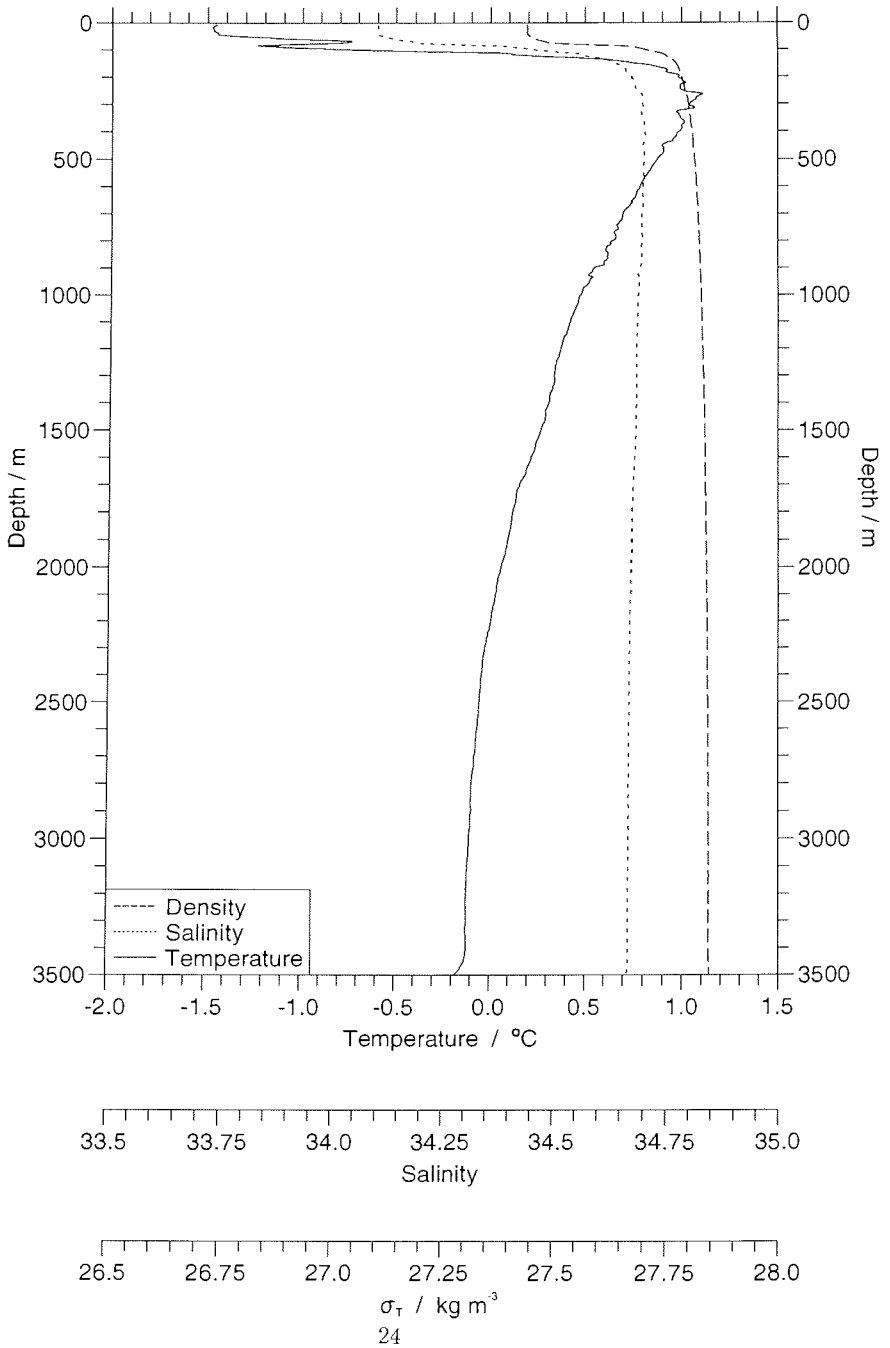

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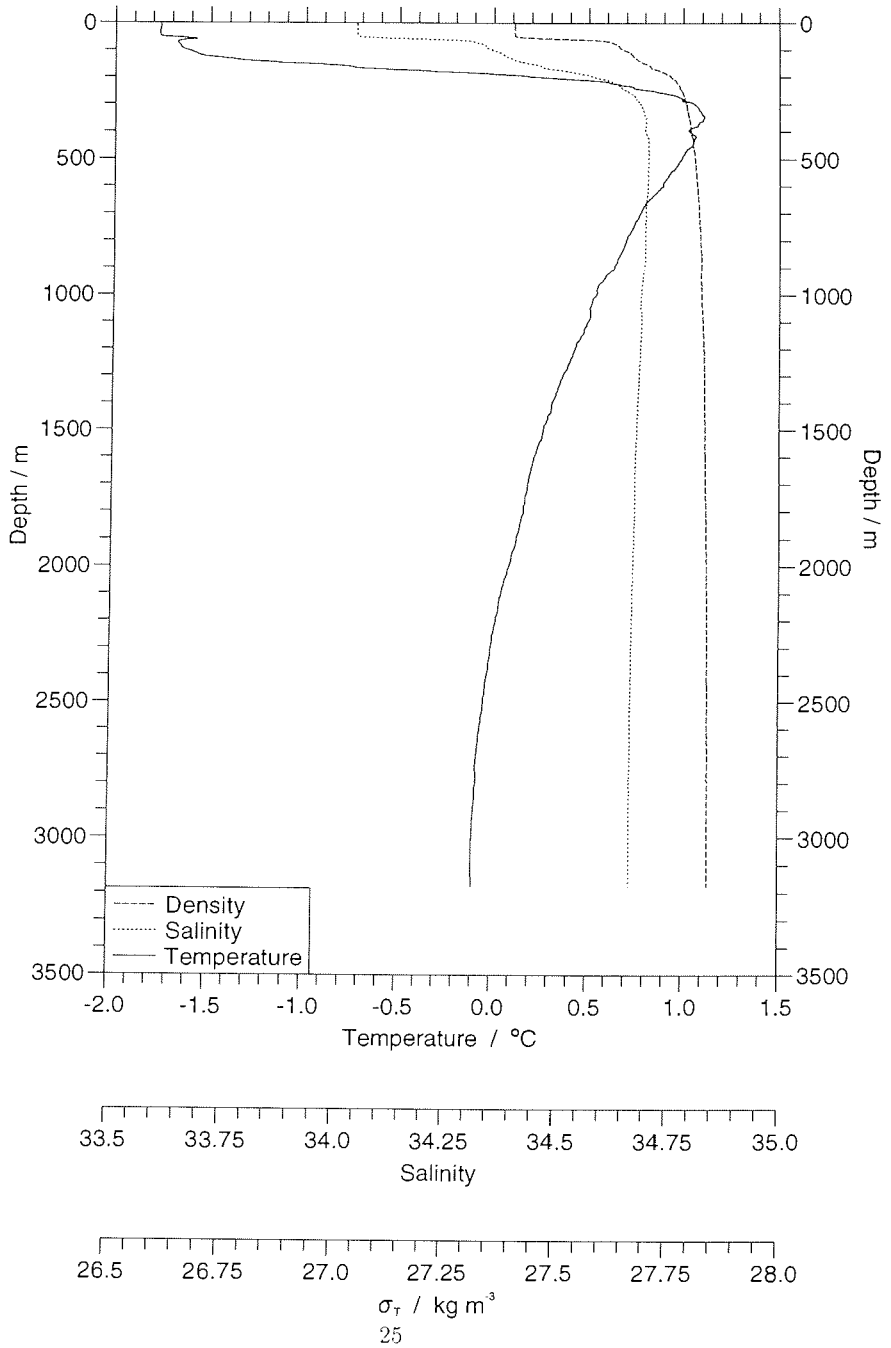

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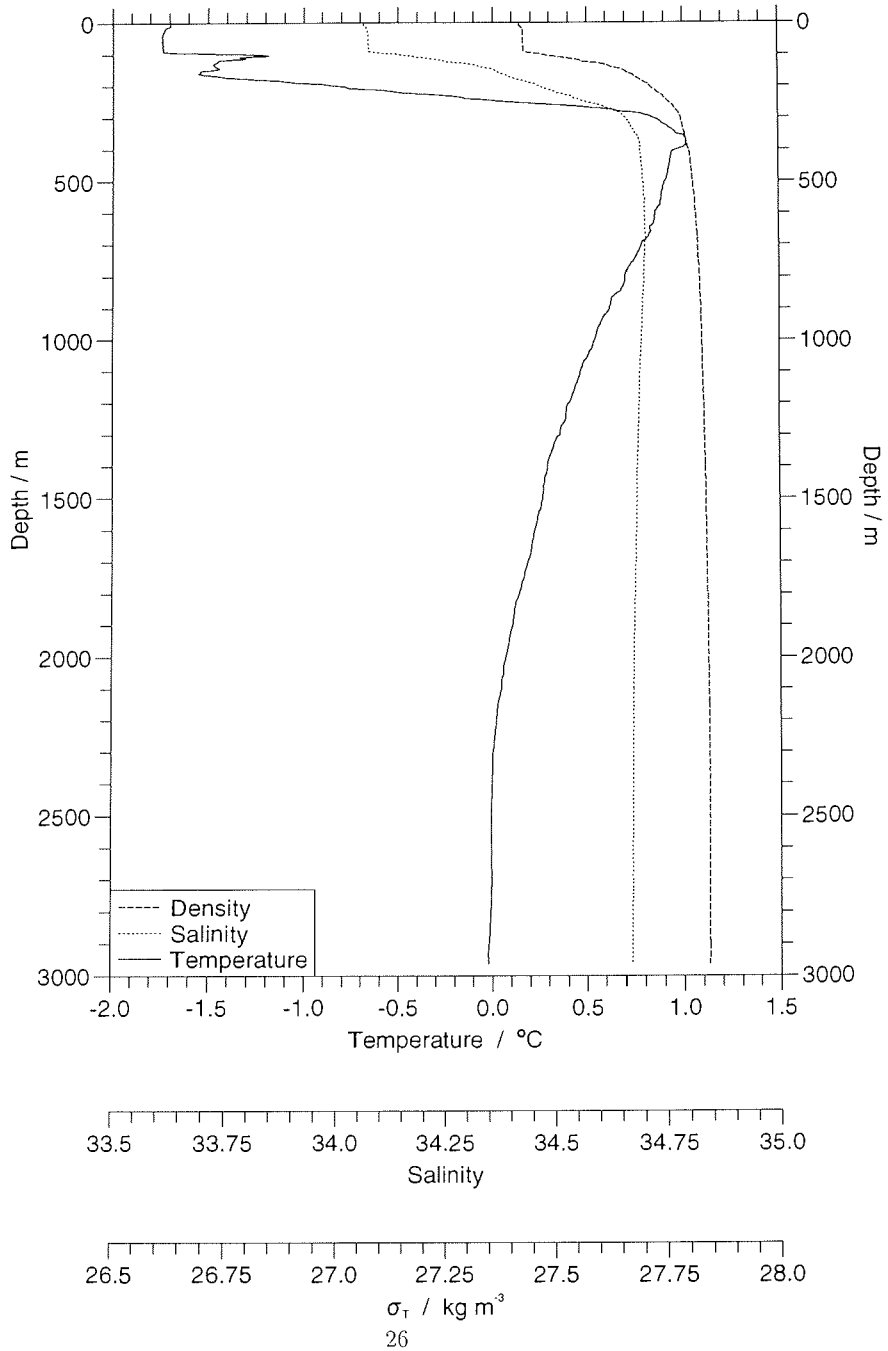

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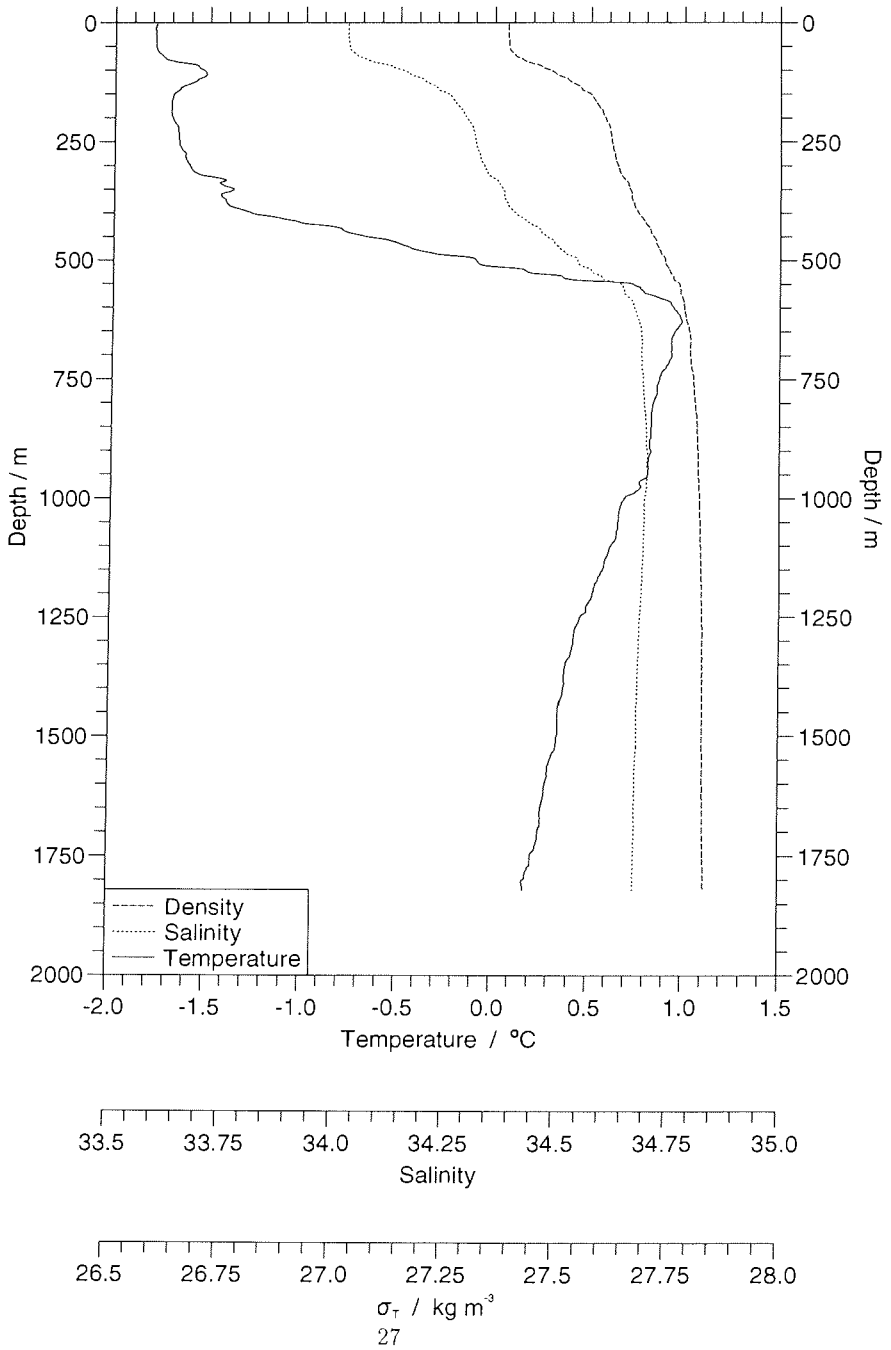

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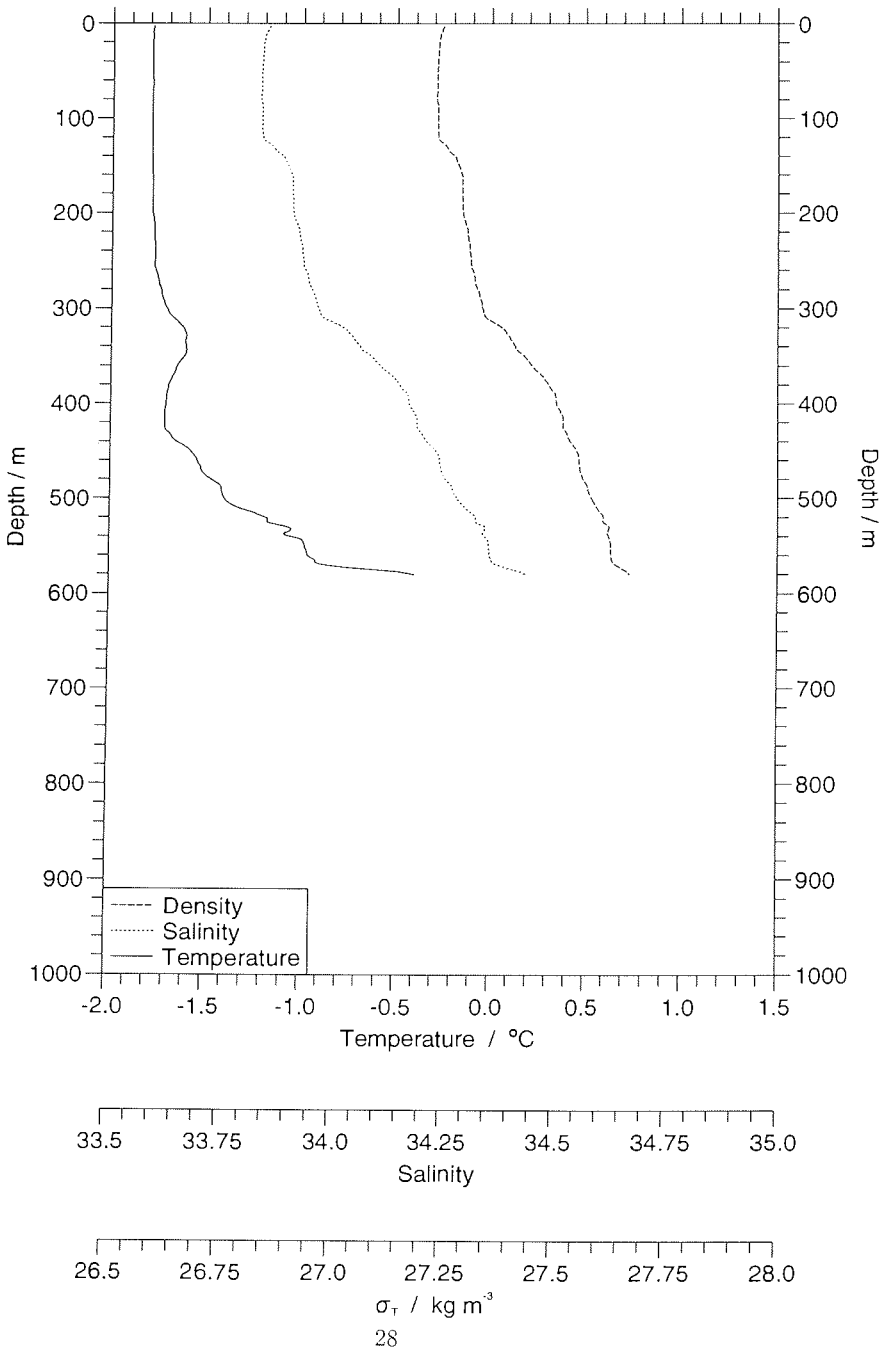

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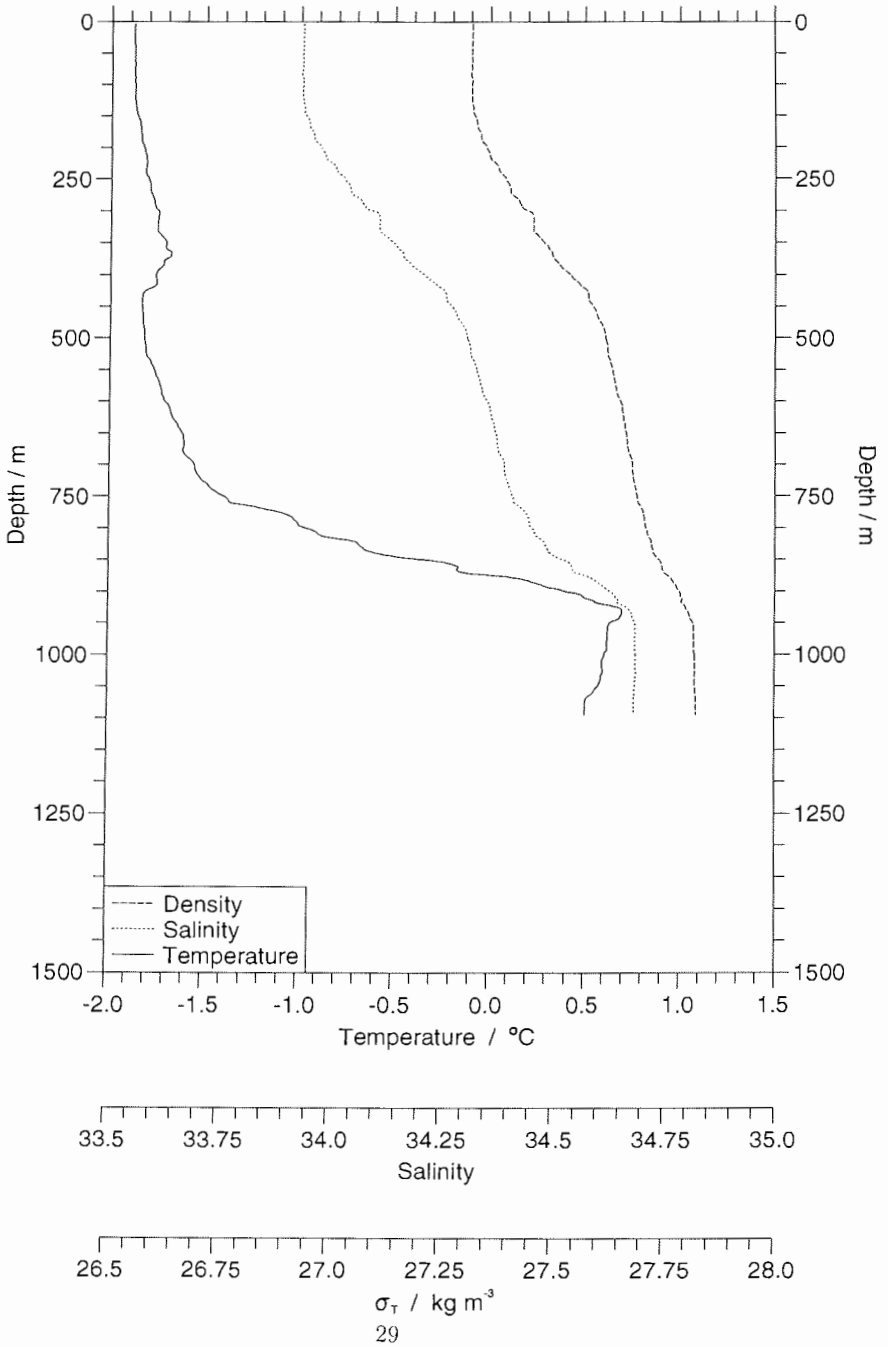

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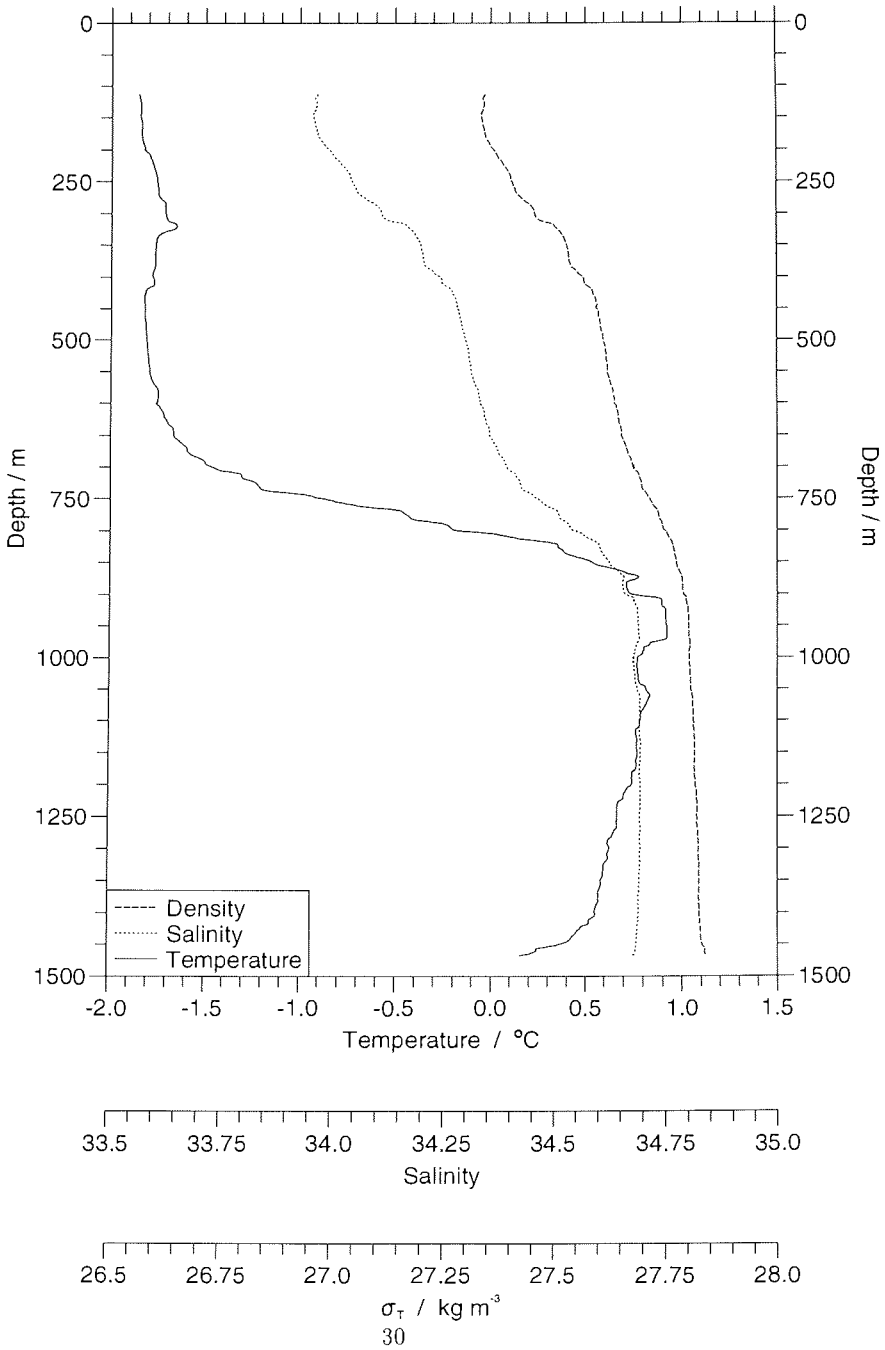

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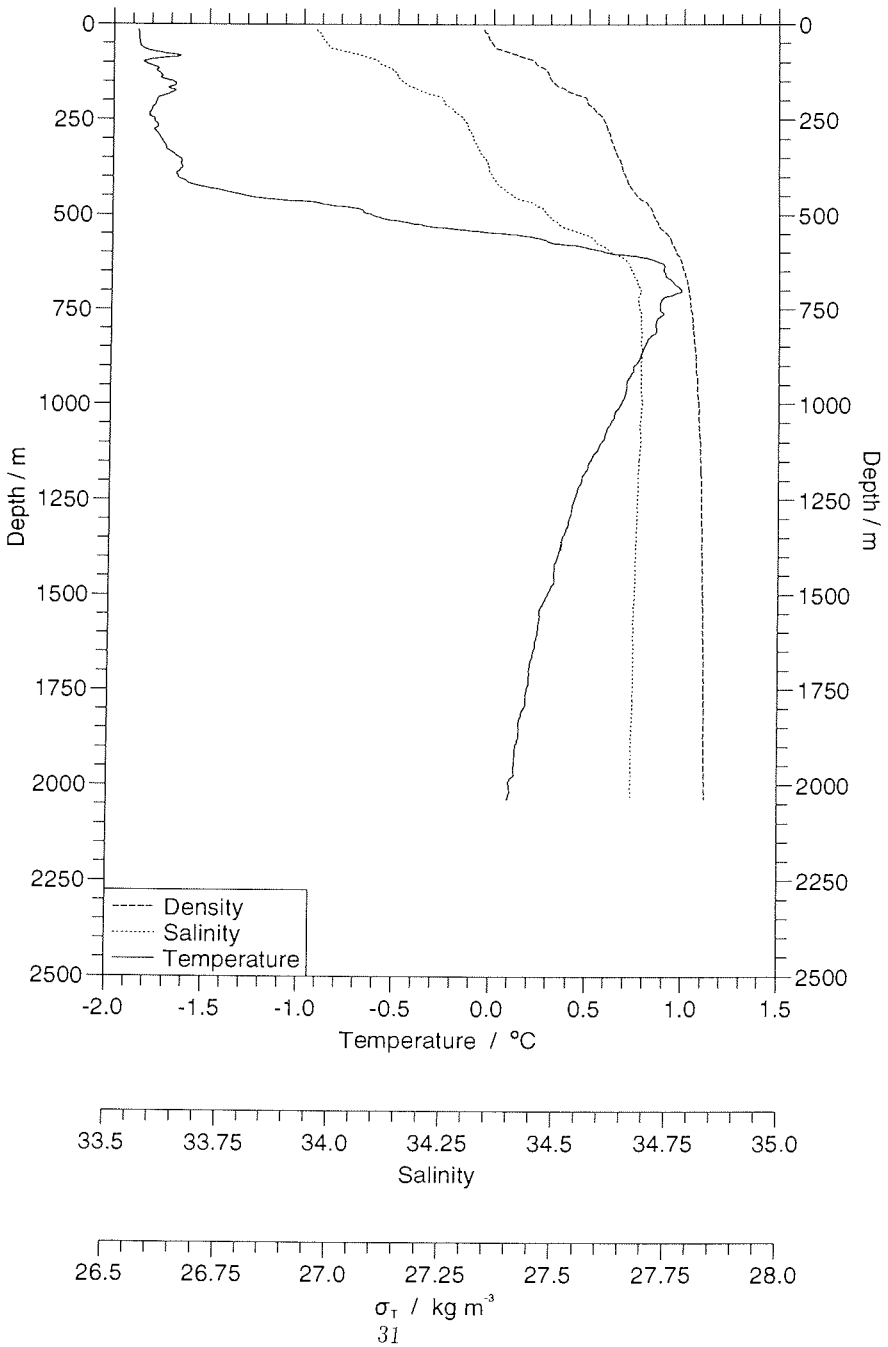

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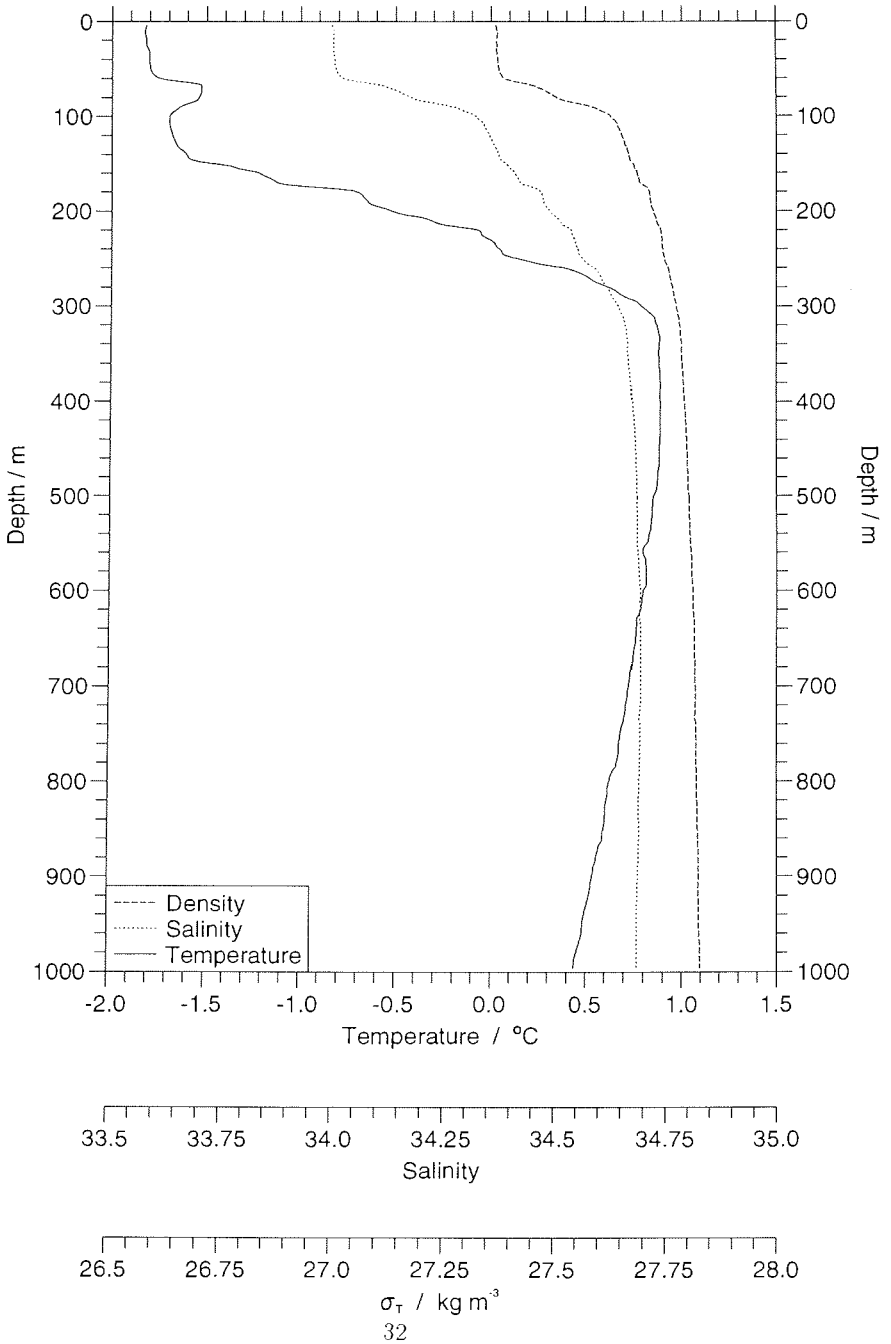

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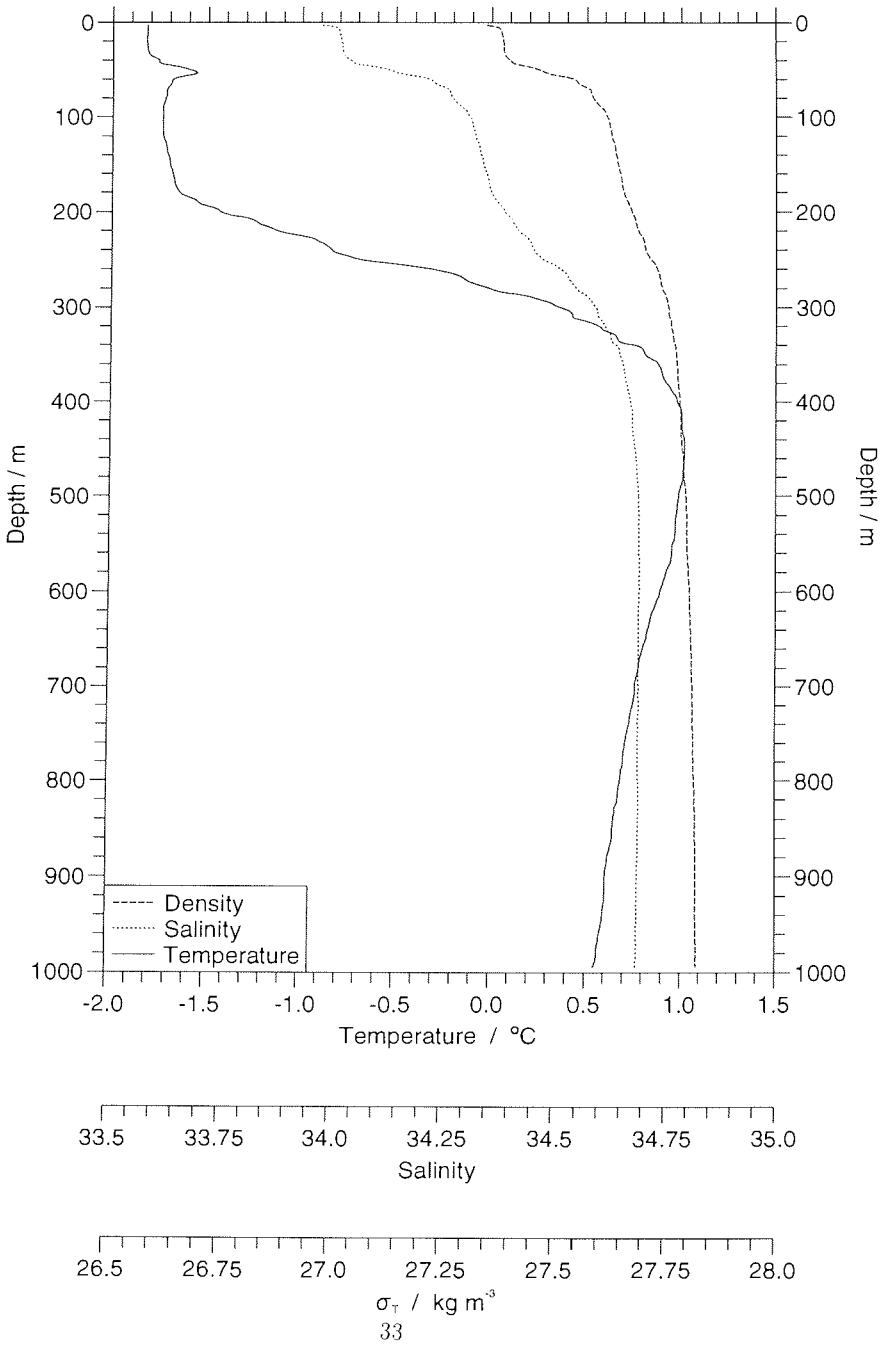

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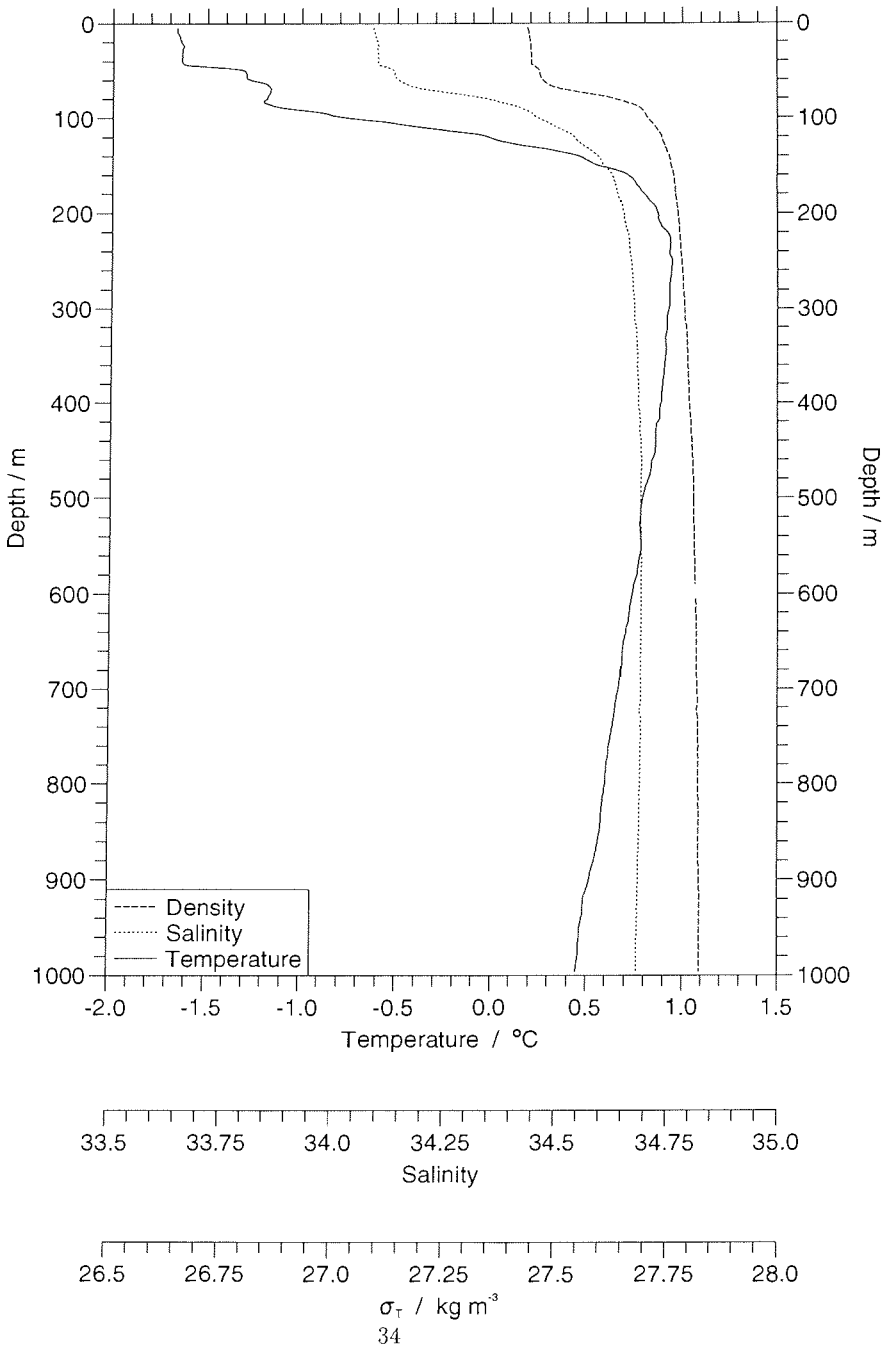

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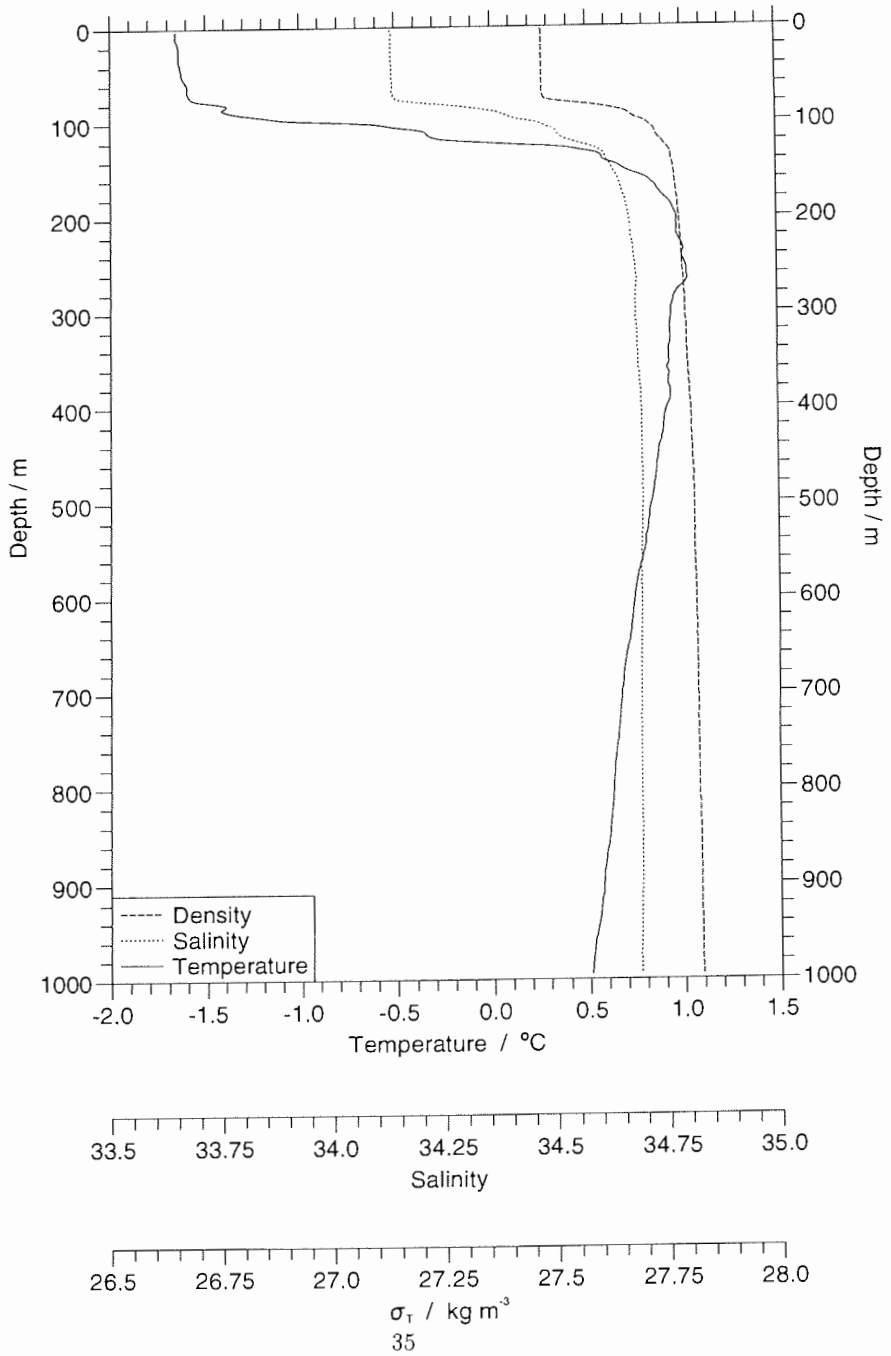

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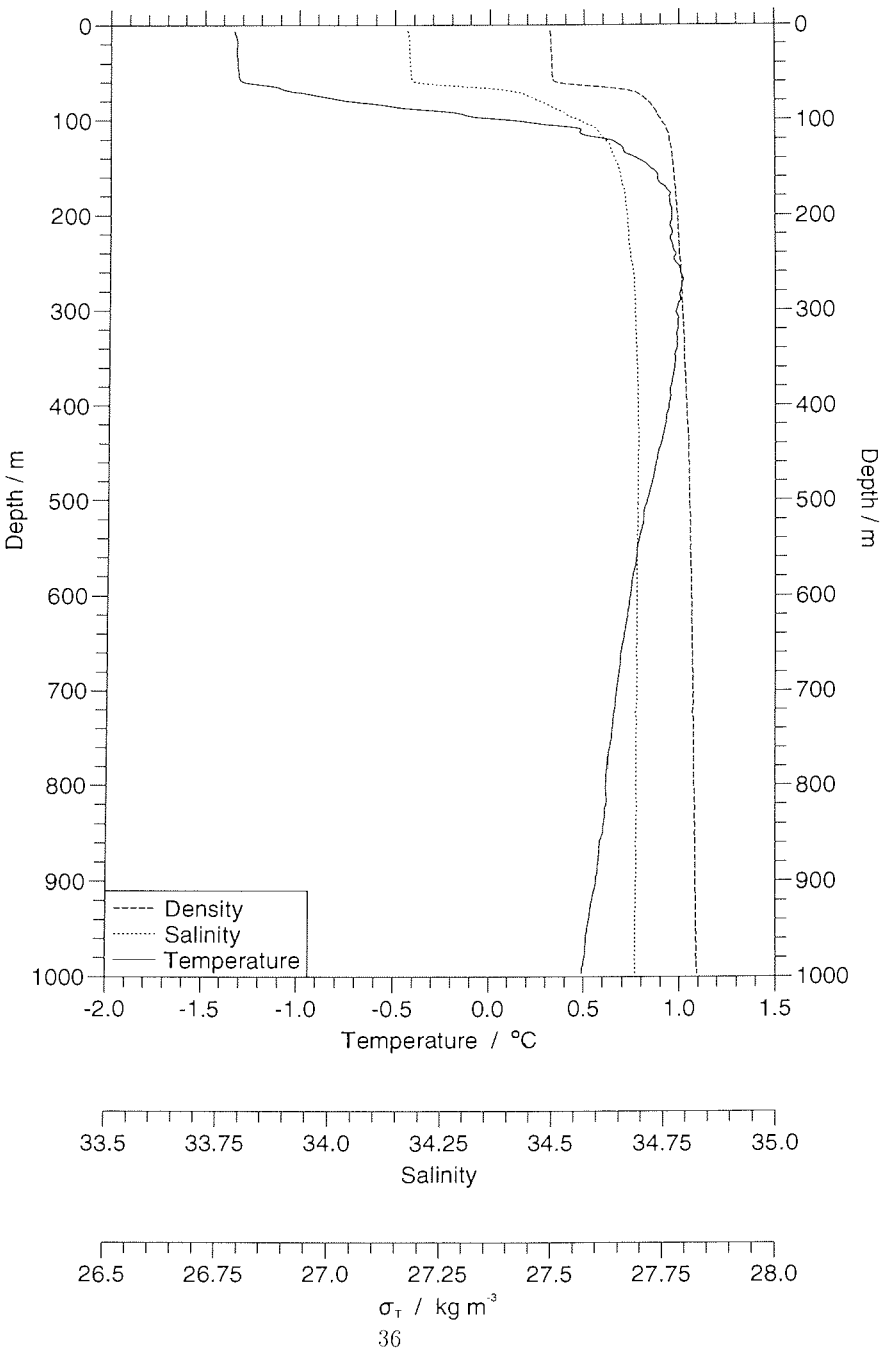

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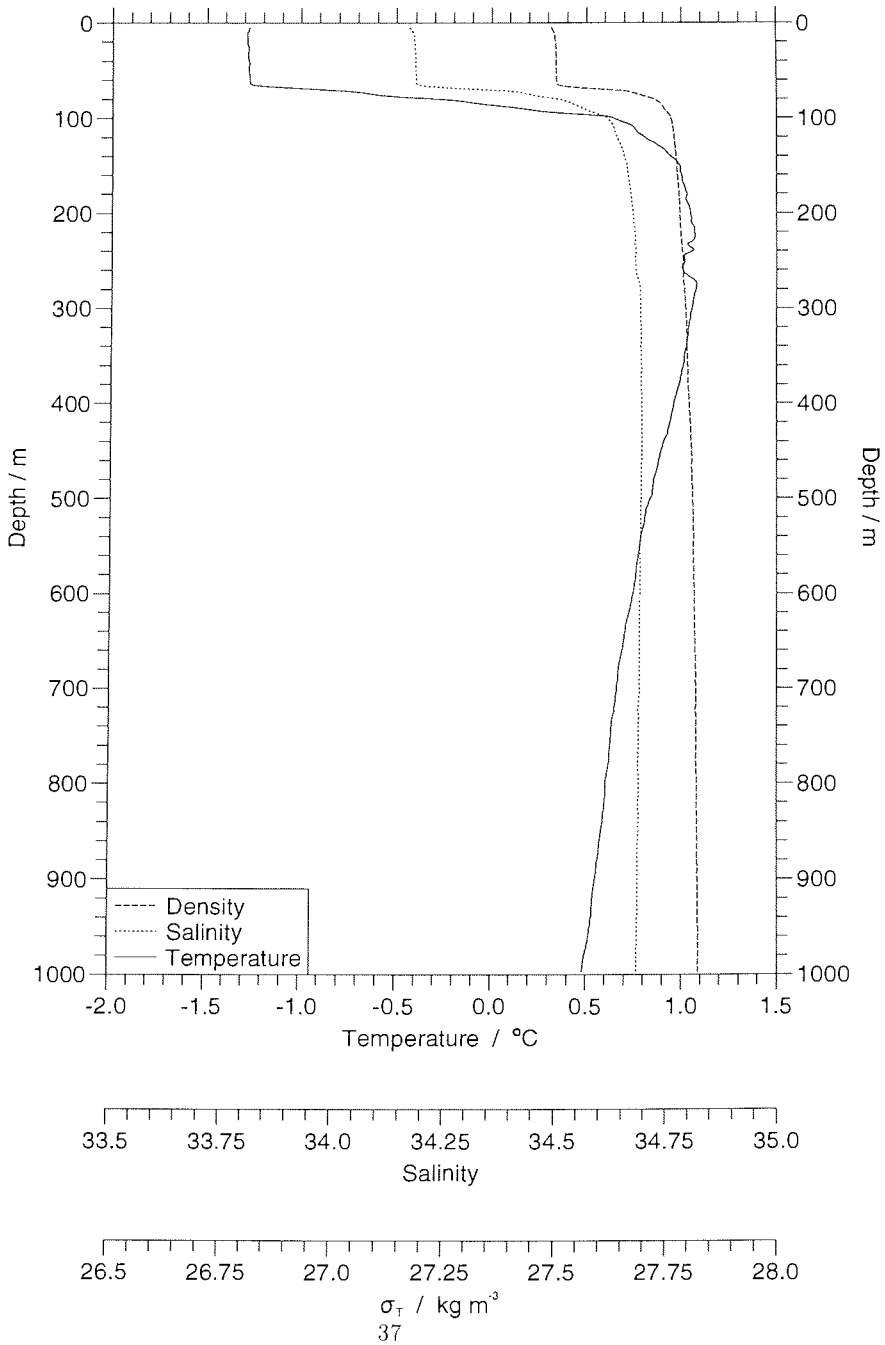

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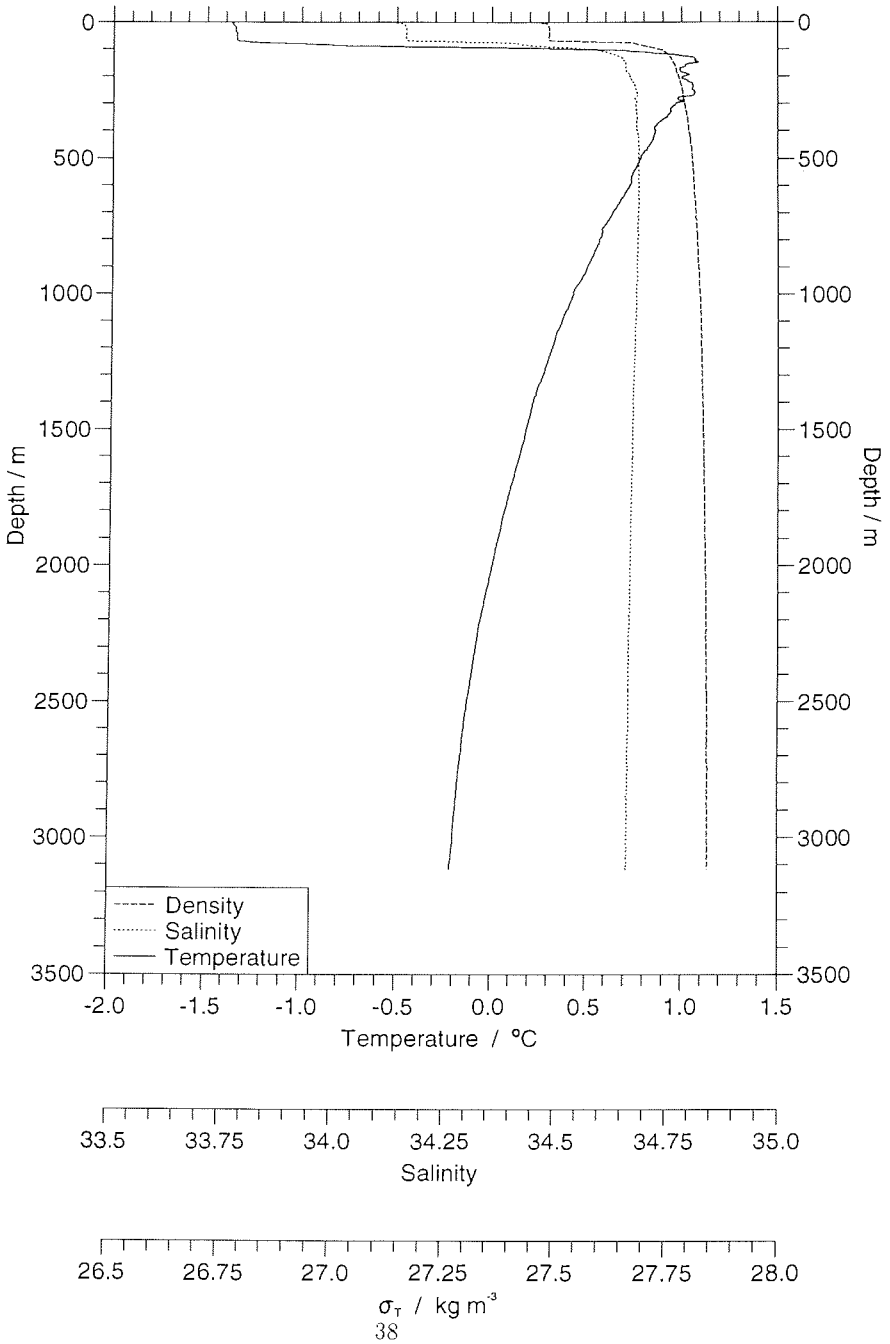

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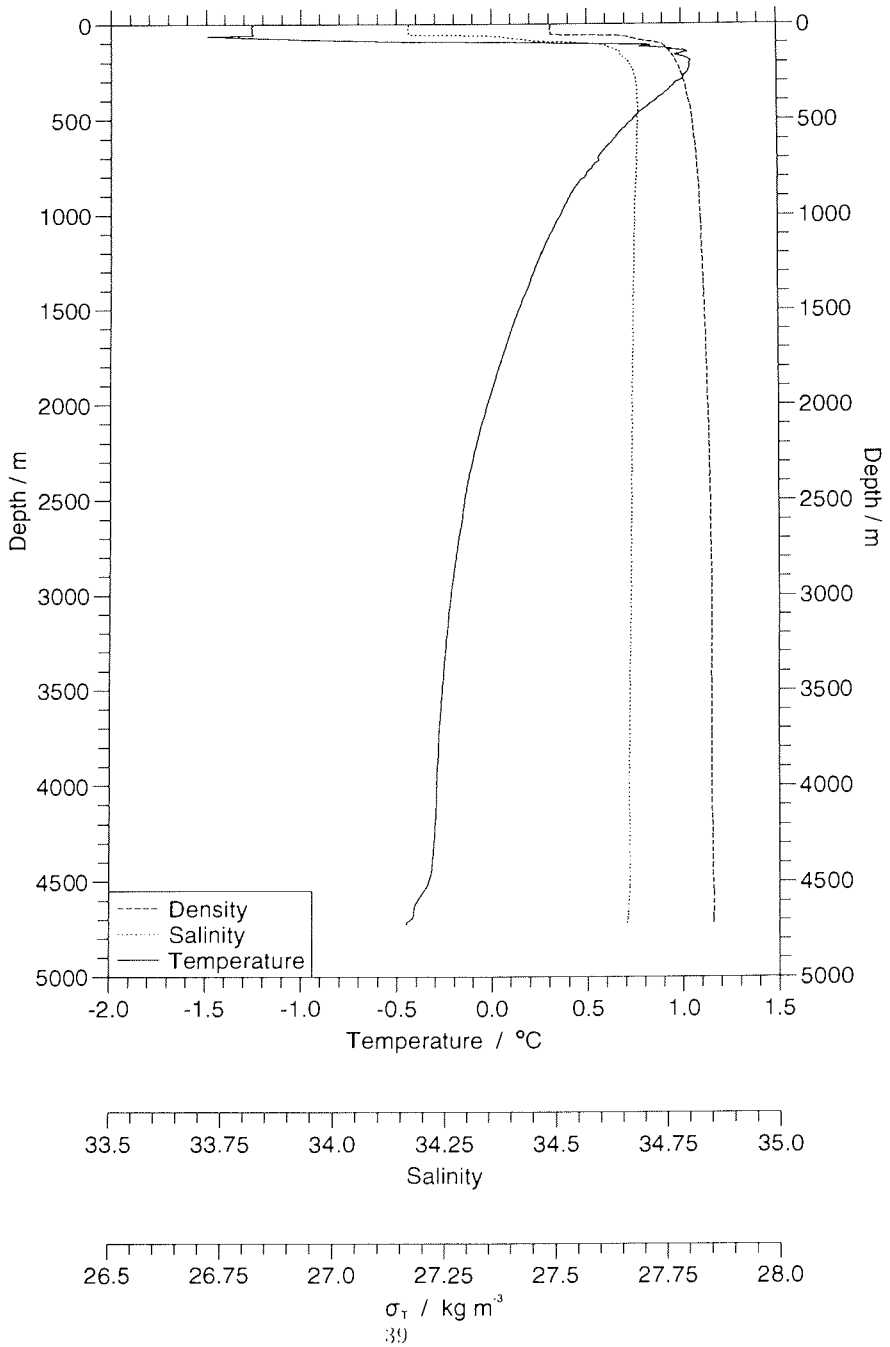

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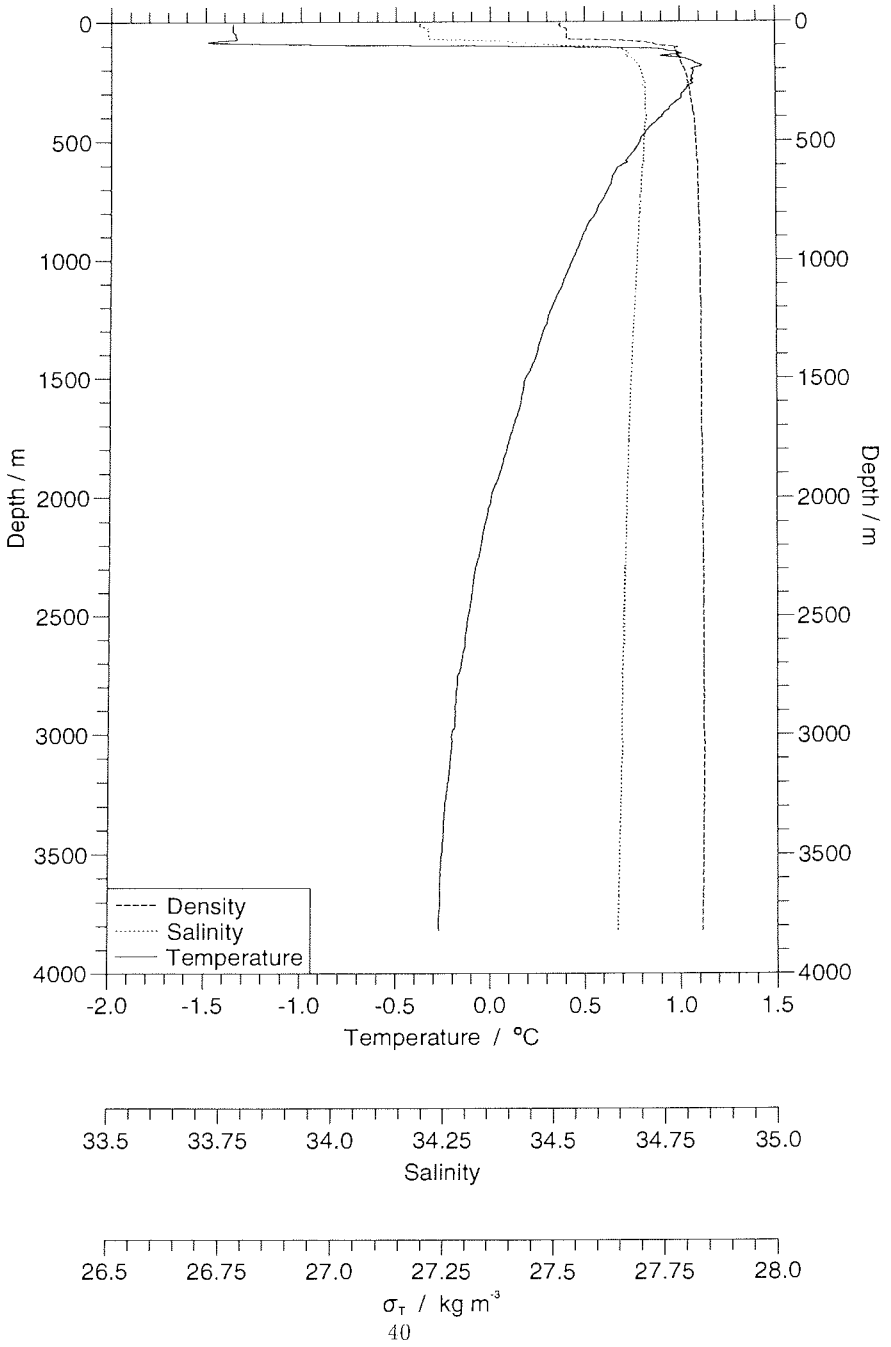

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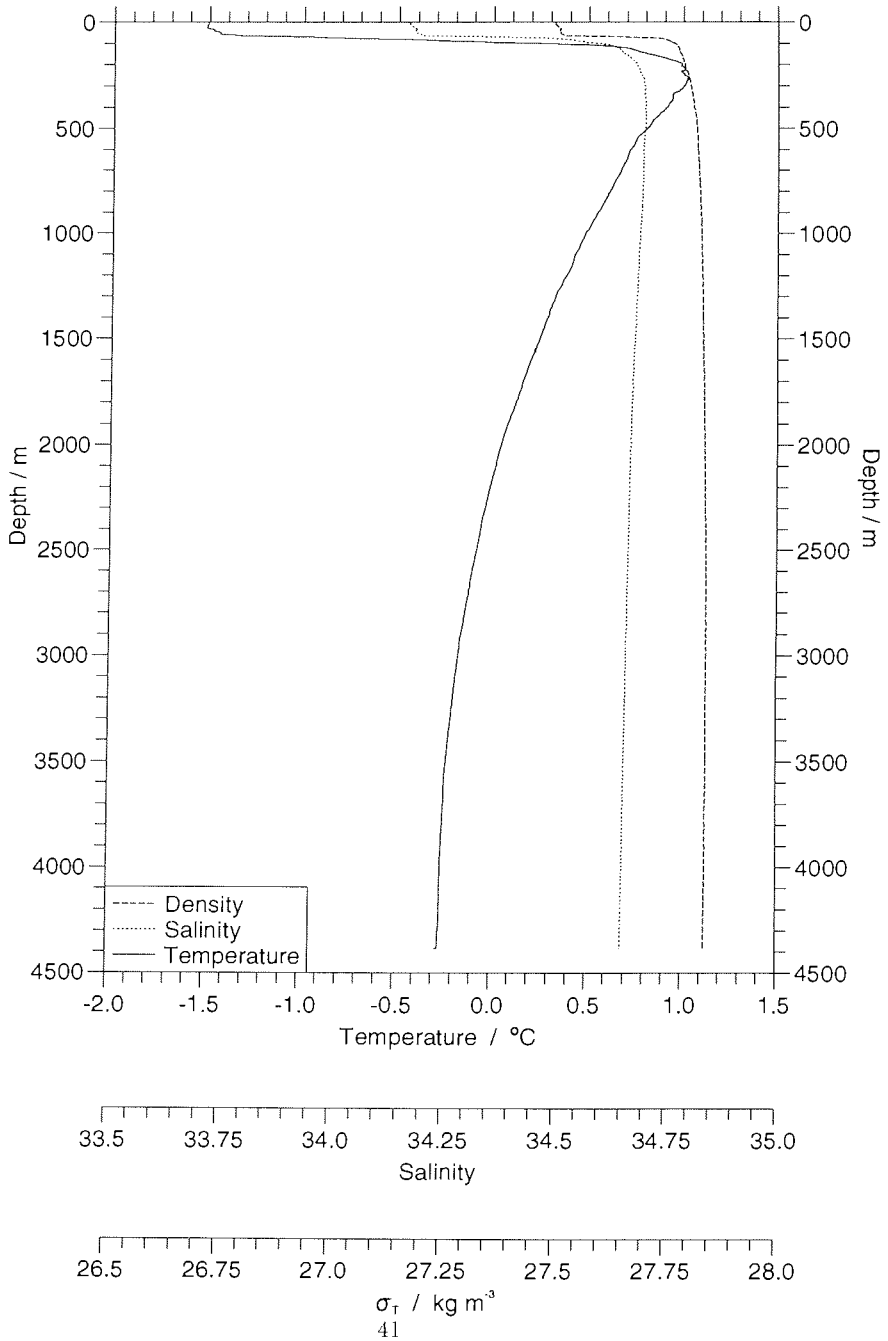

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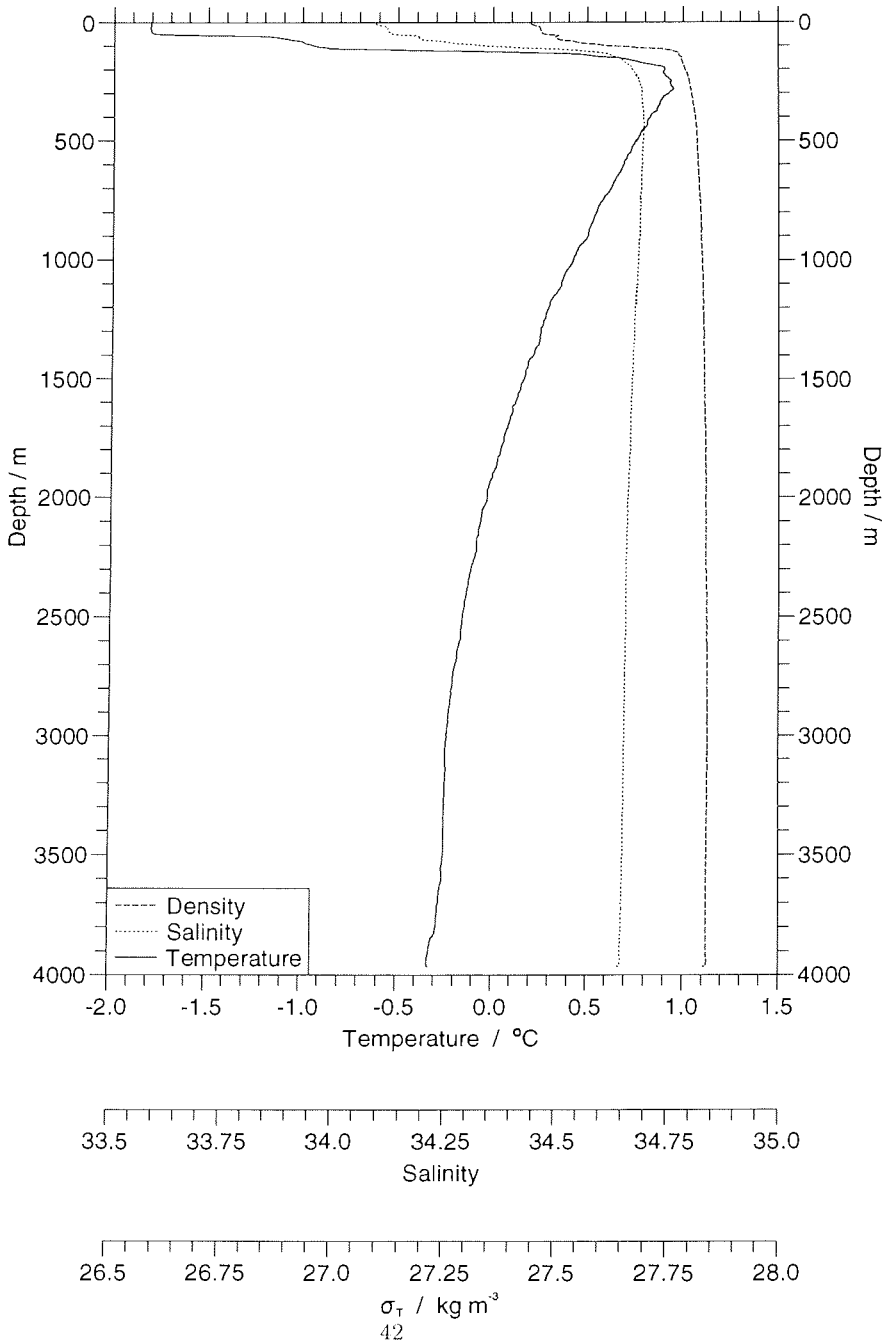

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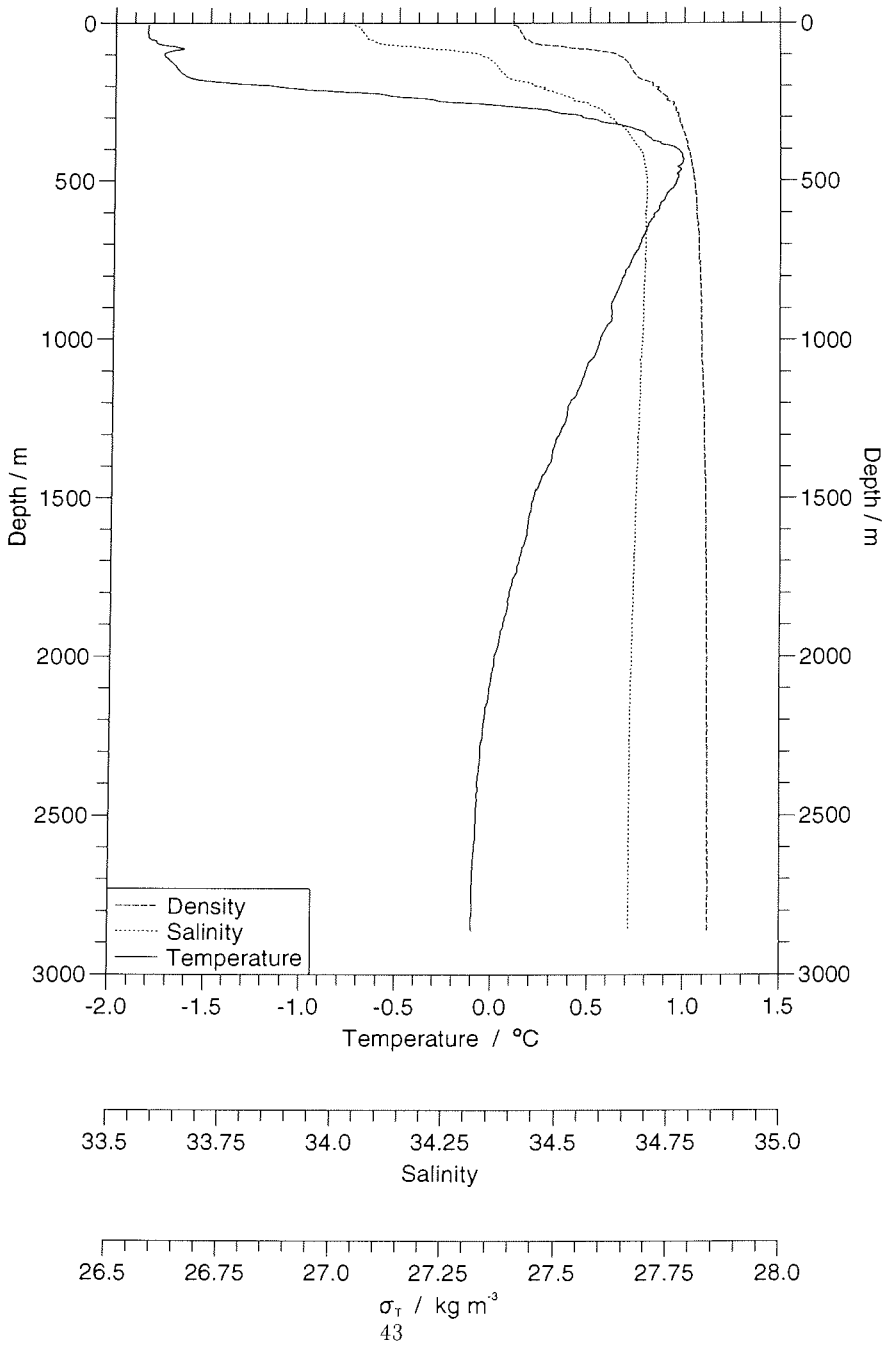

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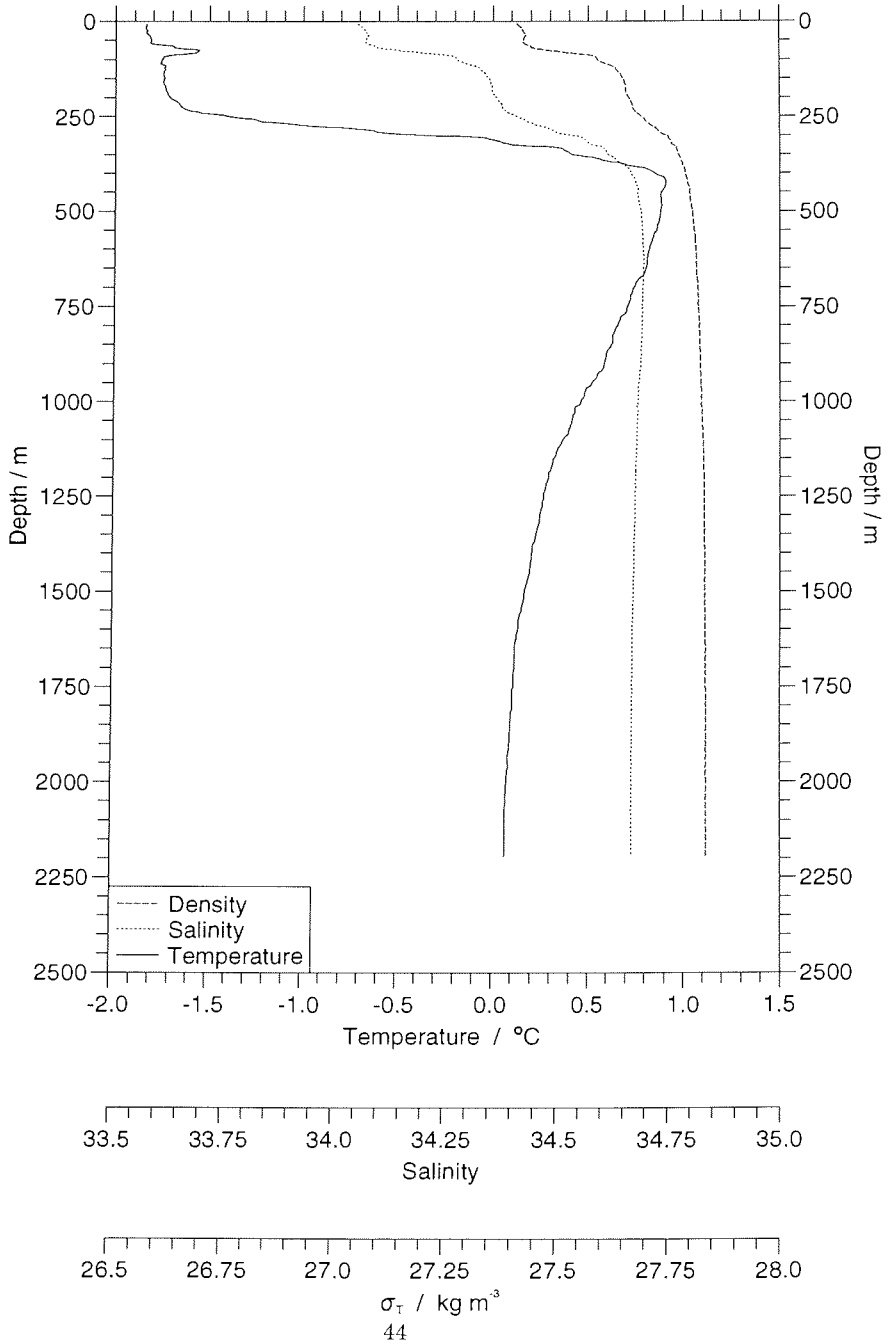

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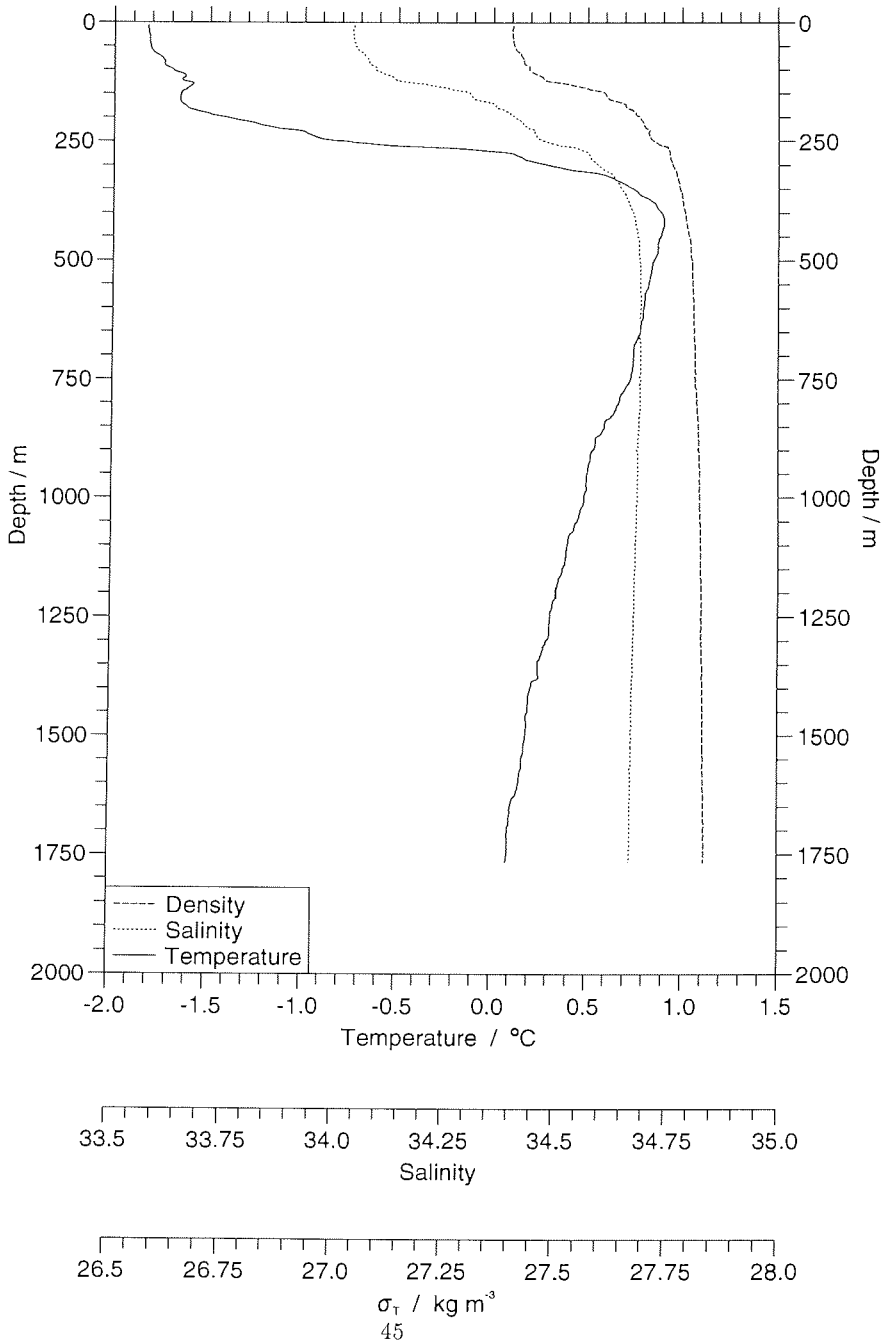

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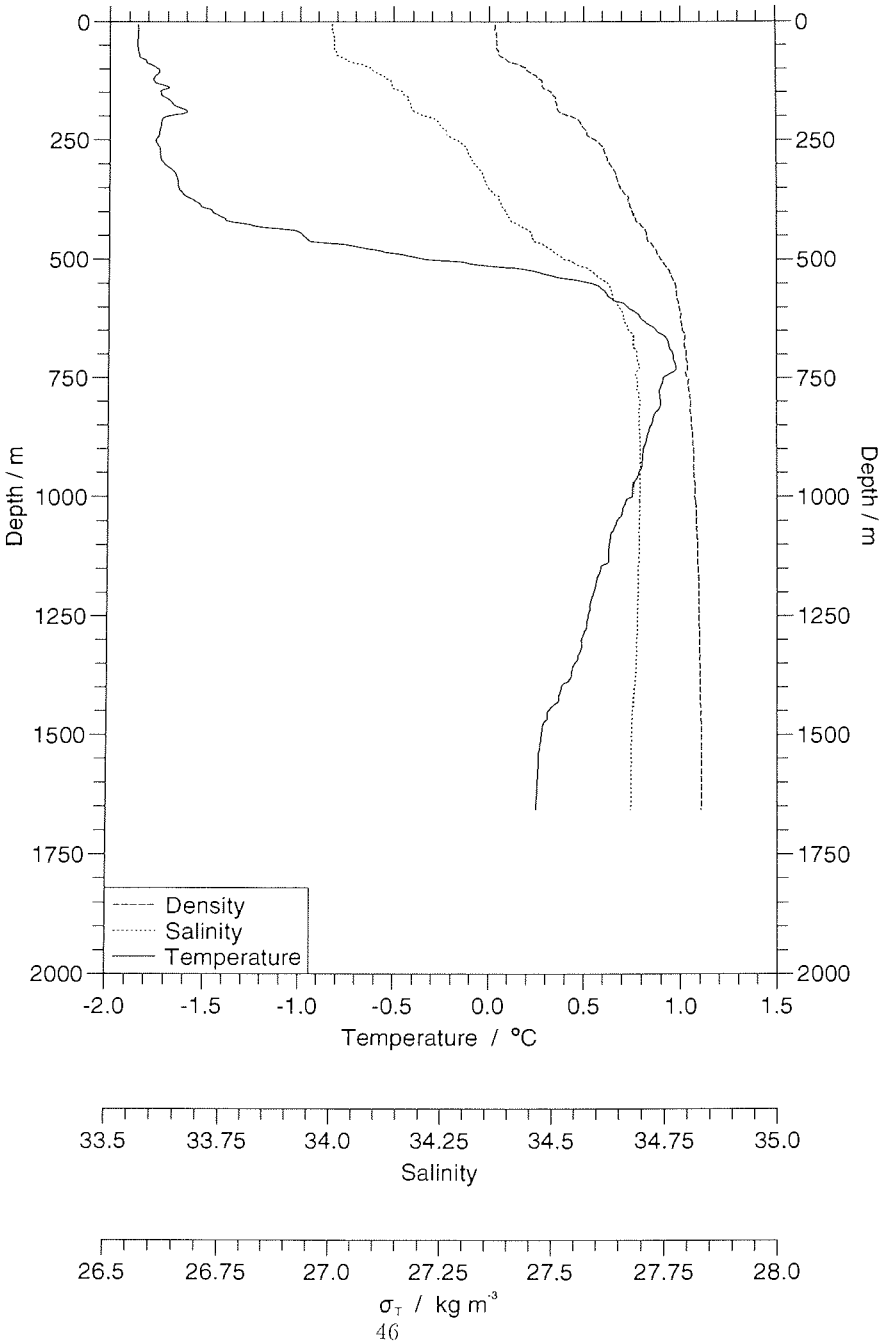

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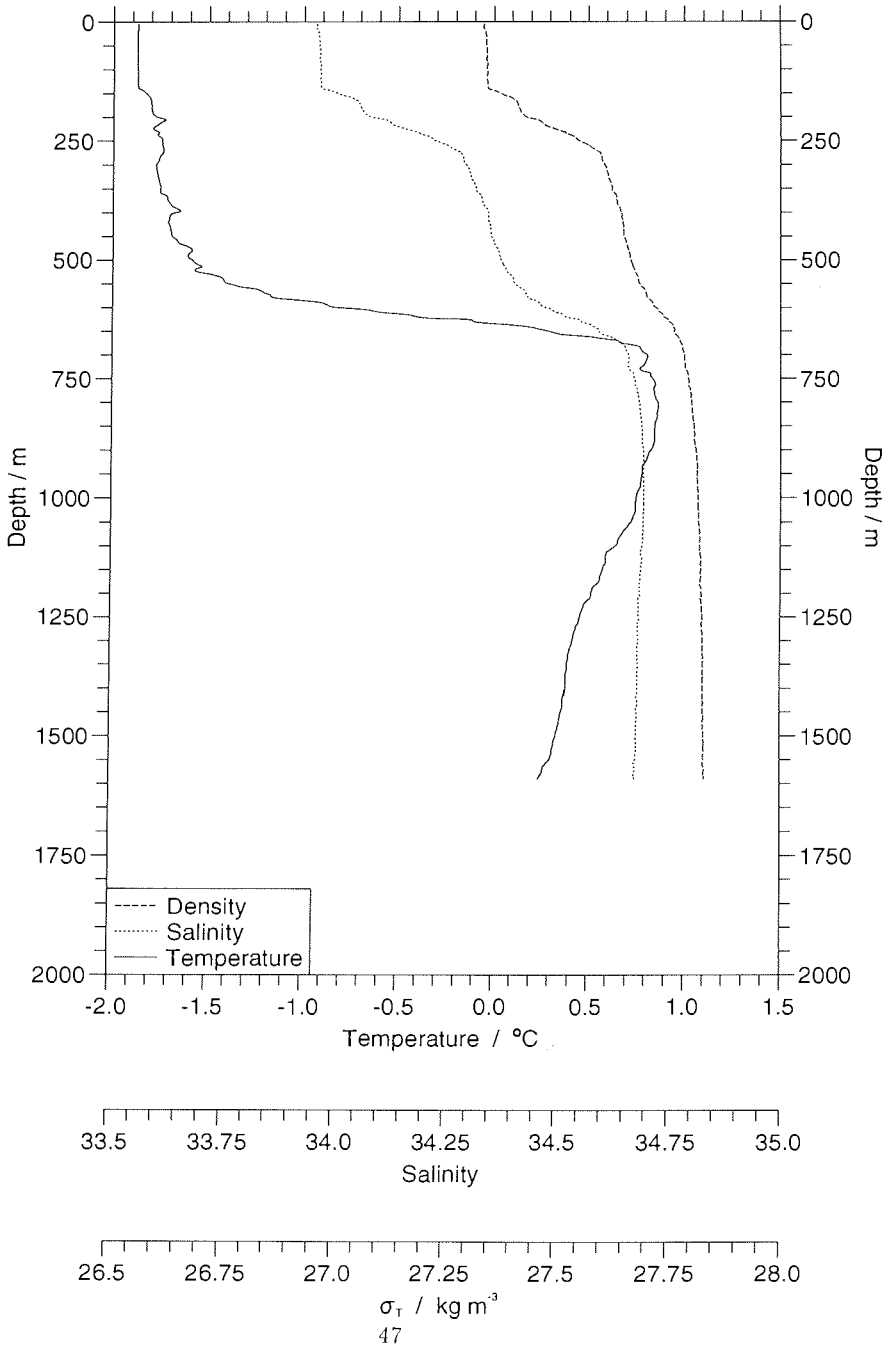

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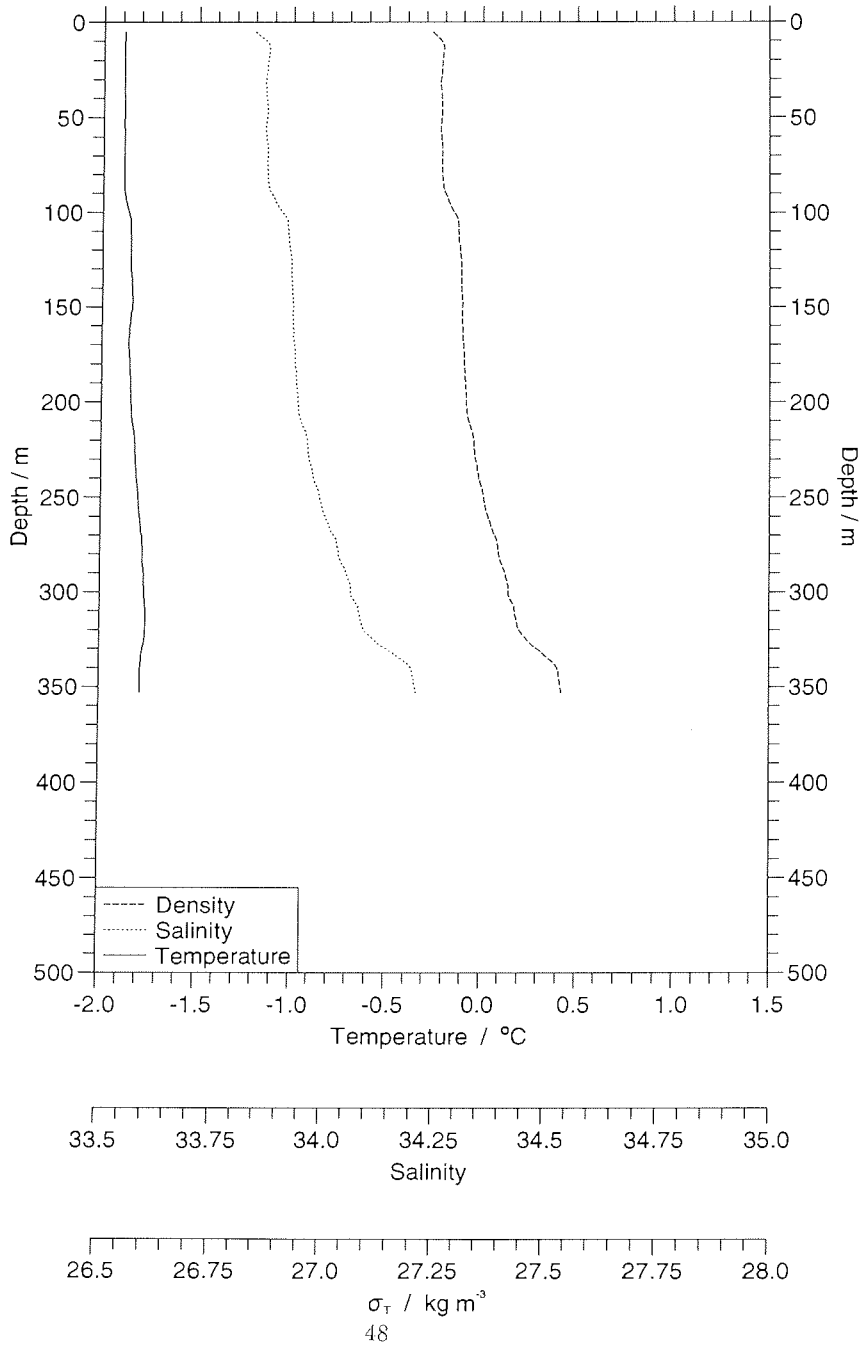

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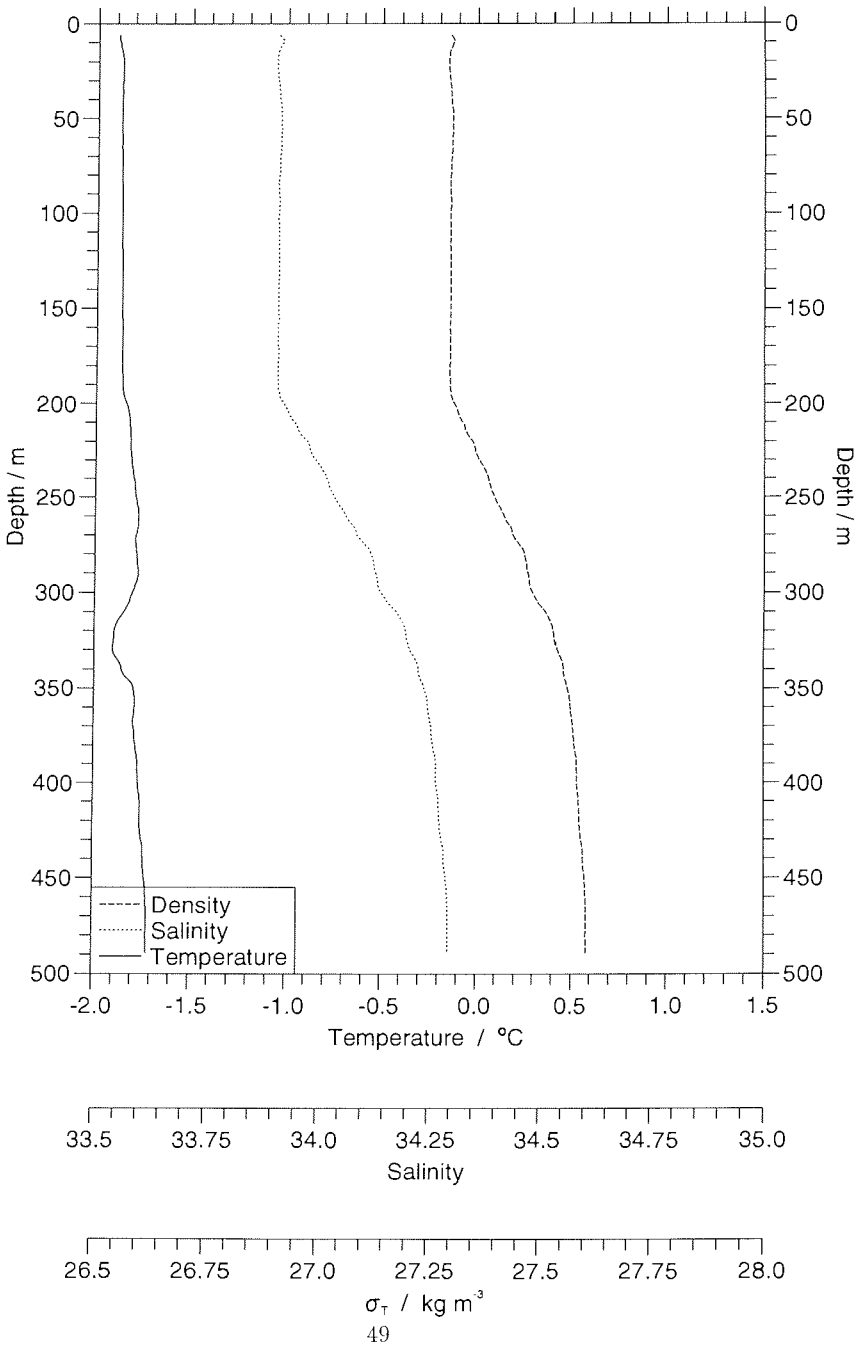

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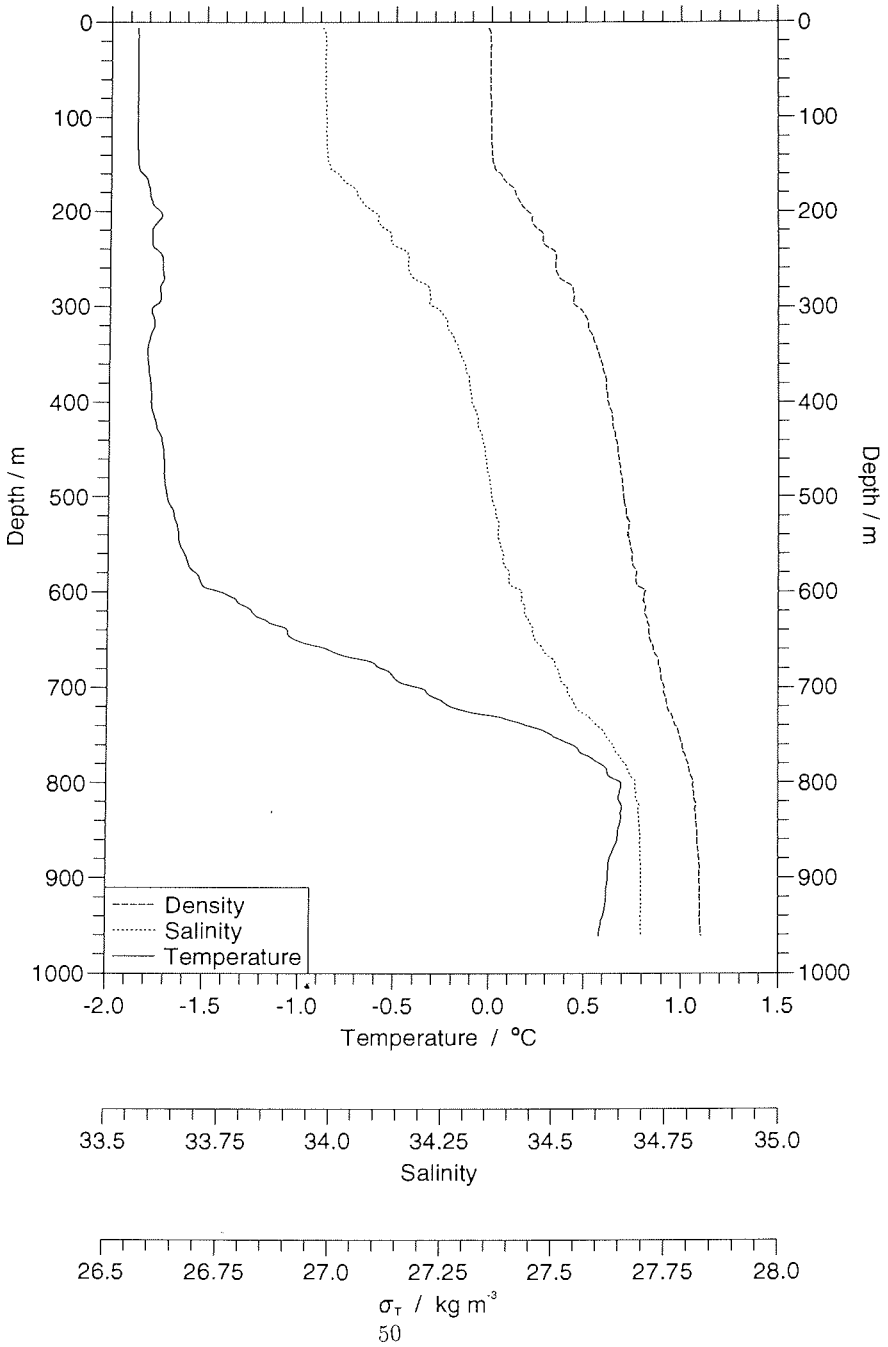

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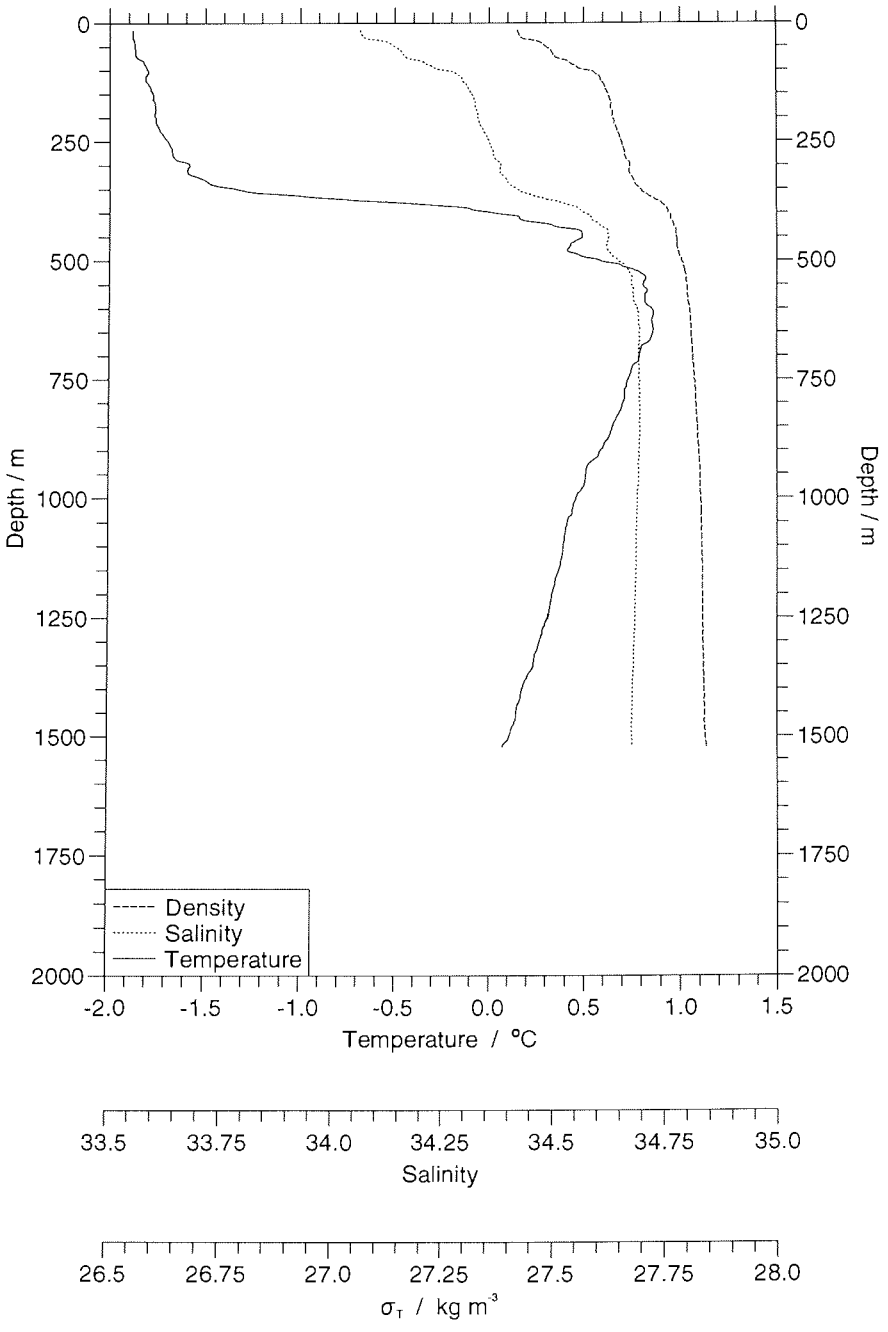

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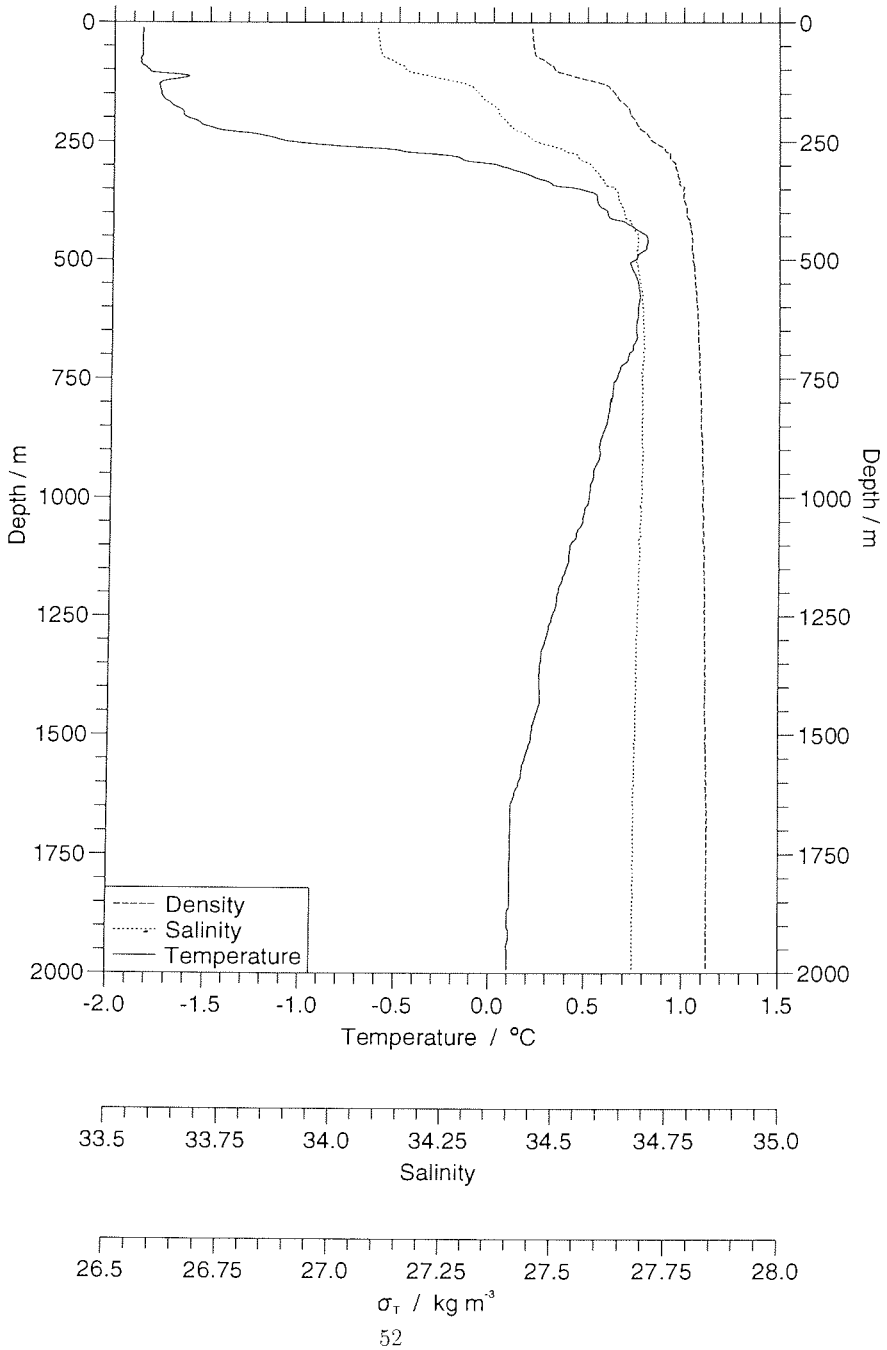

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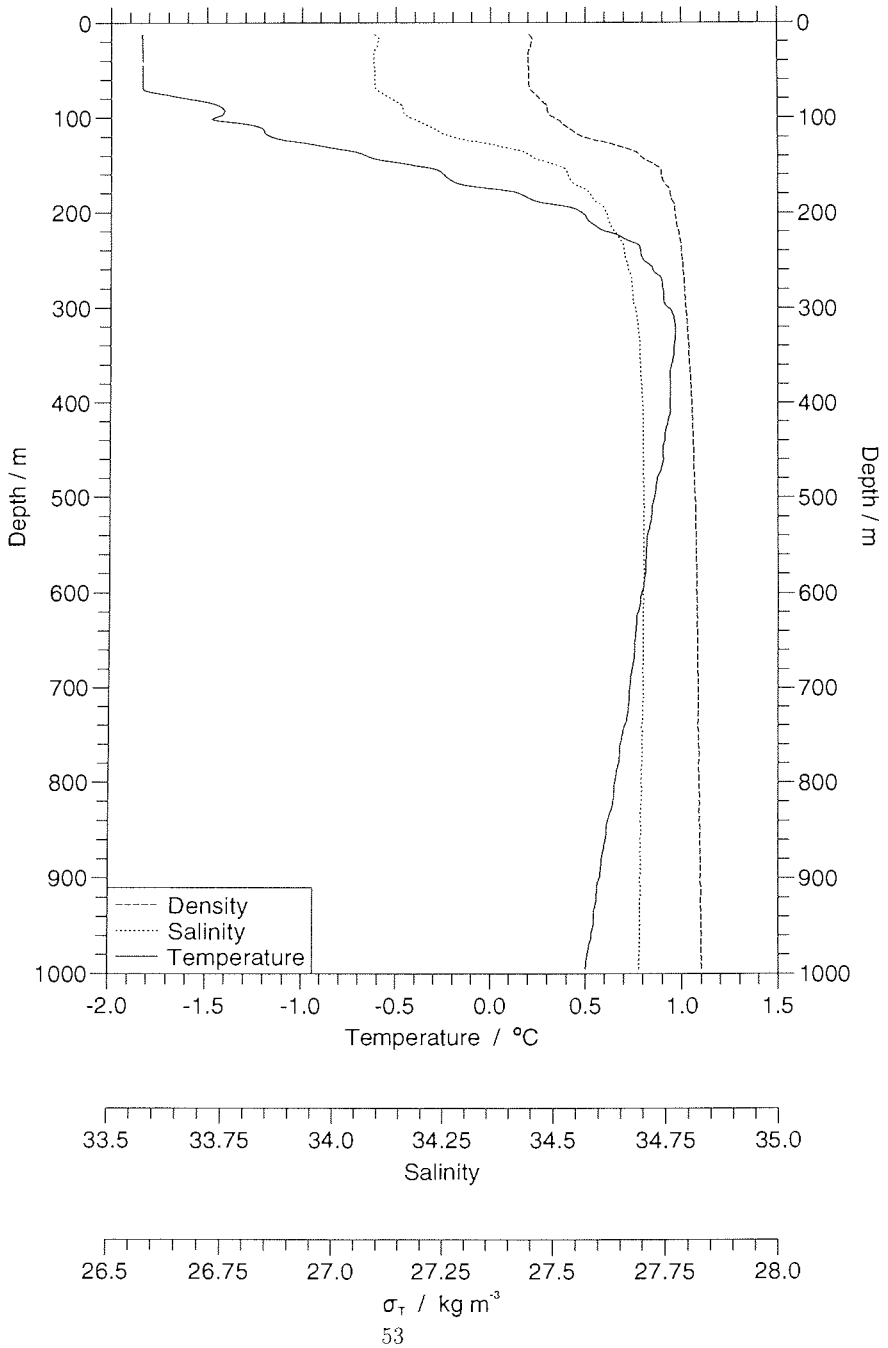

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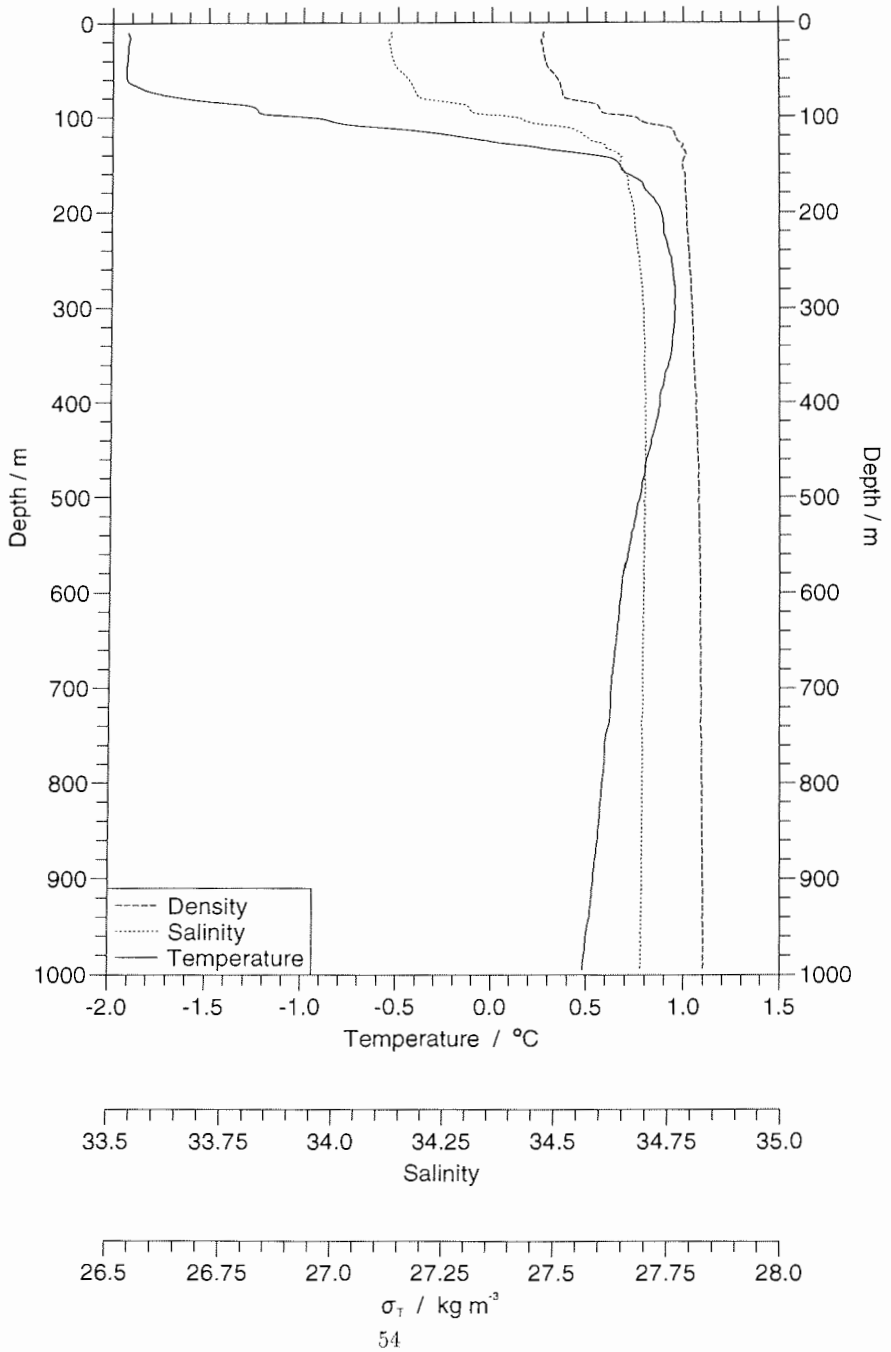

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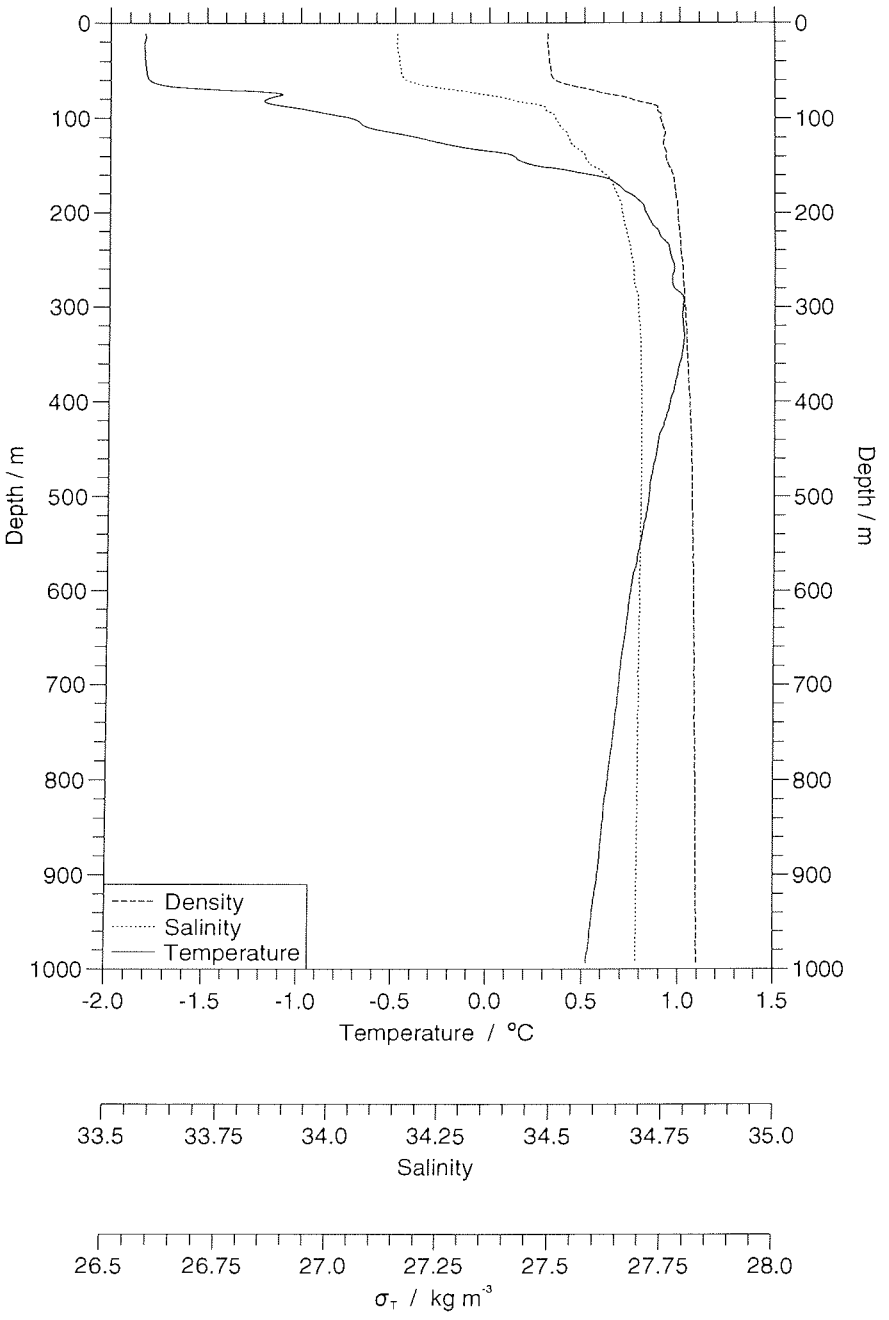

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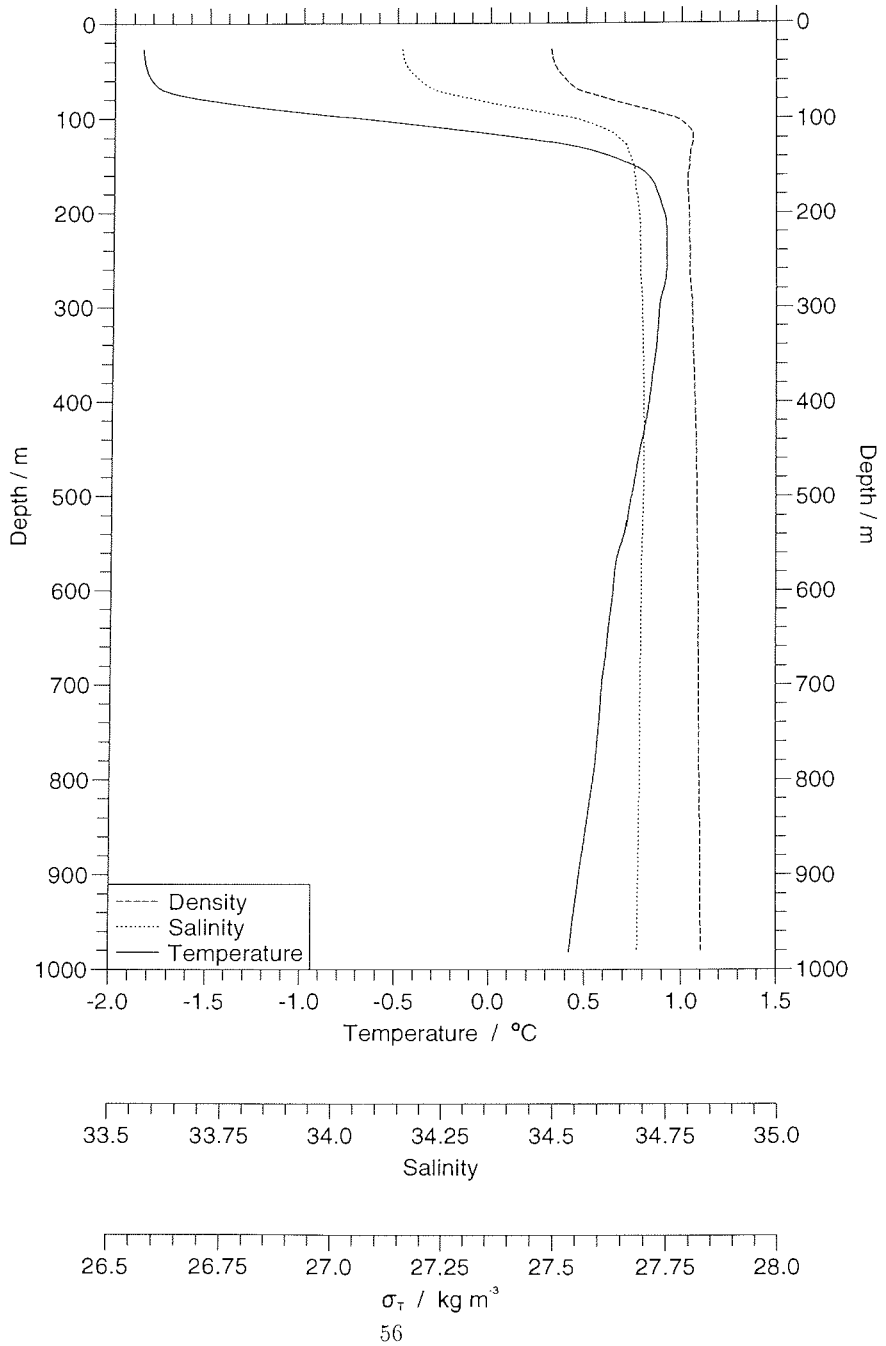

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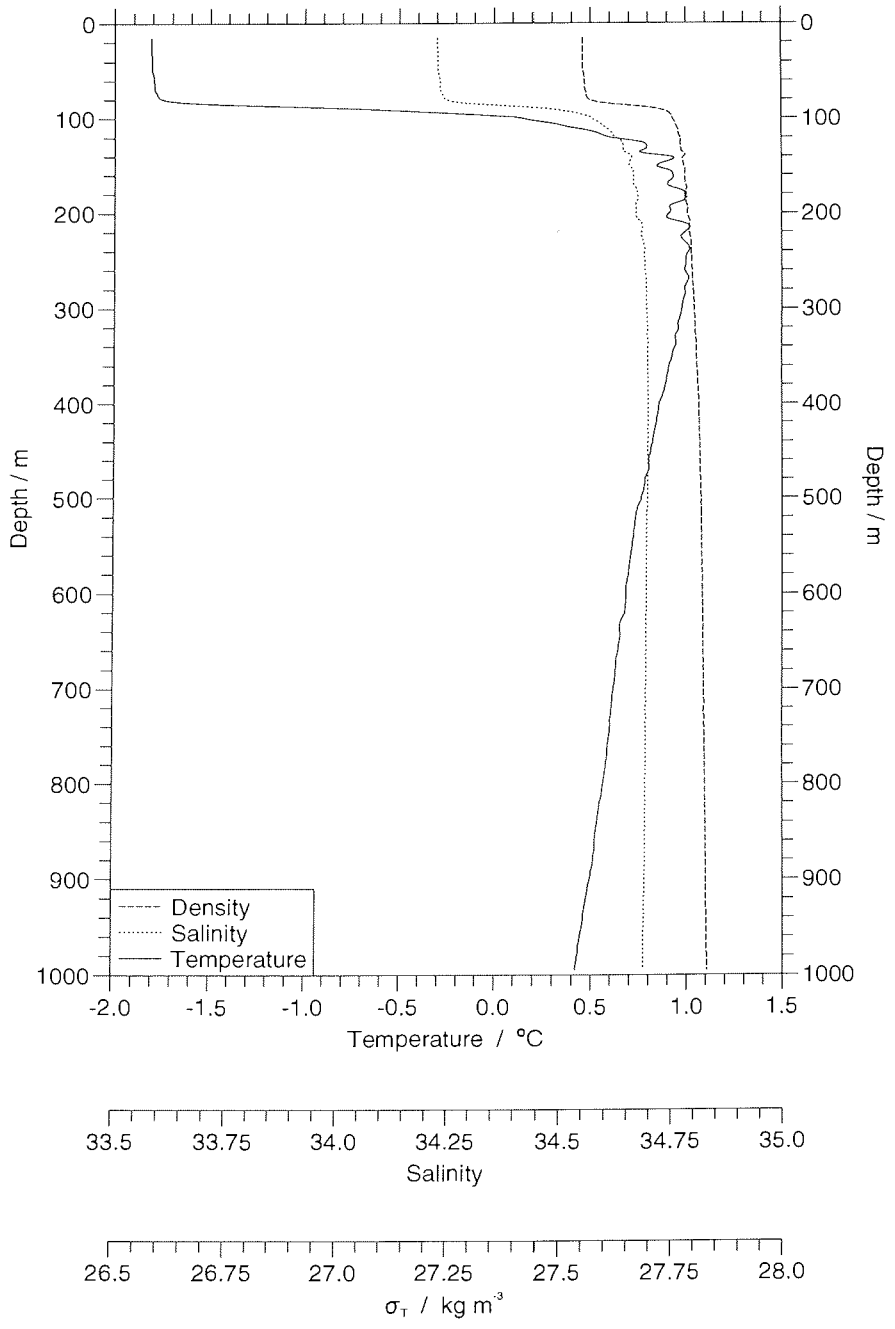

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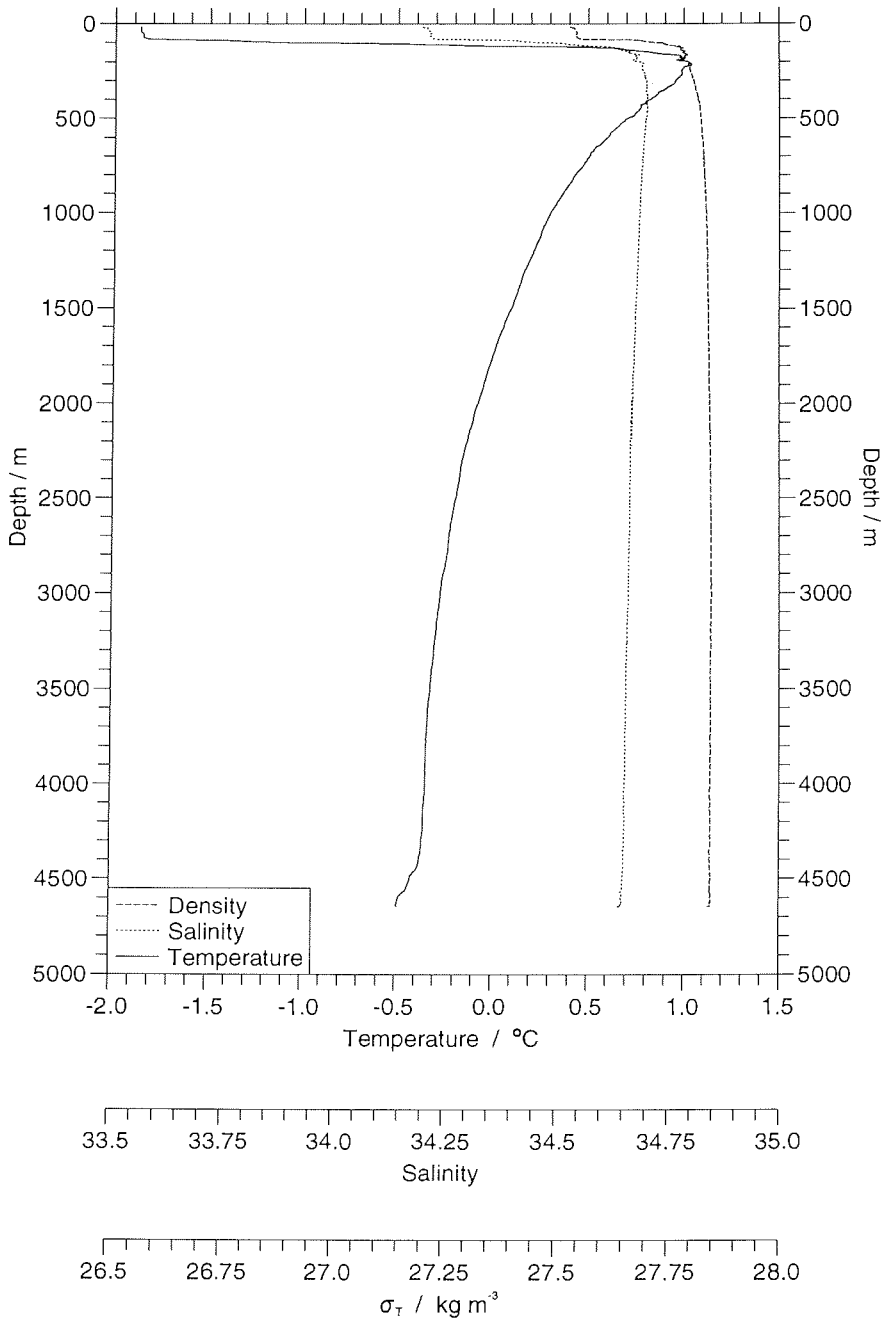

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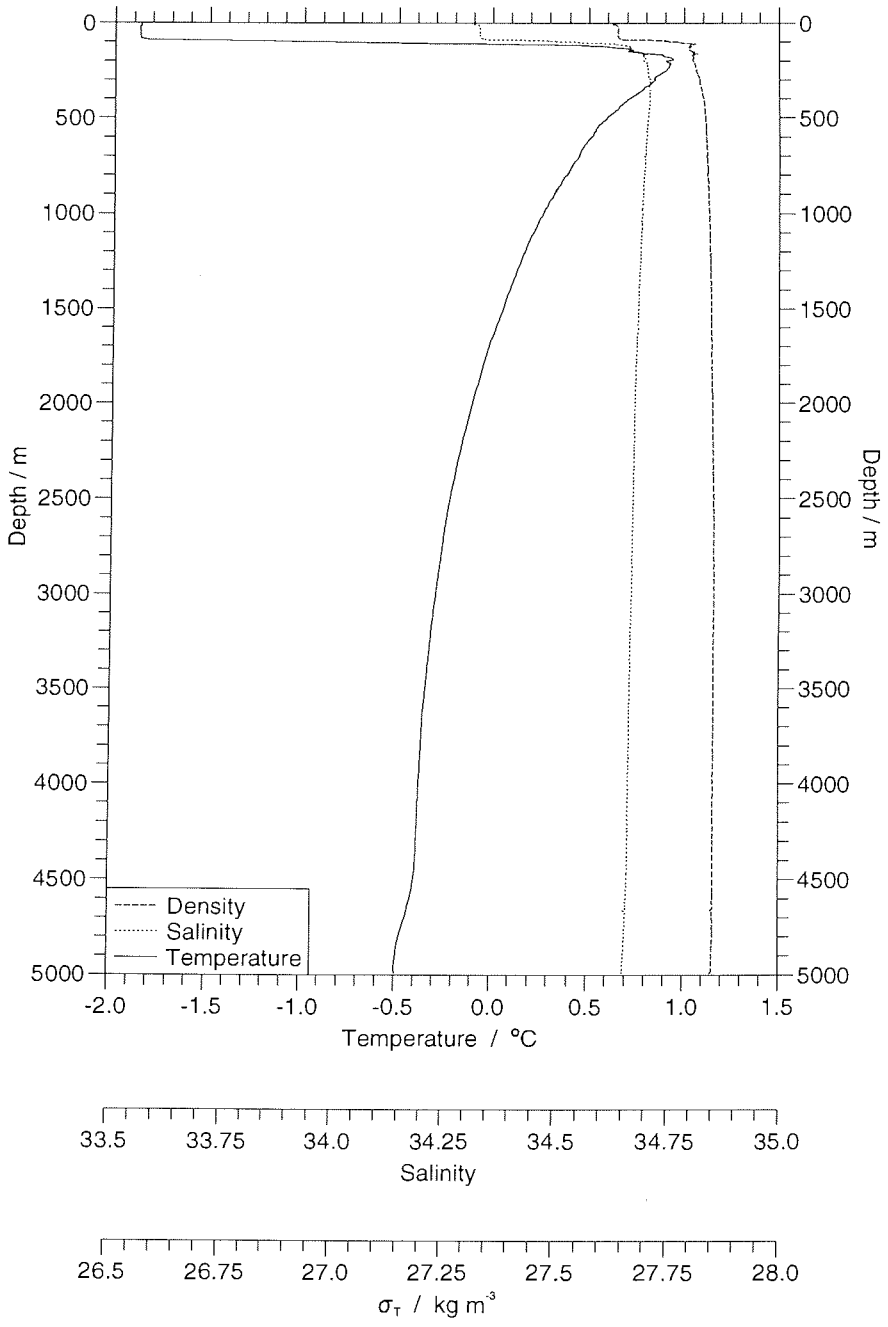

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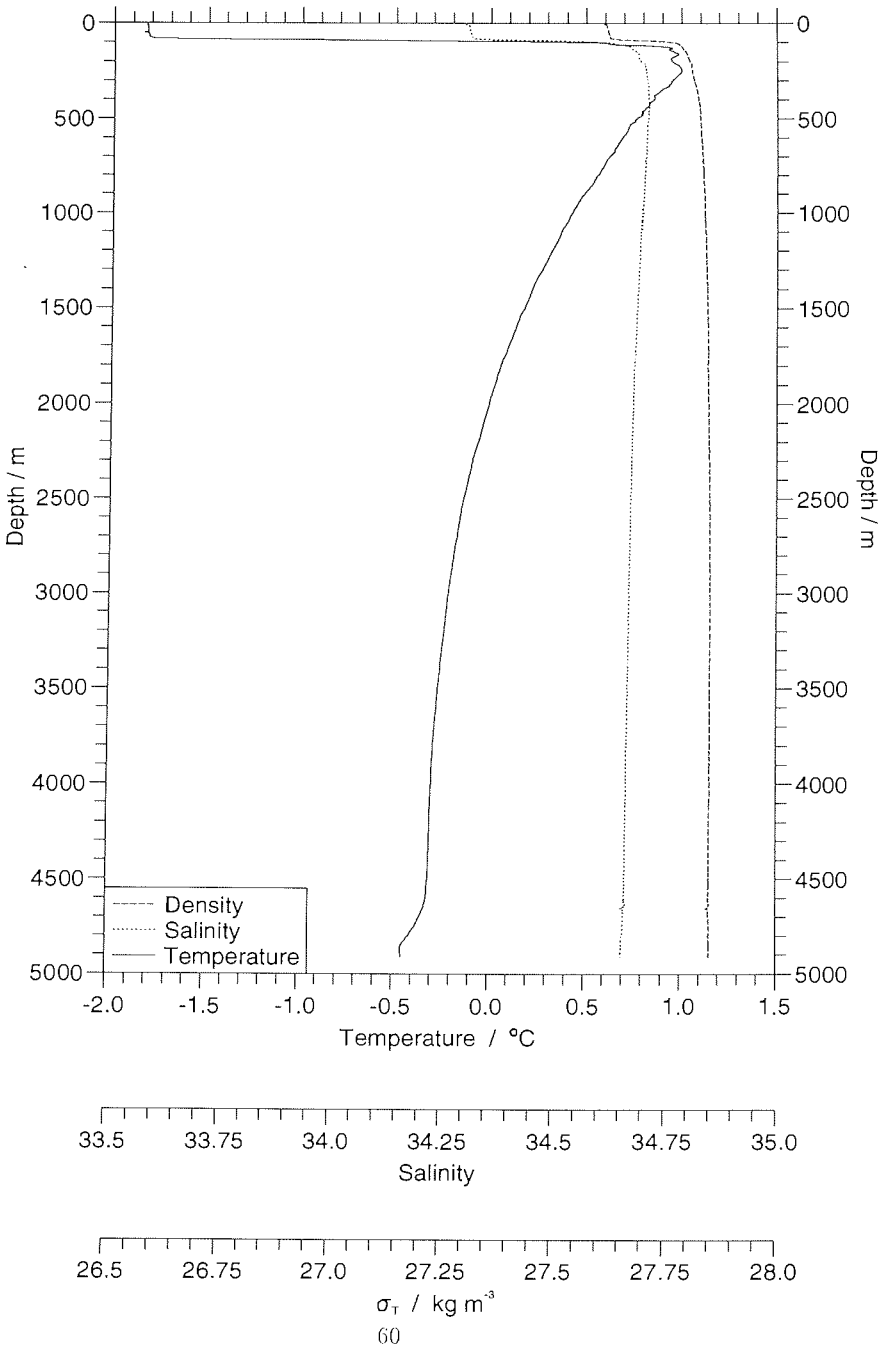

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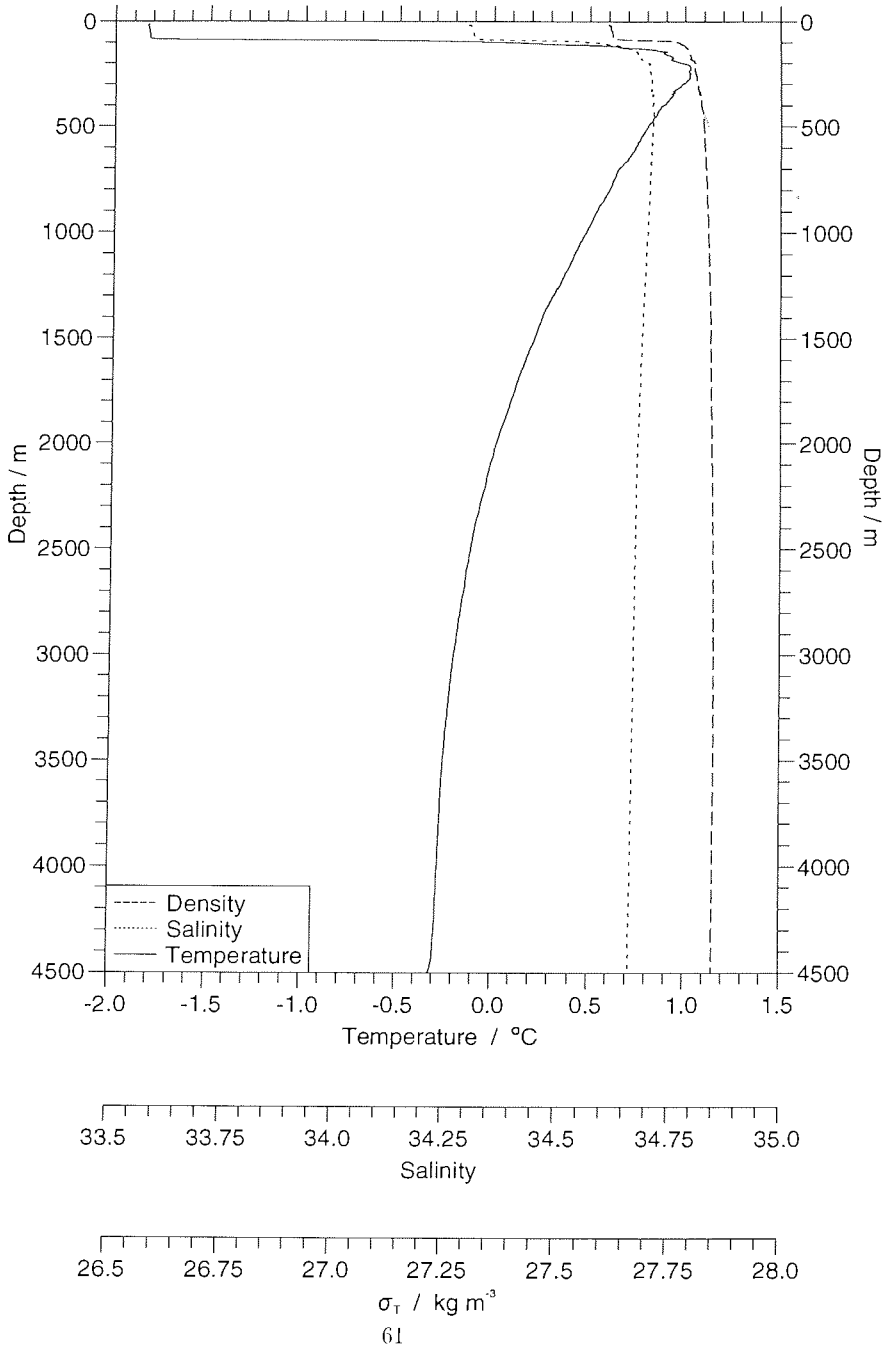

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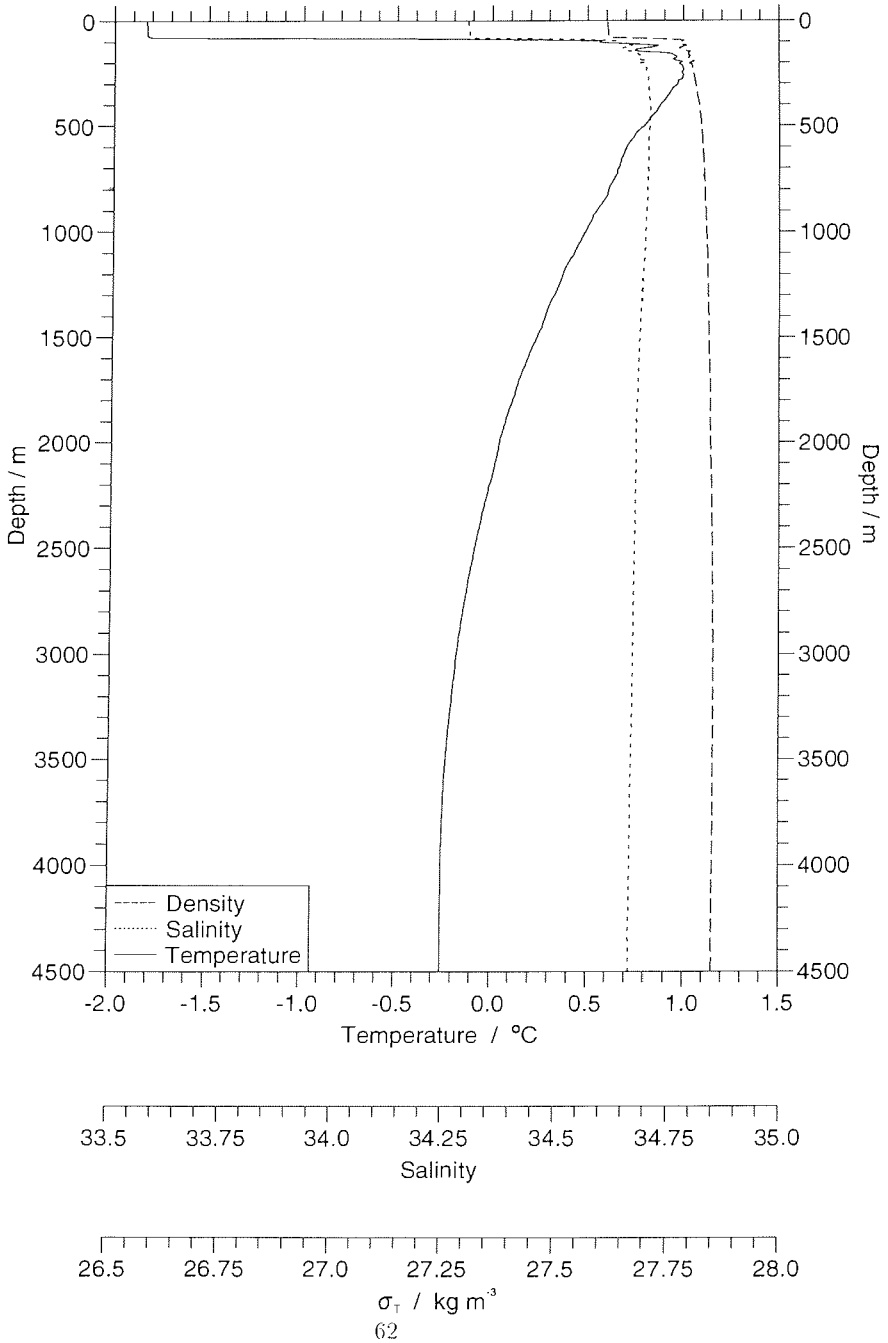

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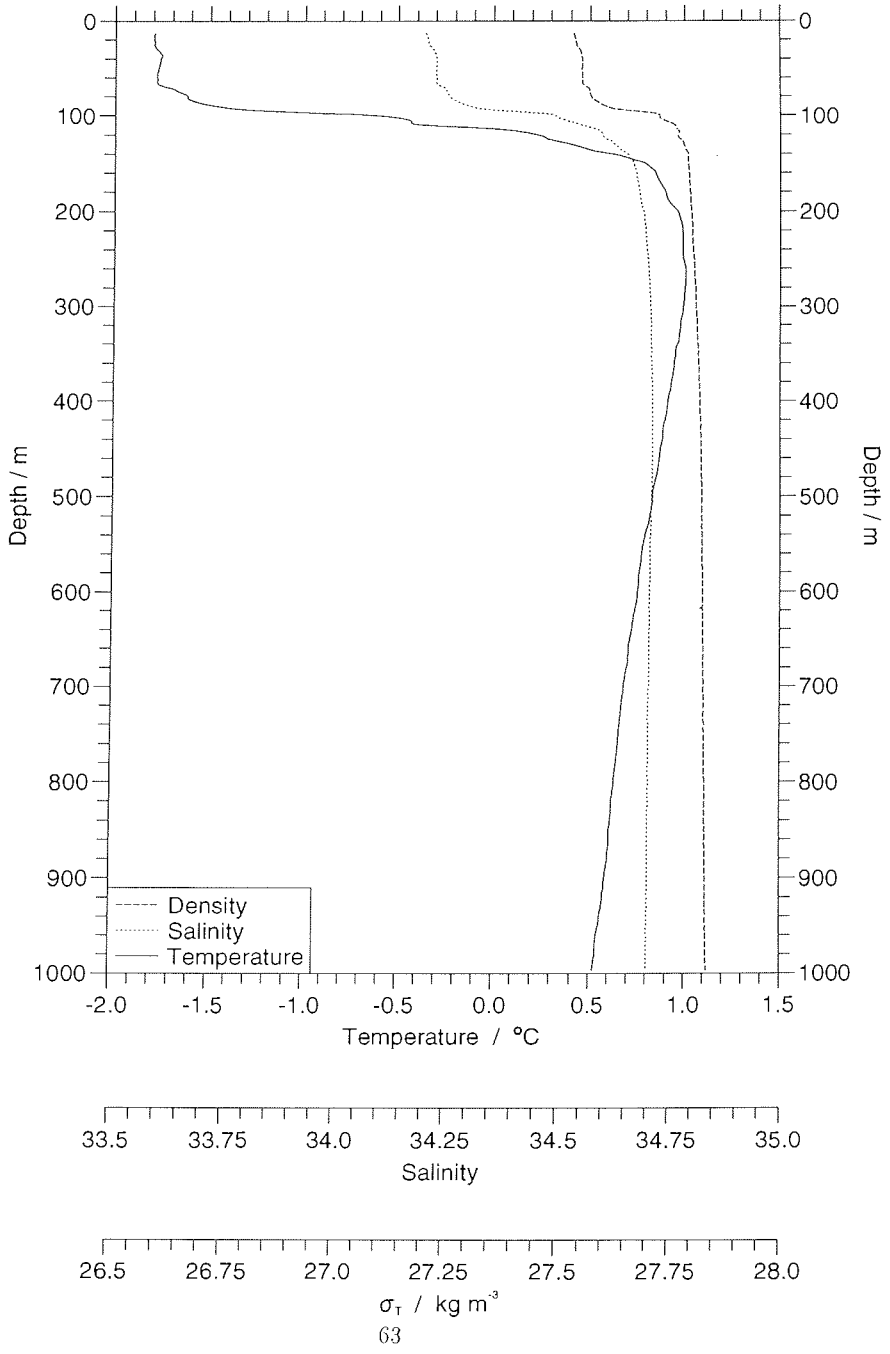

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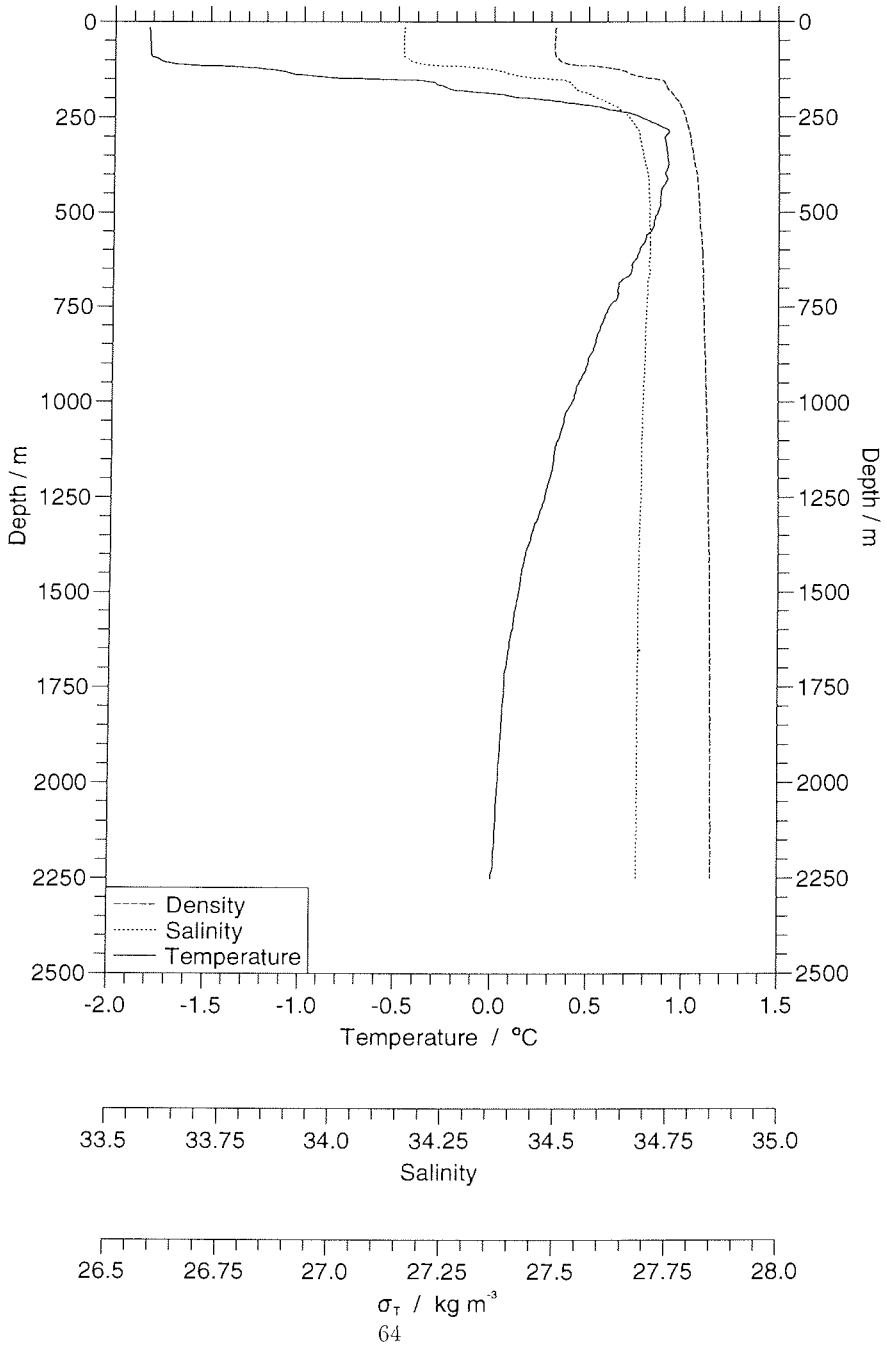

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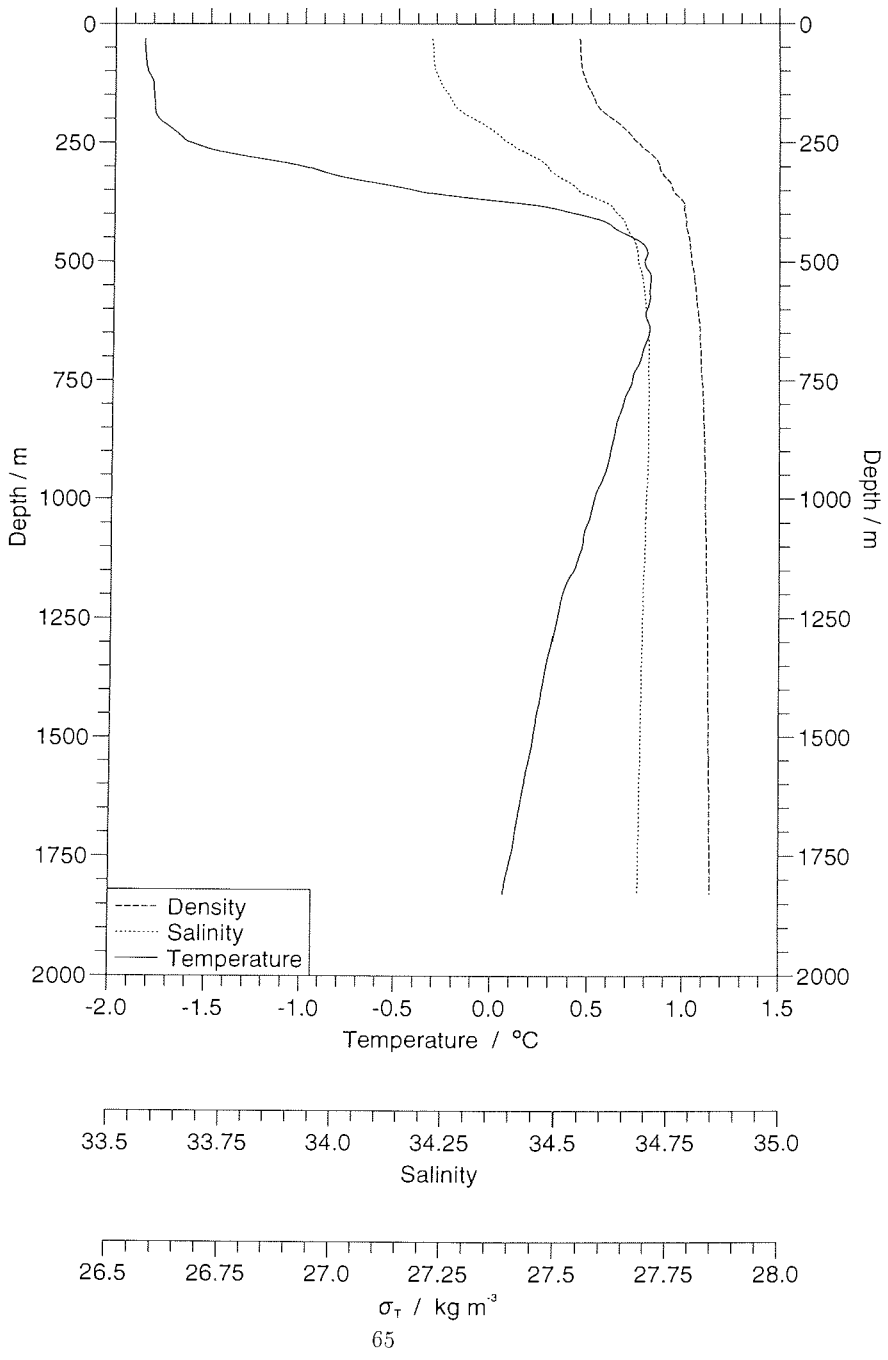

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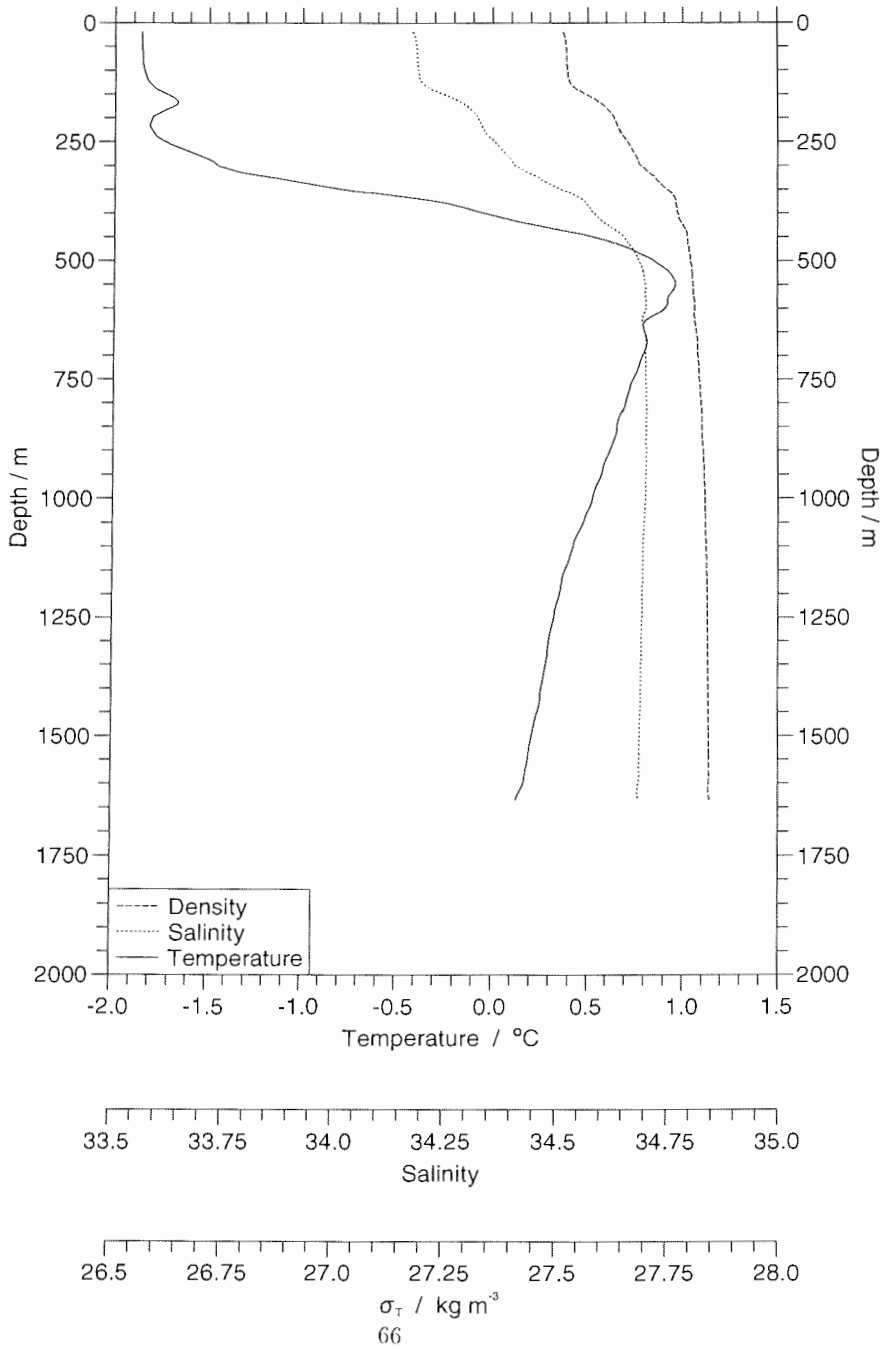

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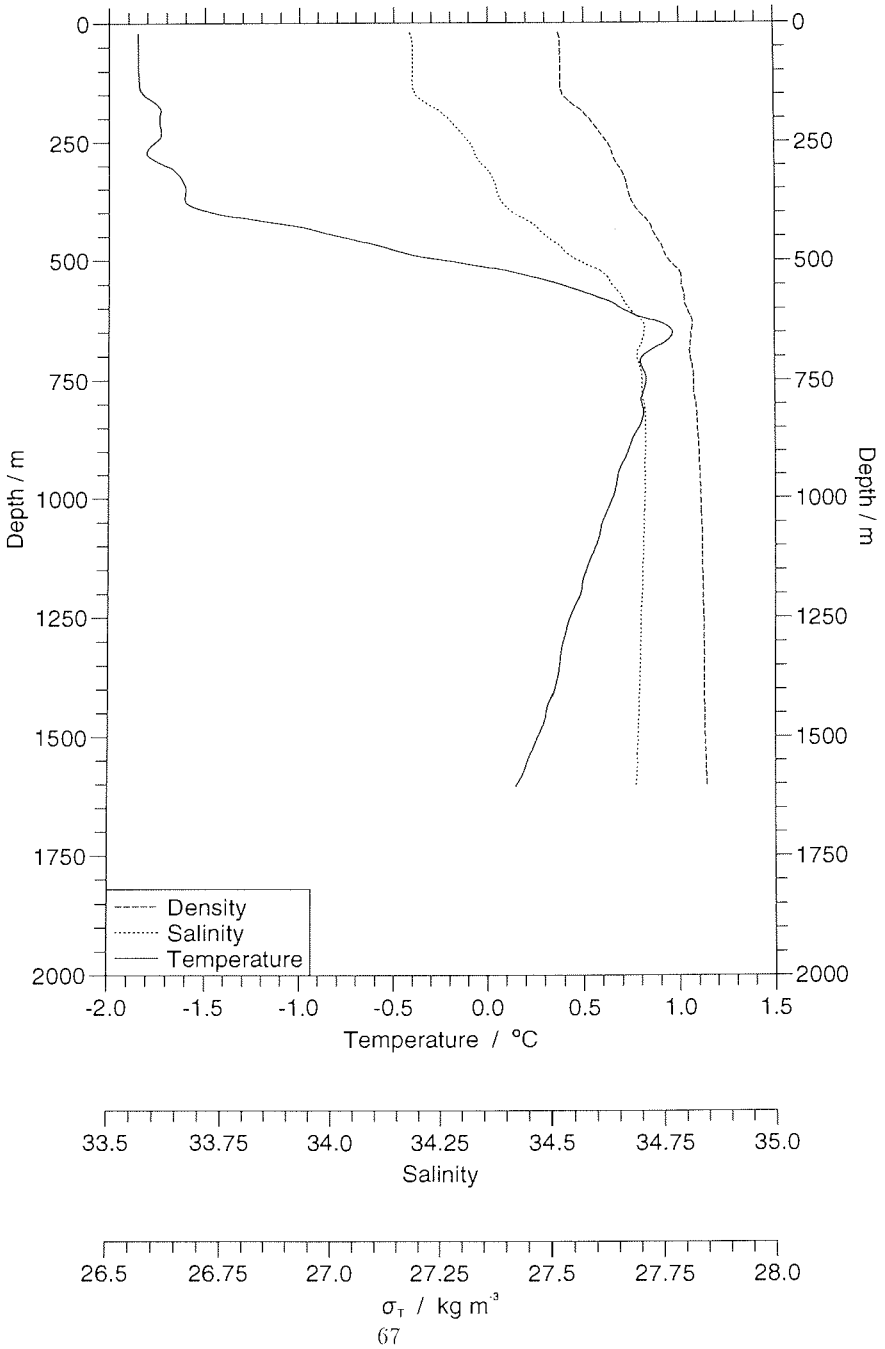

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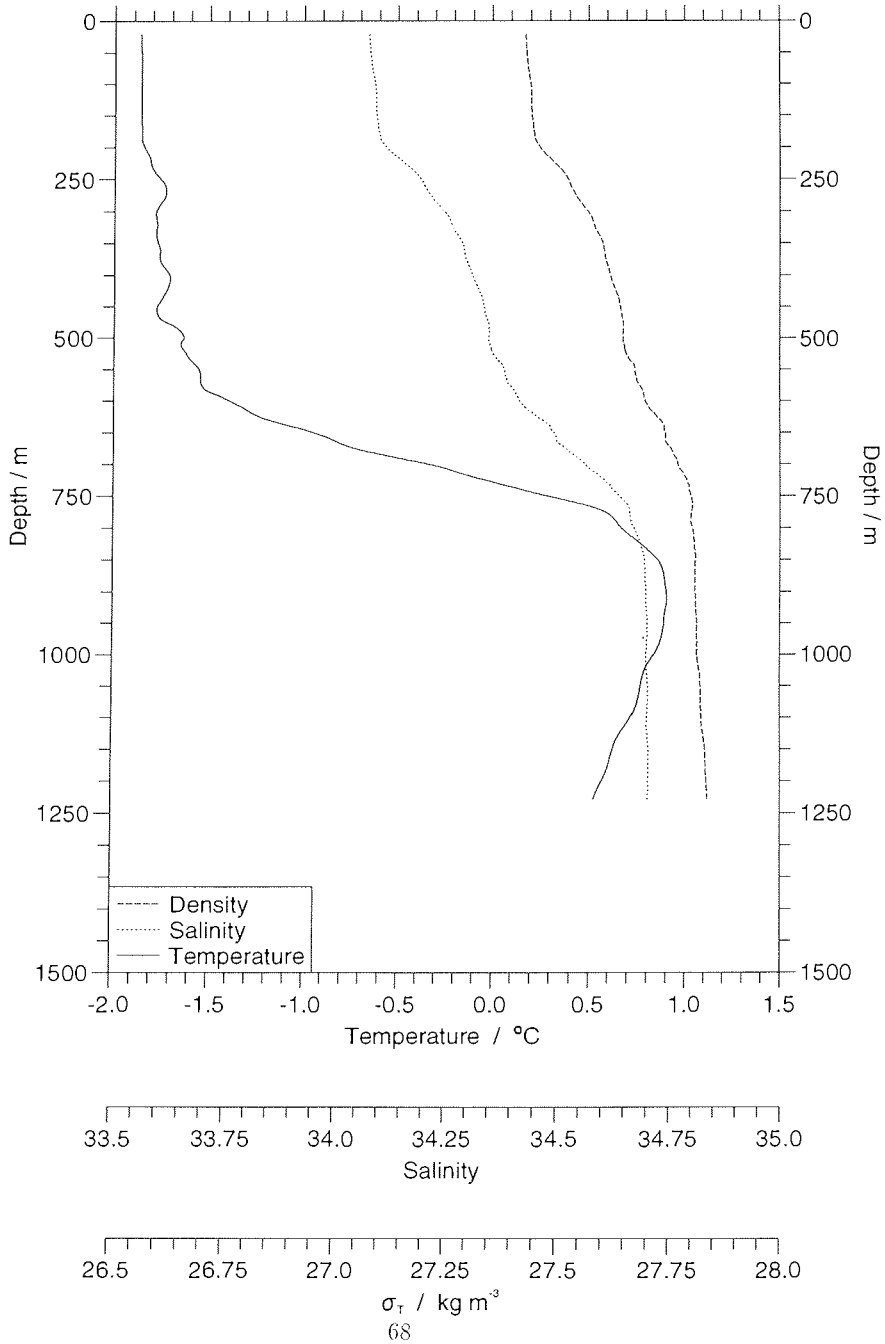

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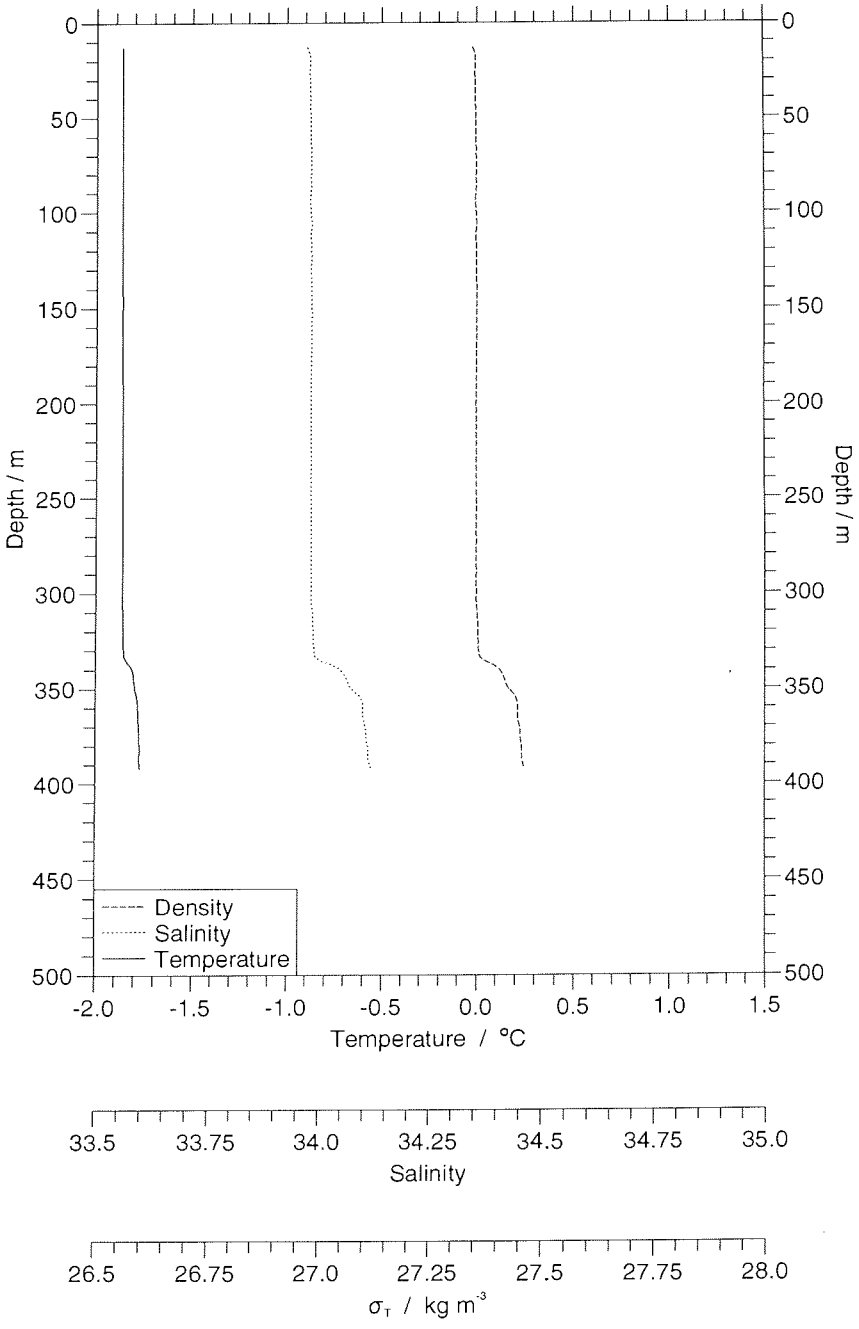

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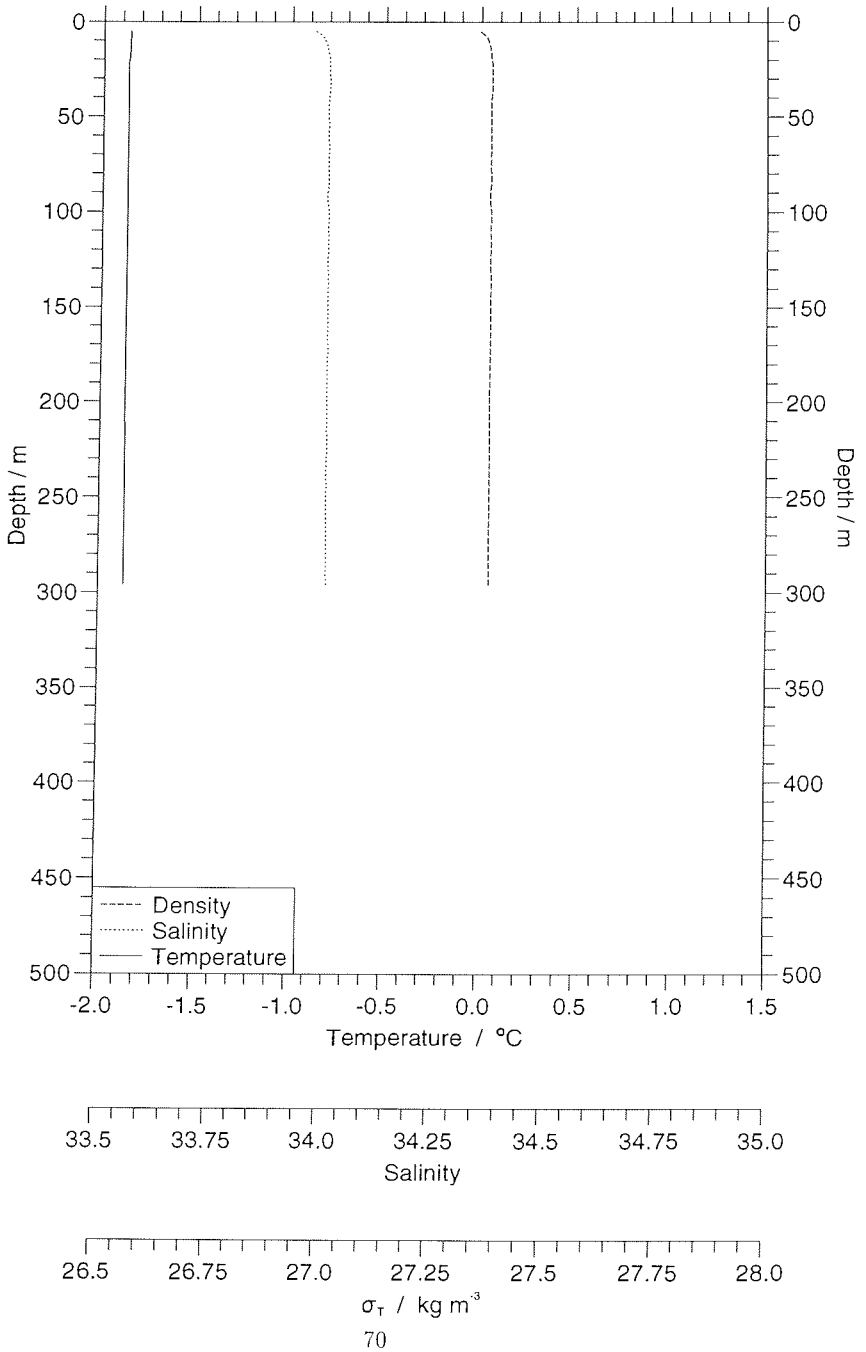


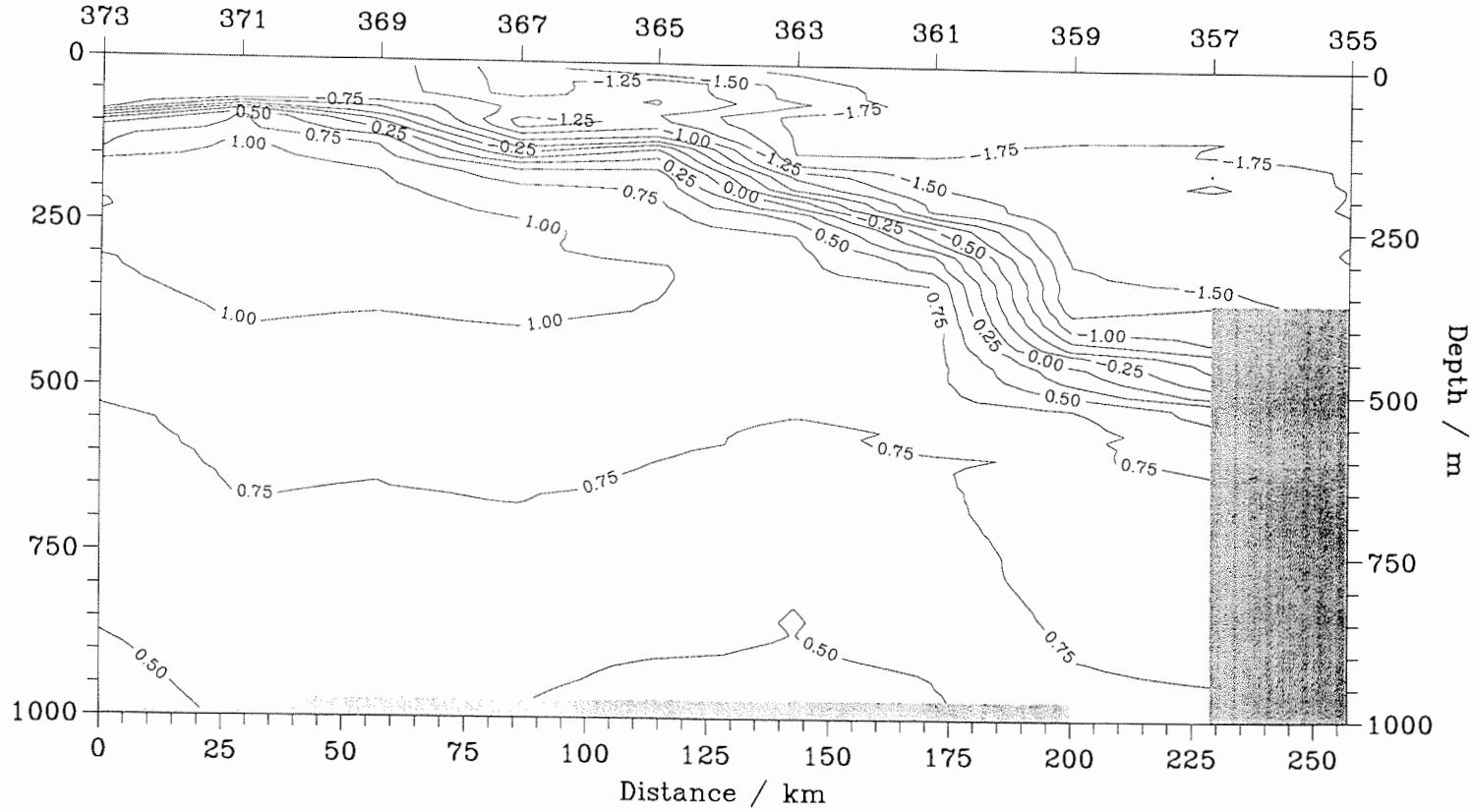
5 Sections

On the following pages the 6 N–S temperature and salinity sections from the sea surface to 1000 m depth are shown. The sections are in a chronological order from the East to the West, what should demonstrate the cooling process in the surface ocean layer during the expedition.

Cruise ANT10, Station 373 – 355

Temperature

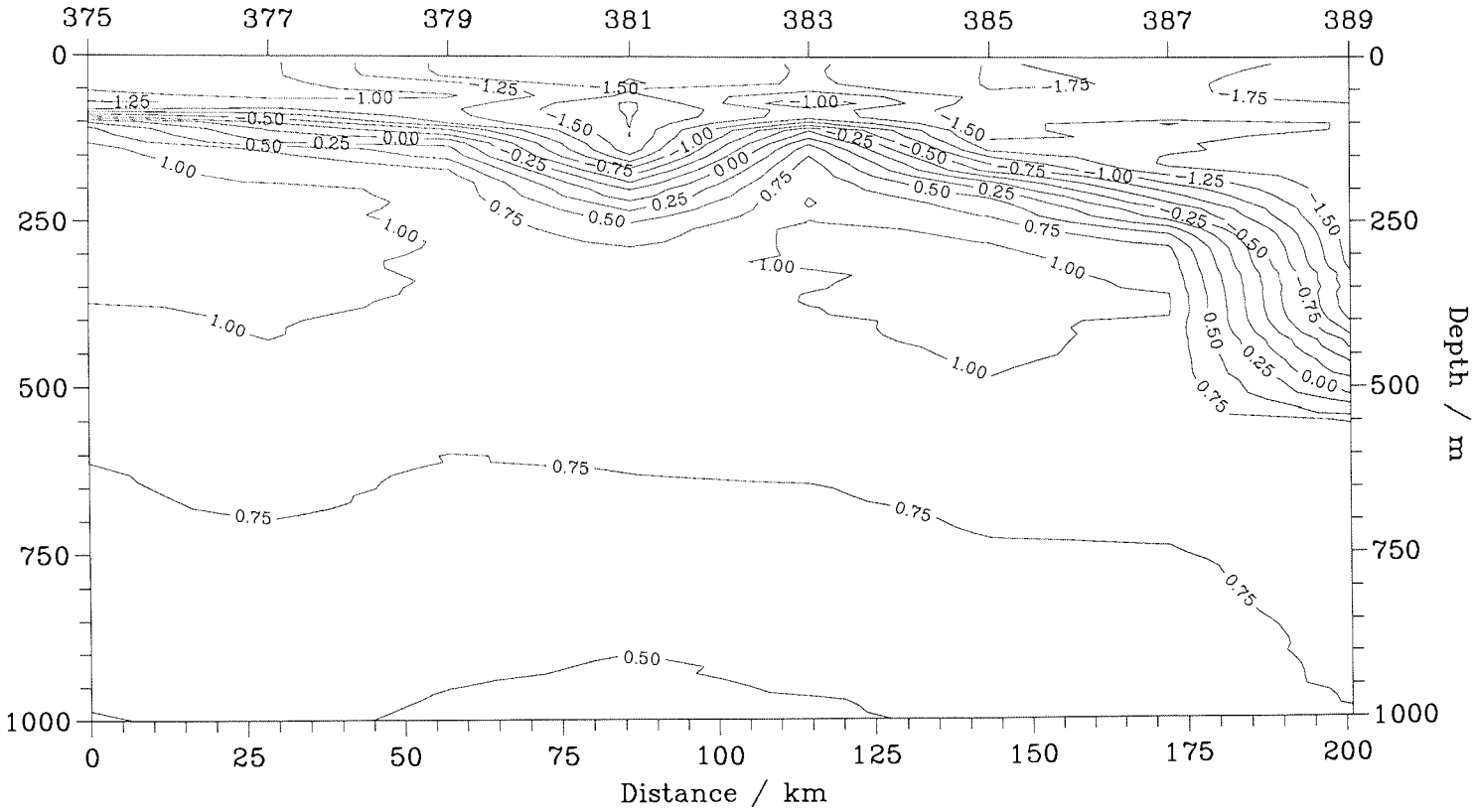
Meeresphysik und Meβwesen, AWI



Cruise ANT10, Station 375 - 389

Temperature

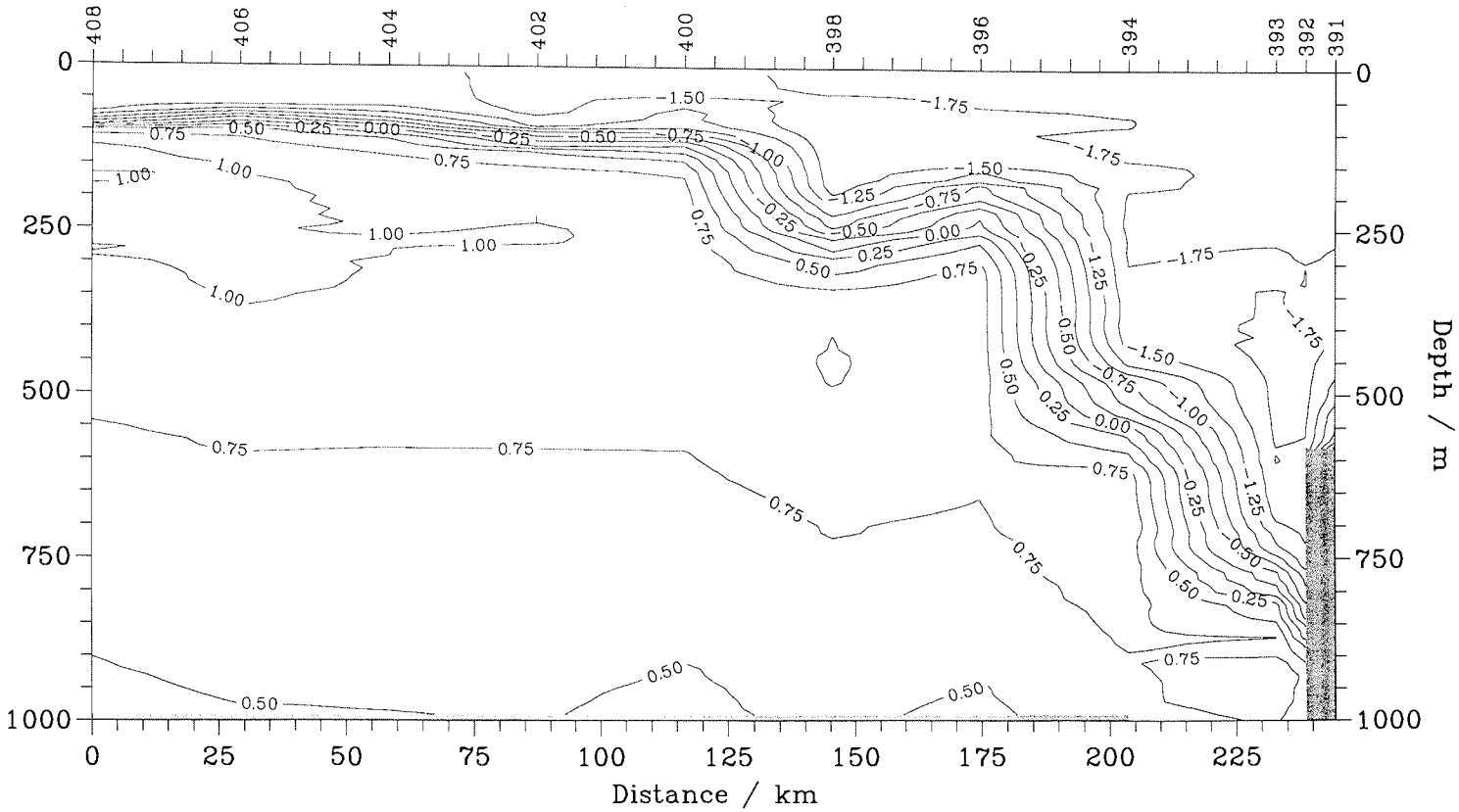
Meeresphysik und Meβwesen, AWI



Cruise ANT10, Station 408 – 391

Temperature

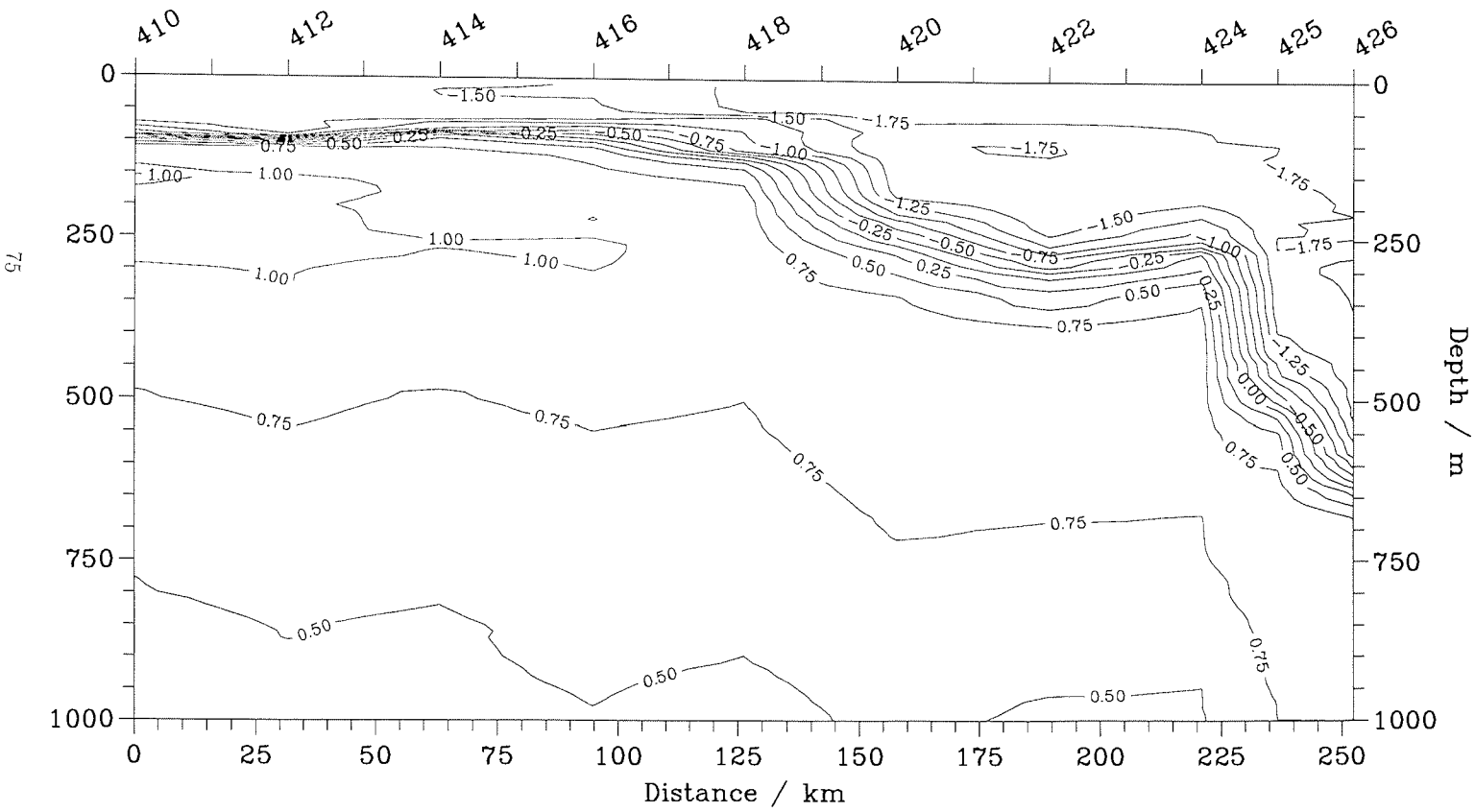
Meeresphysik und Meβwesen, AWI



Cruise ANT10, Station 410 – 426

Temperature

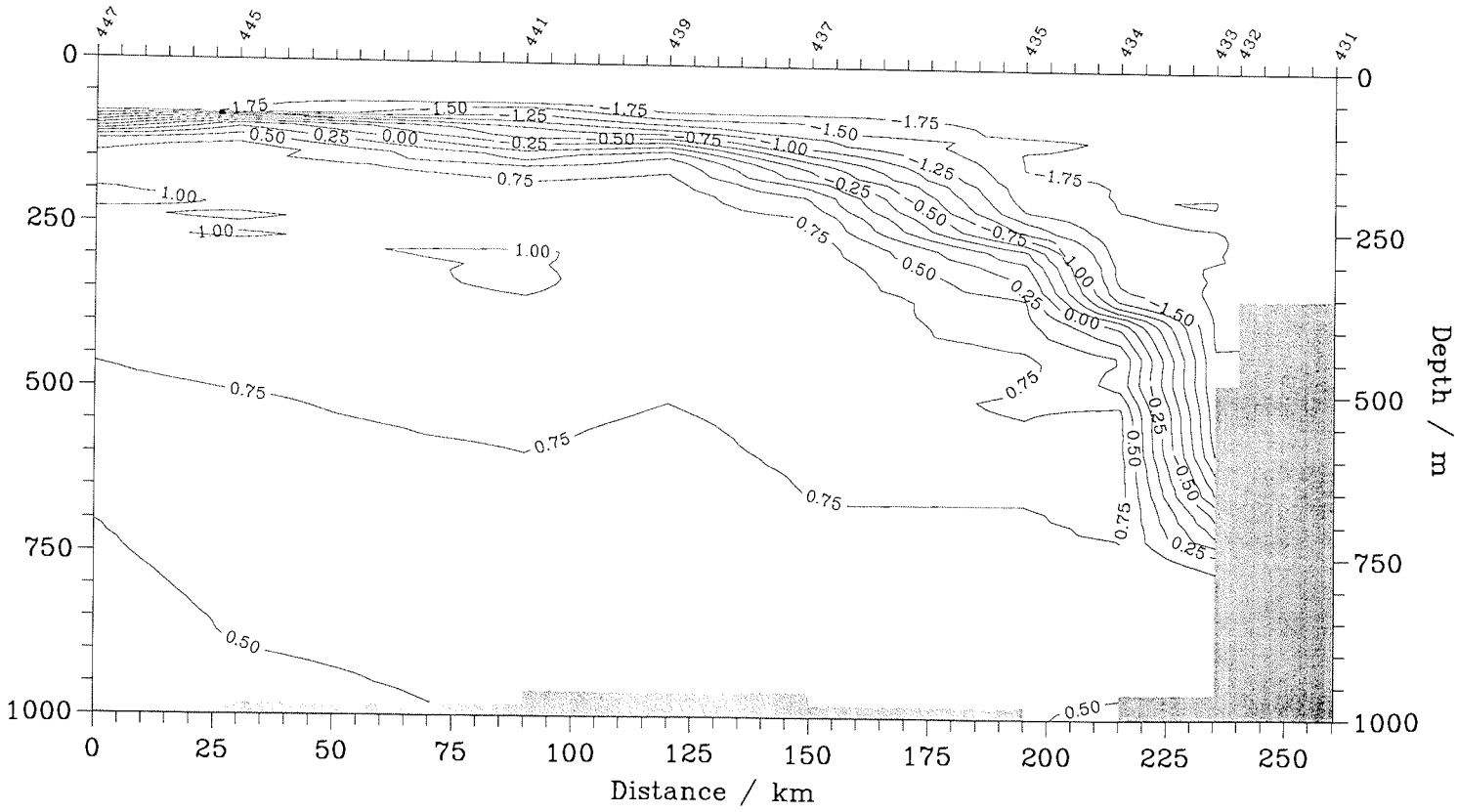
Meeresphysik und Meβwesen, AWI



Cruise ANT10, Station 447 – 431

Temperature

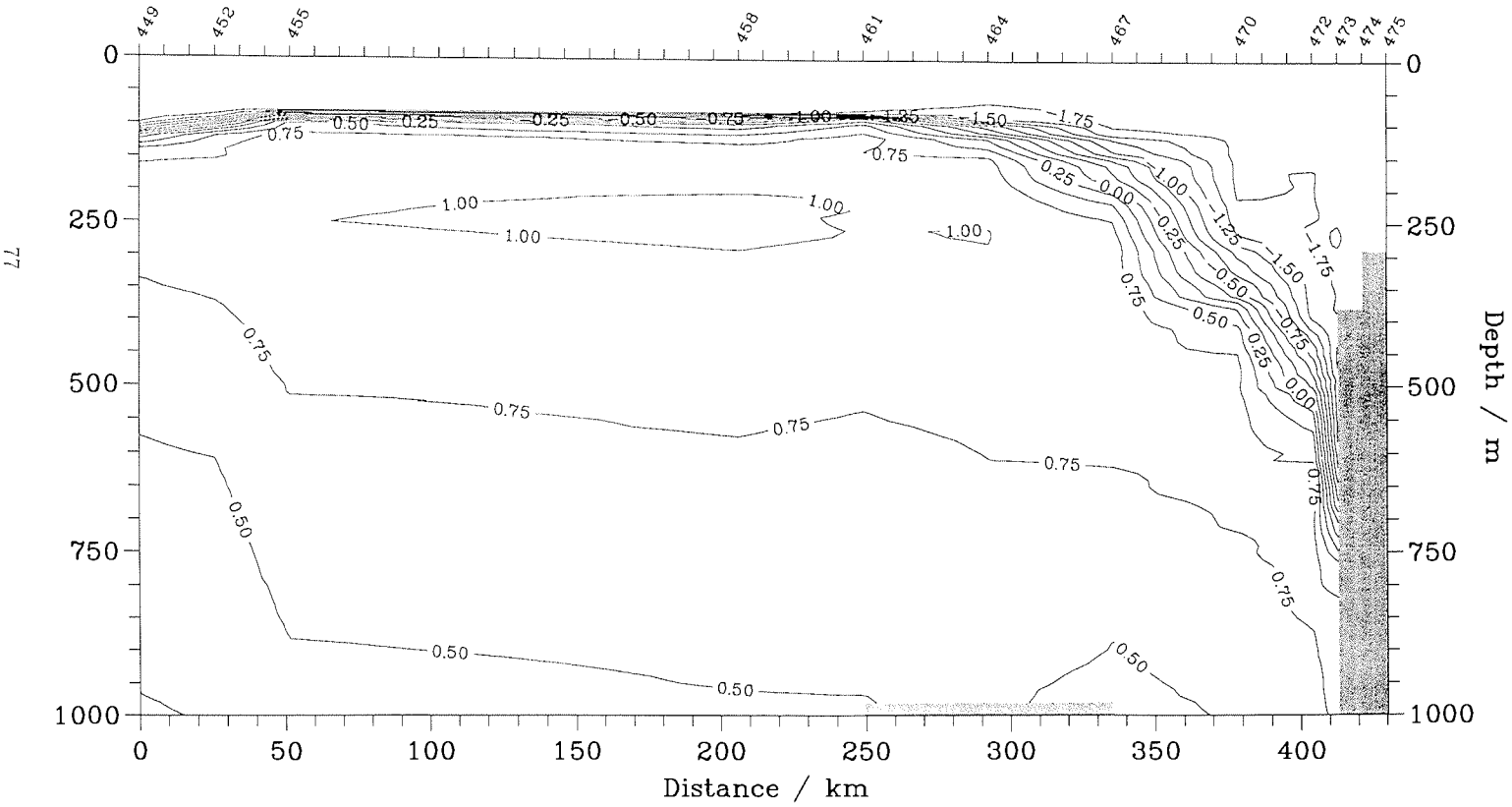
Meeresphysik und Meβwesen, AWI



Cruise ANT10, Station 449 – 475

Temperature

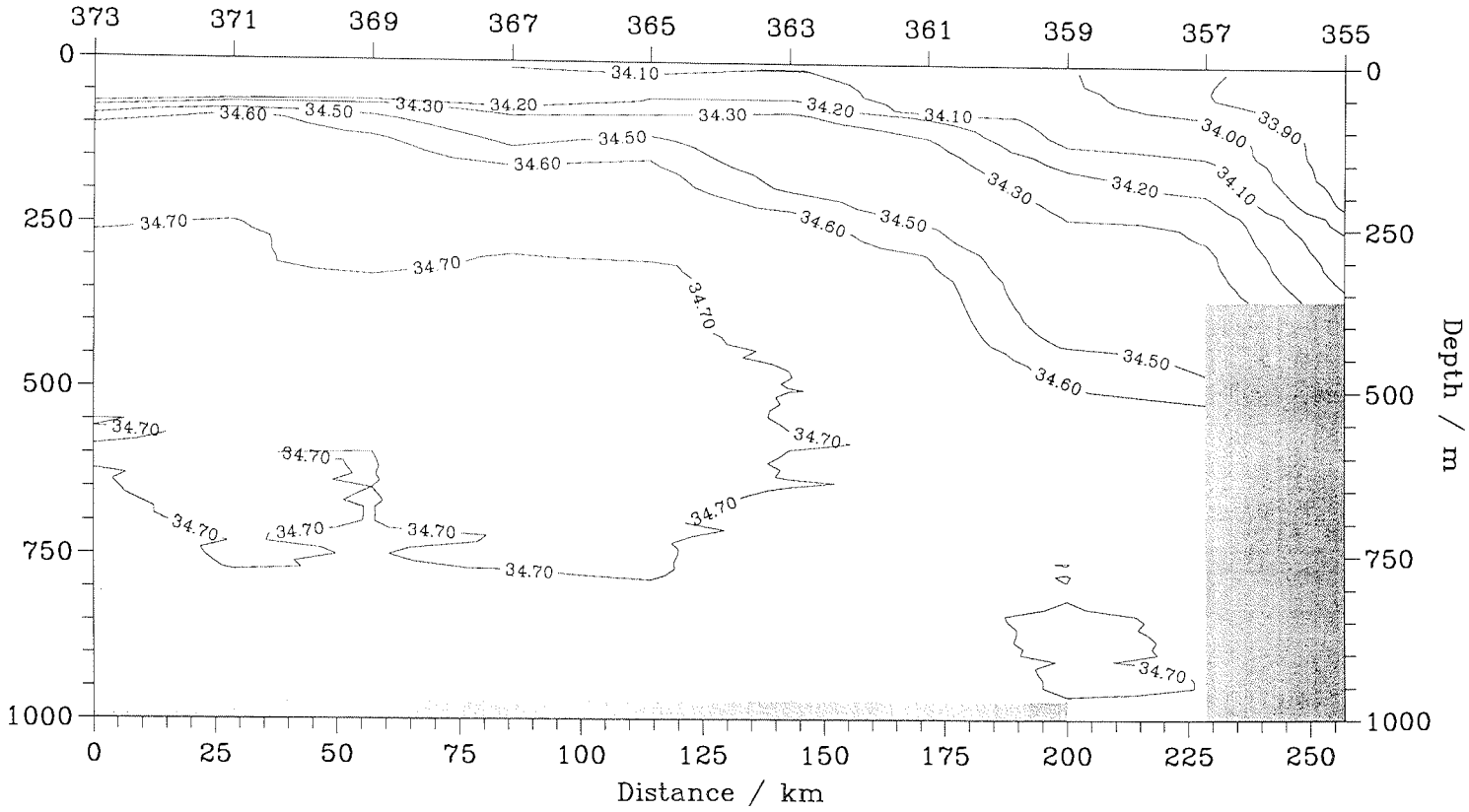
Meeresphysik und Meβwesen, AWI



Cruise ANT10, Station 373 – 355

Salinity

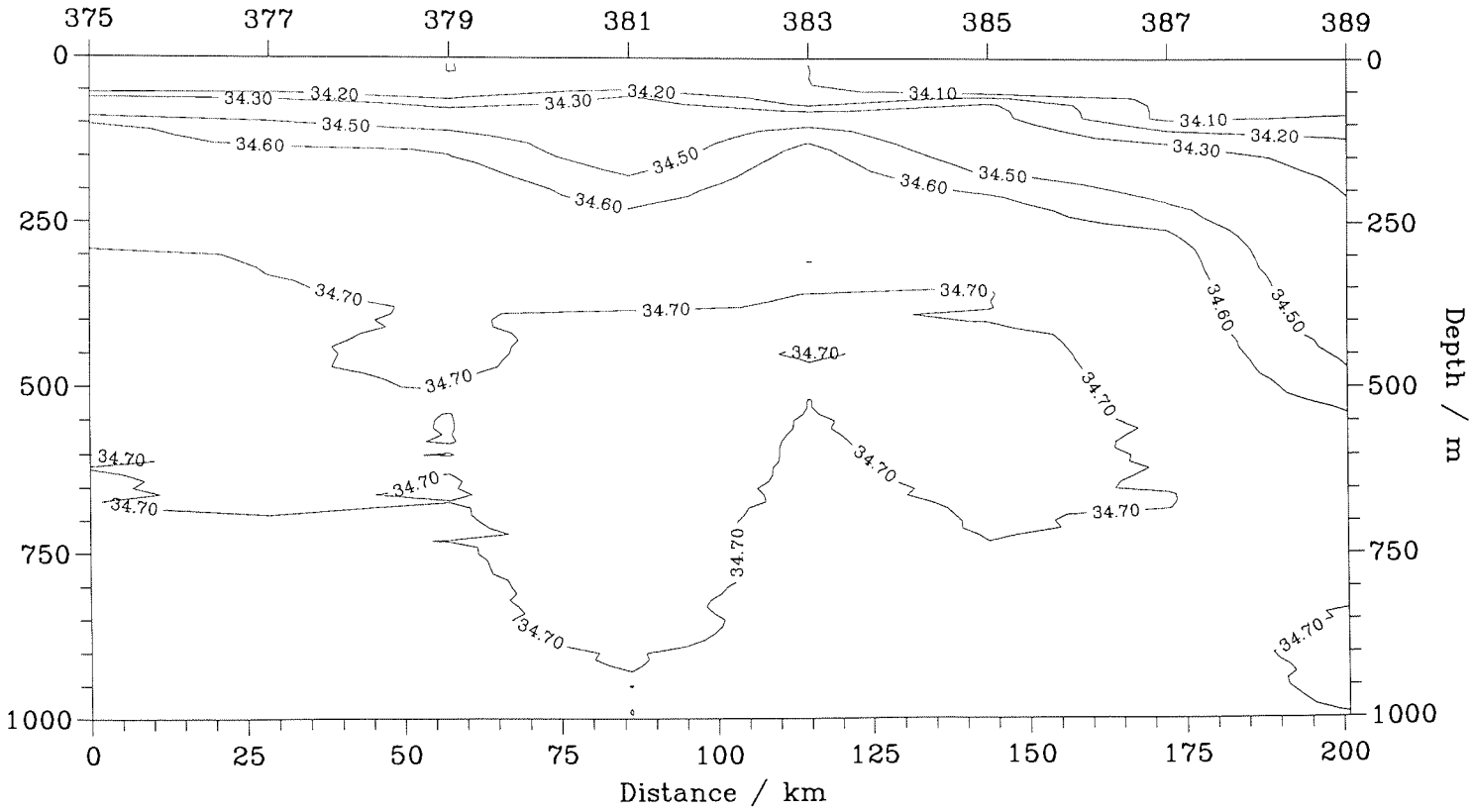
Meeresphysik und Meβwesen, AWI



Cruise ANT10, Station 375 – 389

Salinity

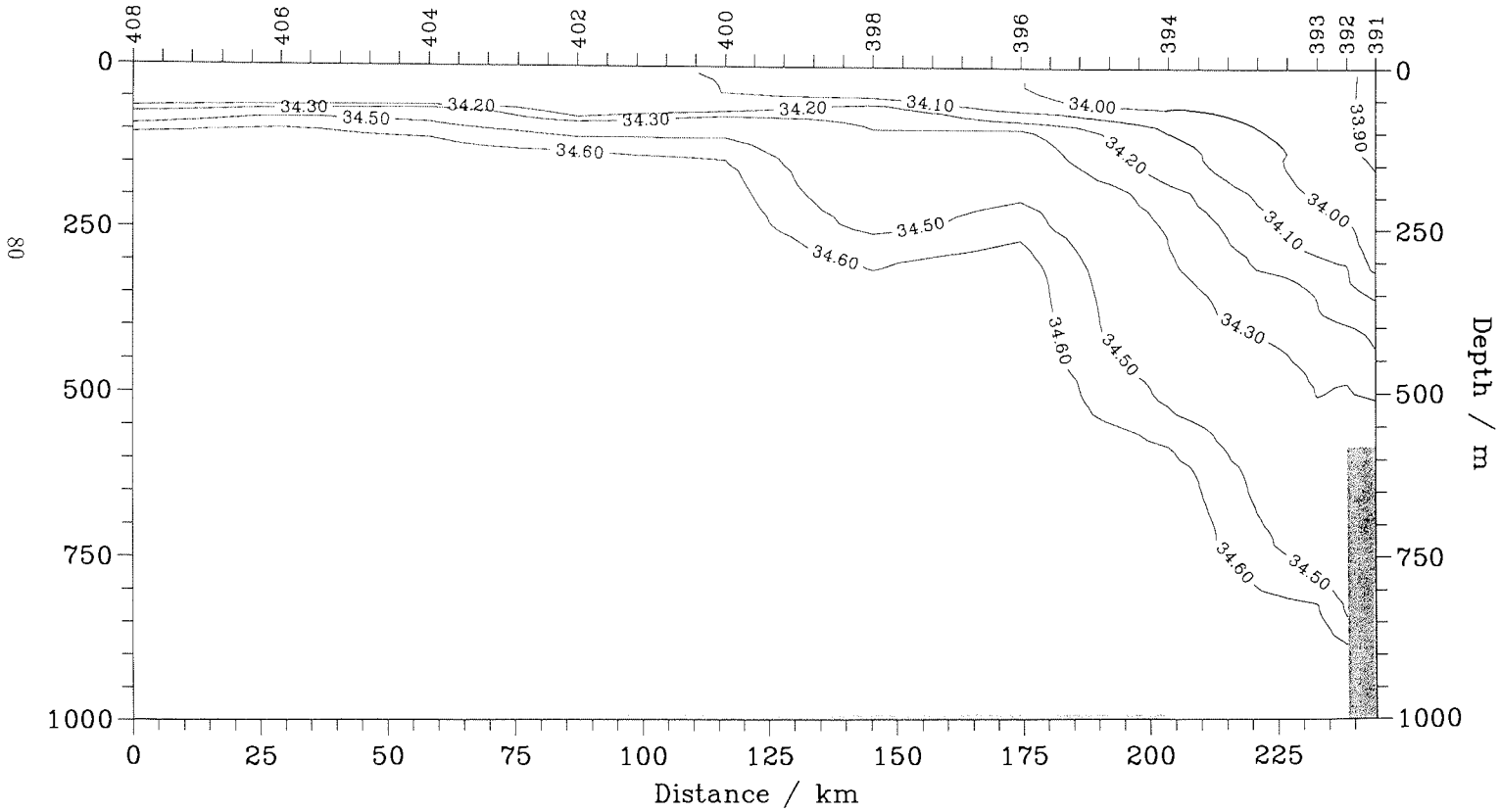
Meeresphysik und Meßwesen, AWI



Cruise ANT10, Station 408 – 391

Salinity

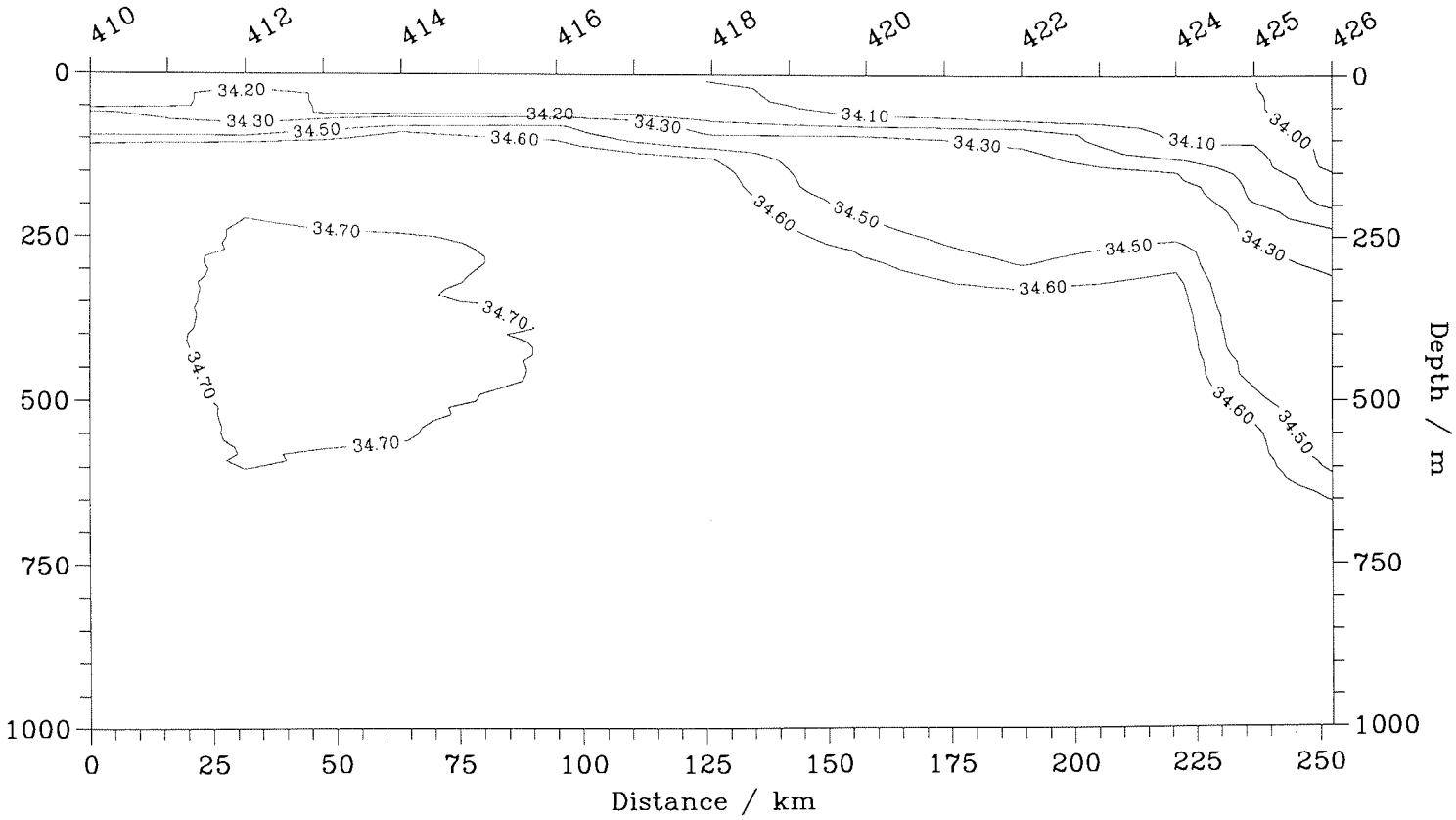
Meeresphysik und Meßwesen, AWI



Cruise ANT10, Station 410 – 426

Salinity

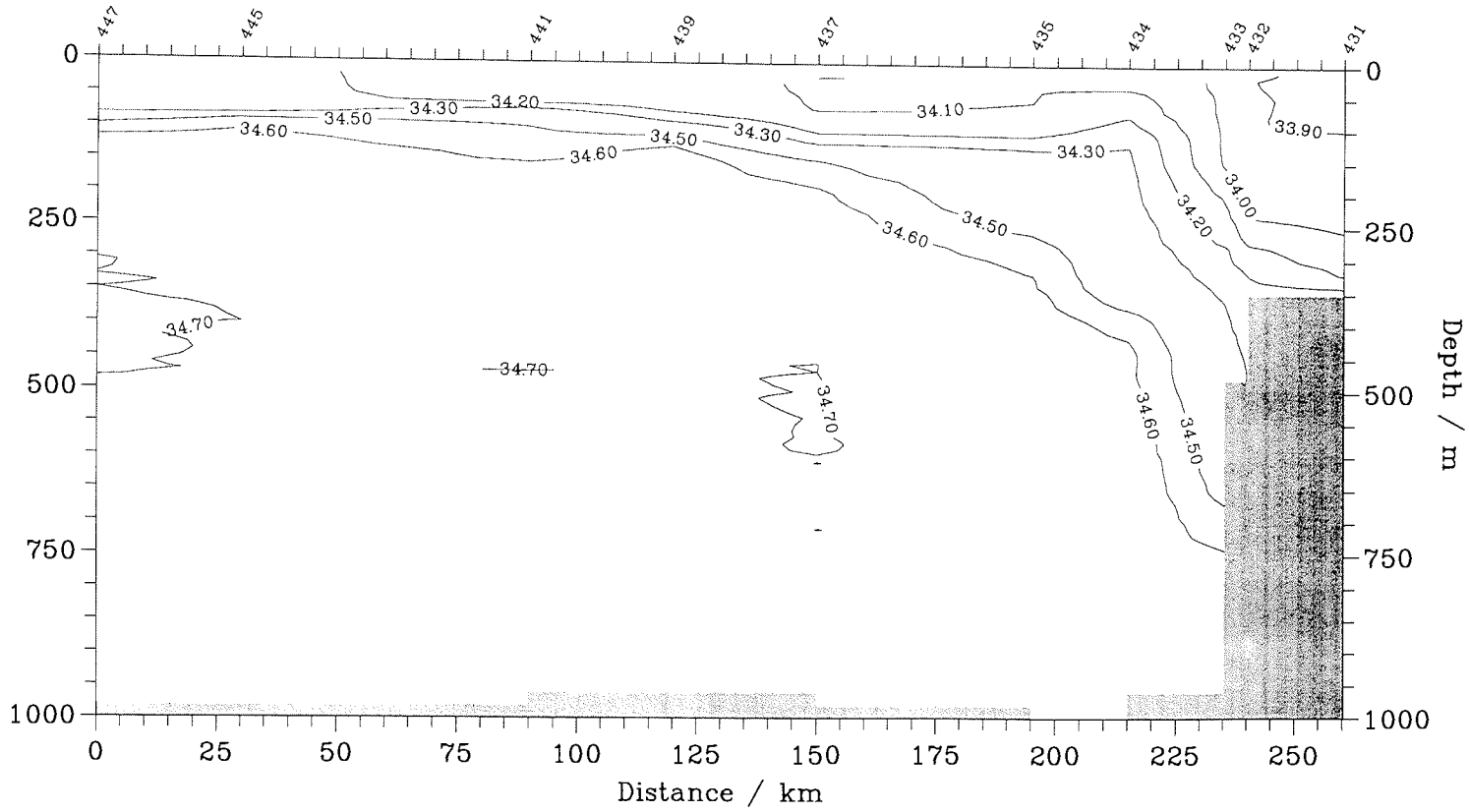
Meeresphysik und Meβwesen, AWI



Cruise ANT10, Station 447 – 431

Salinity

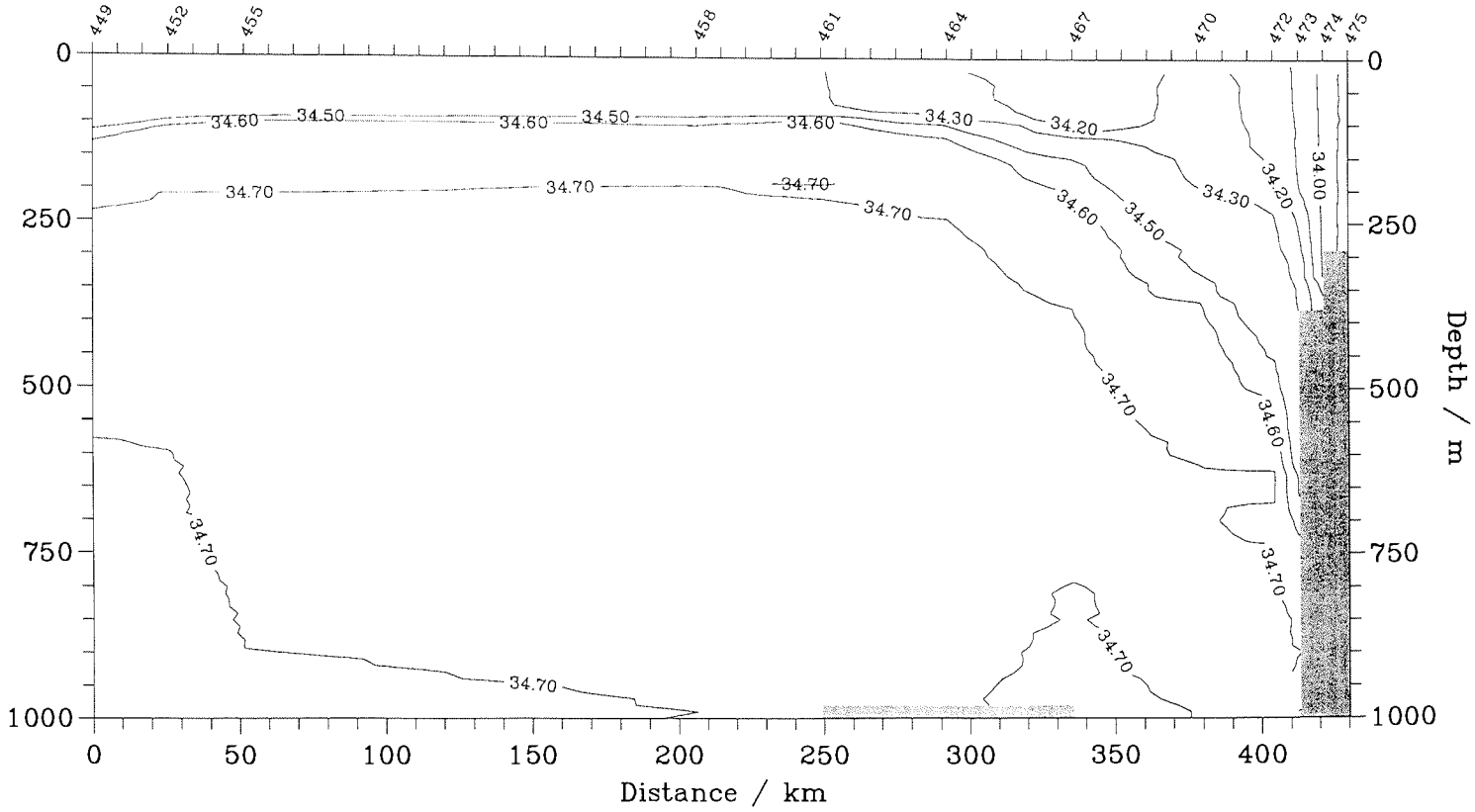
Meeresphysik und Meβwesen, AWI



Cruise ANT10, Station 449 – 475

Salinity

Meeresphysik und Meβwesen, AWI



6 References

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