NOAA Technical Memorandum ERL PMEL-21

PHYSICAL ENVIRONMENT OF THE EASTERN BERING SEA MARCH 1979

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May 1980

UNITED STATES DEPARTMENT OF COMMERCE
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NATIONAL OCEANIC AND ATMOSPHERIC ADMINISTRATION
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Physical Environment of the Eastern Bering Sea
March 1979*

by

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ABSTRACT. This report includes two analyses of data collected by the NOAA ship Surveyor in the southeastern Bering Sea during March, 1979. The first section presents CTD's and data on sea surface temperature and salinity and on surface winds and air temperature. The data indicate that ice was advected south to the ice edge by northerly winds, and that net melting occurred at the ice edge. The second section describes two cases when cold continental air moved from the ice over the water at the edge. An estimate is made of the resulting surface heat flux.

1. INTRODUCTION

During the first two weeks of March 1979, the NOAA ship SURVEYOR (frontispiece) collected data along the ice edge in the southeastern Bering Sea. The region of the cruise and the ship's cruise track are shown in Figures 1 and 2. The ice edge was at approximately 58° to 60° latitude, 3° of latitude north of the shelf break in water less than 100 m deep. The position of the ice as surveyed by joint NOAA-Navy ice reconnaissance overflights on March 2 and March 8 is shown in Figure 3.

This paper presents all the field data and two preliminary interpretations of the data set; a discussion of the manifestations of melting ice at the ice edge; and a report on the atmospheric boundary layer thermal structure near the ice edge during two outbreaks of cold air.

*Contribution No. 467 from the NOAA/ERL Pacific Marine Environmental Laboratory.

2. OCEANOGRAPHY AND METEOROLOGY AT THE ICE EDGE

2.1 Data

Forty-one CTD casts and twenty-three airsondes were taken at locations shown in Figures 4 and 5; Table 1 summarizes information about the CTD casts. Individual CTD casts in Table 2, casts 1-41, were plotted using PMEL graphics program R2D2 (Pearson et al., 1979). Isotherms, isohalines, and isopycnals were drawn by hand for the vertical sections of Figures 7 and 8, at locations shown on Figure 6. Dynamic depth anomaly at 35 m, the greatest common depth, was calculated using R2D2 and plotted in Figure 9.

CTD's were taken with a model 9040 conductivity/temperature/depth sensor manufactured by Plessey Environmental Systems. The standard deviation of error for the CTD when calibrated in January 1979 was: conductivity, 0.017 m-Sieman/cm; temperature, 0.006°C; pressure, 0.73 PSI.

The atmosphere sounding system used was that of the Atmospheric Instrumentation Research Co. It consists of 100-g helium inflated balloons, an expendable aerodynamically shaped instrument package (the "airsonde"), a receiving antenna, a receiver and data processing unit, and a cassette tape recorder for data logging. The instrument package transmits pressure and wet and dry bulb temperatures. No information on wind was obtained. The data rate is one frame (time, dry bulb temperature, wet bulb temperature, and pressure) every 6 sec. The ascent rate is about 2.5 ms^{-1}; there are about 15 m between samples. The precision in the wet and dry bulb temperatures is ±0.5°C and in the pressure it is ±3 mb.

During the first 2 days at the ice edge, sea surface temperature was measured every half hour as a bucket temperature with a thermometer calibrated to ±0.1°C. Dry bulb air temperature readings were made throughout the cruise. The salinity of bucket samples taken every 2 hr was determined using a Guildline 8400 salinometer precise to ±.001 ppt. Air temperature and pressure during the cruise are plotted on Figure 10. Figures 11 and 12 exhibit sea surface isotherms and isohalines.

Relative wind magnitude and direction were continuously monitored with a Bendix 120 wind velocity and direction transmitter accurate to ±0.1% for velocity and ±3° for direction. Relative wind data were digitized over 10-min intervals. The ship's course recorder chart was digitized over the same time intervals, and the ship's velocity was approximated from positions logged every 15-30 min. The true wind magnitude and direction shown in Figure 13 were calculated from this information.

Surface analyses for the Bering Sea region at 00Z and 12Z of March 1-March 31 were obtained from the National Weather Service Forecast Office in Anchorage and digitized for temperature and pressure. The isotherms thus derived are in Appendix A. The surface winds shown in Appendix B were computed from the pressure field by rotating the calculated gradient wind 20° toward lower pressure and decreasing its magnitude by 20% using METLIB (Overland et al., 1980), a software package for meteorological fields. In regions with little bias due to topography, calculated winds agree well with observed winds. In Figure 14 observed and calculated winds at St. Paul and the ship agree in magnitude, but the angle of rotation of calculated wind is slightly too large. This error may be due in part to the fact that the wind vector at St. Paul is the average of three readings, and the ship's wind vectors are derived from 6-hr averages of data digitized over 10-min intervals, while the calculated winds are derived from the instantaneous pressure field.

2.2 Discussion

Winds over the eastern Bering Sea were generally from the northeast during March 1979. This is in accord with usual winter wind patterns (Brower et al., 1977).

Under the influence of persistent northerly winds, ice formed in the shallow northern regions of the Bering Sea would be consistently advected southward (Muench and Ahlnäs, 1976), ultimately reaching the edge. Southward motion of the ice edge itself over most of the region can be seen in Figure 4. A comparison of CTD descriptions in Table 2 with positions in Figure 5 also illustrates motion of the ice edge.

For example, CTD casts 7 and 38, roughly 40 km apart, were both taken in the zone of decaying ice at the edge on March 3 and 13, respectively.

As the ice advected south, it was subject to increased air temperatures (Appendix B). Air temperature at the ice edge was typically -10° to +5°C.

Water at the ice edge had a salinity of about 32 ppt (Fig. 14). Thus its freezing point would be about -1.75°C. Virtually no sea surface temperatures this cold were measured; the ice edge was not an ice-forming region. Since the salinity of the ice is about 15 ppt, its melting point is about -0.8°C. It can be seen in both Appendix A and Figure 11 that water warmer than -0.8°C was common at the ice edge.

Ice at the edge was melting, as shown most readily by the CTD's. CTD's from ice-free areas south of the ice edge illustrated well-mixed water (for example Appendix A, Numbers 5, 11). CTD's from within or at the ice edge generally exhibited a surface layer, 15 to 25 m deep, of relatively cold and fresh meltwater (see Appendix A, Numbers 33, 39-41). The change from well-mixed to two-layer water occurred across a transition zone over which short ice advances and consequent melting had apparently occurred.

Figure 7 presents a cross section of an ice edge surface lens of meltwater; the position of this vertical section is shown in Figure 6. The CTD section in Figure 8 illustrates the presence of a front near the ice edge; CTD casts 1-5 used for this section were taken during the coldest air temperatures seen on the cruise, on the only day grease ice formation was observed. They are also the shallowest CTD casts made; this transect therefore represents an anomaly to the more representative transect of Figure 7.

Due to melting at the advancing ice edge, the colder isotherms and fresher isohalines were moved to the south during the 2 weeks of the cruise, although the isolines further from the ice edge were relatively stationary. In Figures 11 and 12, the -1.0°C and 31.8 ppt isolines moved about 40 km to the south in the 13 days which elapsed between the first and final readings near the eastern end of the cruise track.

The dynamic topography shown in Figure 9 indicates a current to the northwest along the ice edge. This agrees with the currents obtained by Charnell, Schumacher, Coachman, and Kinder (1979). The density distribution near the ice edge is changing faster than geostrophic currents could adjust, due to ice movement and melting. However, the dynamic method offers an order-of-magnitude calculation for currents near the ice edge. The CTD transect shown in Figure 7 suggests a narrow current of 1-2 cm sec^{-1} and the transect in Figure 8 a current with a maximum velocity of about 6 cm sec^{-1} at the front. Thus, currents at the ice edge are transporting water parallel to the edge and it is unlikely that they would cause the isoline motion seen in Figures 11 and 12.

An estimate was made of the amount of ice which had melted to create the temperature profile of the lens in Figure 7, using:

$$m_i = \frac{C_p \, \Delta T_w \, m_w}{L} ,$$

where C_p is the specific heat, ΔT_w is the change in water temperature, L is the latent heat of freezing and m_i and m_w are the masses of ice and water per unit area, respectively.

This formula was used to estimate the heat removed from 'cores' of water of unit surface area for every kilometer along the transect. The heat removed from each core was assumed to be a centered average of the heat per area about the core. It was assumed that the temperature was originally +0.1°C, (see CTD cast 39, Appendix A), and that density was constant at 1.03 g cm^3. C_p was set at 0.94 cal $g^{-1}deg^{-1}$ (The Oceans, 1942). It was assumed in the equation that all the heat extracted was used to melt ice, that the ice was already at the melting point, and that the salinity of the ice was 15 ppt so that the latent heat was 16 cal g^{-1} (Neumann and Pierson, 1966).

This calculation indicates that enough heat was extracted from the lens to melt a 60-km strip of ice averaging 50 cm thick. Lower initial water temperature or salinity of the ice gives lower values, as would the inclusion of cooling of the lens due to off-ice winds. Martin and Kauffman (1979), who took cores along transects into the ice pack, found that the pack was generally 30 cm thick except in the outer couple of kilometers, where rafting increased thickness to more than 1 m. Thus the 50-cm estimate for ice thickness may be too large, which would lead to an underestimate of lateral ice melting of almost one-third.

Further discussion of marginal ice zone physics during March 1979 can be found in Pease (1980), McNutt (1980), Bauer and Martin (1980), and Squire and Moore (1980).

2.3 Conclusion

Data taken along the ice edge in the southeastern Bering Sea in March 1979 are consonant with the advance of the ice edge due to northerly winds, but retarded and limited by the melting of ice due to advection to warmer water. Ice formation at the edge was only observed on one occasion, during the coldest air temperatures and in the shallowest water of the cruise in the lee of Nunivak Island.

3. BOUNDARY LAYER OBSERVATIONS NEAR THE ICE EDGE

3.1 Measurements

At many times during the cruise there were cold air outbreaks in which continental air passed from the ice to the water with a consequent large increase in surface heat flux. Because of other demands on the ship's time, only two cases were documented: Case A on March 5 and Case B on March 15. Case B also benefitted from simultaneous overflights by the NASA C-130 aircraft. The location of Case A and B is shown in Figure 15.

A total of 23 airsonde flights were made. They are summarized in Table 2. The potential temperature for each sounding is plotted to 2000 m in Figure 16. In all of the soundings we see a mixed layer capped by a sharp inversion at 400 to 1000 meters. We noted a warming and deepening of the mixed layer and a cooling of the inversion layer as observations were taken at increasing distances from the ice edge. This is shown clearly in Figure 17 where potential temperature is plotted for the four soundings of Case A. Note that the superadiabatic layer near the surface may be amplified by thermal contamination from the ship's stack. The warming of the mixed layer was clearly a result of heat flux from the warm ocean, while cooling of the inversion layer can be attributed to entrainment of cold air from the underlying mixed layer. This entrainment produced a net downward heat flux, adding to the warming of the mixed layer and cooling the inversion layer. The inversion was further cooled by radiation from the cloud layer that developed soon after the air passed over the water, a product of the greatly increased moisture flux.

An additional mechanism that may contribute to the deepening of the mixed layer is found in the increased stress due to buoyant mixing. This increased stress slows the air in the mixed layer and creates a low level convergence that results in a positive vertical velocity at the inversion. With potential temperature conserved the adiabats rise, as in Figures 21 and 25.

3.2 Case A

At the time of Case A, ~ 0300Z 5 March, there was a small low pressure system about 180 km southeast of the ship (see the surface and 850 mb analyses, Figure 18, and the National Weather Service soundings for four nearby stations, Figure 19). The geostrophic flow was from the east, with most of Alaska dominated by this zonal flow. The wind at the ship was 9 to 13 ms^{-1} at 020° to 040°. As shown in Figure 20 the ship steamed downwind 70 km to the southwest and four balloons were launched at 1-hr intervals (0243Z to 0634Z, 5 March). A cross section of the potential temperature of the four soundings is presented in Figure 21, in which we see the warming and deepening of the mixed layer as a function of distance from the ice. Note also the rising of the -4 and -6°C adiabats indicating the cooling of the inversion. The interpretation of this figure is limited by two major difficulties. The first is the nonsynoptic nature of the observations. The 850-mb maps (1100 m) indicate a 6°C warming from 00Z to 12Z 5 March and a shifting of the 7 to 10 ms^{-1} winds from 030° to 090° as the low to the south developed. Second, the distance the air travels over the water may be different than the distance the ship traveled since ice was last observed, due to the irregular nature of the ice edge. Nevertheless the warming and deepening of the boundary layer and the cooling of the inversion are clear.

3.3 Case B

Case B was characterized by a weak and nearly stationary low pressure center 250 n mi south of the ship with an occluded front to its southwest (see the surface and 850-mb analyses, Fig. 22, and the upper air soundings, Fig. 23.) The geostrophic wind was from the northeast at the ship's position and there was a very weak flow off of the Alaskan land mass. The 850-mb maps (1300 m) indicate a shift in the wind from 045°/3 ms^{-1} at 12Z 15 March to 330°/3 ms^{-1} at 12Z 15 March. The temperature was steady to within 1°C.

Again we see a warming and deepening of the mixed layer as the ship steamed to the south. Figure 24 is a cross section of potential temperature as the ship made a 180-km transit south from the ice edge. Figure 25 is a map of the ice edge with the winds and temperatures measured by the bridge plotted for the time of each airsonde launch, and wind and temperature observations by the NASA C-130 aircraft plotted on three legs at 100 m, 350 m, and 680 m.

The airplane data indicate the same general shape to the profile but the temperatures are up to 5°C warmer than those measured by the airsonde. The airsonde data are supported by two independent sources: the temperature measured by the airsonde before launch matched that of the bridge to within 0.5°C, and the temperature of the wet bulb while it froze rose to -0.6°C (for pure water it should have been 0°C), indicating that the temperature circuit was functioning reasonably well. The variance of the temperature as measured by the airplane was substantially larger at the 650-m level than at lower levels. This level was near the height of the maximum temperature as indicated by the airsonde sounding. Large temperature fluctuations would be expected in this region as the airplane passed in and out of plumes of cold air from below or warm air from above. These fluctuations are further evidence of active entrainment near the inversion.

Also evident in the airplane data plotted in Figure 25 is a slight counterclockwise backing of the wind with height. Ekman turning of the wind normally veers in a clockwise sense and the backing is indicative of cold air advection. (The thermal wind component normal to the ship's track for Case A was 12 ms^{-1} km^{-1} from a mean horizontal temperature gradient of 0.03°C km^{-1}.) For Case B it was 18 ms^{-1} km^{-1} from a gradient of 0.05°C km^{-1}.

There were high level altostratus and cirrus moving into the area from the south and a well developed layer of stratocumulus clouds within a few kilometers south of the ice edge. This layer of saturated air was observed in the airsonde surroundings, but unfortunately the thickness of the cloud layer could not be determined because the wet bulb wick was in the process of freezing for most of the soundings during this critical time.

3.4 Surface Heat Fluxes

A very rough estimate of the surface heat flux may be obtained by the bulk aerodynamic method in which the wind speed at 10 m, U_{10}, and the air sea temperature difference, ΔT, are used to find the surface heat flux:

$$F_H = \rho c_p \, U_{10} \, \Delta T \, C_h \ ,$$

where C_h is the bulk heat transfer coefficient (approximately 1.2×10^{-3}, Kraus, 1972), c_p (1004 J $deg^{-1}kg^{-1}$) is the heat capacity and ρ(≅1.3 kg m^{-3}) is the density of the air. For Case A (U_{10} = 10 ms^{-1}, ΔT = 10°C) the heat flux is about 120 Wm^{-2} and for Case B (U_{10} = 5 ms^{-1}, ΔT = 5°C) it is about 30 Wm^{-2}.

We can also find the difference in heat content between two columns of air of depth Z by integrating the expression

$$\Delta H(Z) = c_p \int_0^Z \rho \, (T_2 - T_1) \, dz \ , \qquad (1)$$

in which T_1 and T_2 are the temperatures of the two air columns. The heat flux into the air column can then be approximated from

$$F_H = \frac{U \Delta H}{d} \ , \qquad (2)$$

where U is the mean wind speed in the air column and d is the distance between the soundings. We must assume steady state conditions and that the second sounding is directly downwind from the first.

If no heat were transferred through the inversion (Z=h) the air above would remain unchanged from the first sounding to the second. ΔH would then be constant for z>h and would represent the total heat flux from the surface into the mixed layer. Equation (1) is plotted for Cases A and B in Figures 26 and 27. In Case A we see that this constant is about 1.5 x 10^6 Jm^{-2} at Z=1000 m, and using (2) we obtain 210 Wm^{-2} for the heat flux into the column (vs 120 Wm^{-2} from the bulk aerodynamic method). For Case B we find no hint of a constant ΔH; the fact that ΔH is negative above 800 m could reflect a bias in one of the temperature sensors or a violation of the assumptions of steady state, downwind profiles.

This method of calculating heat fluxes places extreme requirements on the accuracy of the temperature profiles, for with a precision of 0.5°C the expected error in the heat flux calculated with Z=1000 m, d=50 km, and U=10 ms^{-1} is 140 Wm^{-2}. The expected error for a precision of 0.5°C is plotted for each case in Figures 26 and 27. Clearly the error is very large and quickly overwhelms the value of ΔH as we integrate upward. If we could be certain that at some high level the temperatures of the two profiles were the same, any bias in the temperature sensors could be adjusted for, and the expected error would be much smaller. Unfortunately, the nonsynoptic nature of the observations precluded any such certainty.

3.5 Conclusion

There are many questions that remain about the air modification that occurs at the ice edge. Of most interest is the nature of the three-dimensional wind field near the ice edge that reflects different values of the surface stress and heat flux at the up- and downwind sides. It would also be very useful to accurately determine the heat and moisture fluxes as a function of distance from the ice edge. Accurate field observations could be used to verify the results obtained with various air modification models or to substantiate working assumptions of ocean or ice circulation models. This study represents a first and somewhat cloudy look at an intriguing phenomena.

4. ACKNOWLEDGEMENTS

This study was financed in part by the Marine Services Project of the Marine Meteorological Studies Group at Pacific Marine Environmental

Laboratory and in part by the Bureau of Land Management through interagency agreement with the National Oceanic and Atmospheric Administration under a multiyear program, responding to needs of petroleum development of the Alaskan continental shelf, managed by the Outer Continental Shelf Environmental Assessment Program (OCSEAP) Office. The cruise time on the NOAA ship SURVEYOR was requested by the late Robert Charnell of PMEL and was arranged by the OCSEAP Juneau Project Office. Seelye Martin of the Department of Oceanography at the University of Washington acted as chief scientist on the cruise. The shipboard measurements were carried out with the help of the survey technicians and other crew members of the SURVEYOR under the command of Captain James G. Grunwell.

The National Weather Service Forecast Office in Anchorage supplied the surface analyses, and the National Climate Center in Nashville supplied the NWS soundings. Bruce Webster, ice forecaster at WSFO in Fairbanks, contributed ice and pressure analyses. Francis Parmenter of NESS in Anchorage provided NOAA and TIROS satellite images. Lt. (jg.) Daniel V. Munger and AGC William B. Damico flew the Navy ice reconnaissance for the NOAA-Navy Joint Ice Center under the leadership of Commander James C. Langemo.

James D. Schumacher, James E. Overland, and R. Michael Reynolds gave advice and direction on the physics. Sally A. Schoenberg did much of the digitizing and Linda Green generated many of the computer plots. Peter Lanore helped with the wind analysis. Joy I. Golly and Gini May prepared the drafted figures and James Anderson and Claudia J. Smith did virtually all the photography. Lai K. Lu typed the original manuscript and the PMEL Word Processing Center prepared the final draft.

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TABLE 1. CTD OPERATIONS SUMMARY

Cast #	LATITUDE(N)	LONGITUDE(W)	ICE CONDITIONS	DEPTH(M)	DAY	TIME
1	58° 26.8'	165° 57.0'	Loose pancakes and grease ice	40.9	062	0009
2	58° 21.7'	165° 58.9'	Same	37.5	062	0652
3	58° 16.9'	165° 59.2'	Same	38.4	062	0909
4	58° 14.3'	165° 59.6'	Adjacent Edge of Loose Cakes	41.4	062	1035
5	58° 11.2'	166° 00.2'	Clear of Ice Open Water	43.6	062	1152
6	58° 15.0'	167° 18.8'	Condensed Pancakes	55.8	063	2246
7	58° 13.8'	167° 21.3'	Adjacent Edge of Condensed Cakes	56.7	064	0013
8	58° 11.9'	167° 21.0'	Near-By Lead Open Water	57.0	064	0213
9	57° 41.4'	168° 00.8'	Clear of Ice Open Water	63.1	064	0614
10	58° 13.8'	167° 44.0'	Adjacent Ice Edge	55.3	065	0511
11	58° 13.6'	167° 49.8'	Clear of Ice Open Water	56.2	065	0554
12	58° 29.8'	167° 56.1'	Adjacent Ice Edge Moving North	50.6	066	0406
13	58° 45.9'	168° 45.1'	8 NM into Loose Pack Ice	47.3	066	1636
14	58° 45.1'	168° 47.8'	Inside Ice Pack, Floes Compacting	49.6	067	0403
15	58° 38.7'	169° 05.2'	Clear of Ice Open Water	58.5	067	0805
16	59° 02.2'	170° 01.2'	Adjacent Ice Edge, Cakes Rotting	63.5	067	1635
17	58° 58.1'	170° 12.0'	Slightly Away From Ice Edge	66.6	068	0340
18	58° 57.2'	170° 45.6'	Same	67.2	068	0804
19	59° 22.2'	170° 59.2'	Adjacent Rotting Pack Ice Edge	67.2	068	1635

(TABLE 1 Contin.)

Cast #	LATITUDE(N)	LONGITUDE(W)	ICE CONDITIONS	DEPTH(M)	DAY	TIME	
20	59° 16.6'	171° 04.5'	Same	69.5	069	0212	
21	59° 11.2'	172° 22.0'	Same	83.6	069	0807	
22	59° 37.1'	172° 40.0'	Adjacent Rotting Pack Ice Edge	82.7	069	1625	
23	59° 30.8'	172° 36.4'		83.4	069	2129	
24	59° 22.8'	172° 19.7'		81.8	070	0000	
25	59° 17.7'	172° 02.4'		78.1	070	0136	
26	59° 13.2'	171° 45.3'	Decaying Cakes and Rubble	77.0	070	0316	
27	59° 07.9'	171° 28.5'		75.7	070	0440	
28	59° 02.4'	171° 10.8'		72.0	070	0614	
29	58° 58.4'	170° 57.6'		69.5	070	0736	
30	58° 53.7'	170° 40.8'		69.8	070	0928	
31	58° 49.2'	170° 23.3'		68.0	070	1117	
32	58° 44.2'	170° 07.2'	Decaying Ice, Rubble Field	65.9	070	1316	
33	58° 56.5'	170° 06.8'	Adjacent Ice Edge, Rotting Floes	63.4	070	1639	
34	58° 53.8'	170° 13.9'	Rubble Field, CTD Hung Up	65.4	071	0439	
35	58° 52.6'	170° 17.9'	Decaying Rubble	67.1	071	0822	
36	58° 46.9'	170° 25.3'	Adjacent Ice Edge, Rotting Floes	70.2	071	1636	
37	57° 58.5'	168° 21.1'	Clear of Ice, Open Water	67.1	072	0438	
38	57° 45.2'	167° 37.7'	Open Water in Lead, Compact Floes	61.0	072	0812	
39	58° 01.6'	166° 14.9'	Same	54.9	073	0436	<
40	58° 00.5'	166° 14.7'	Same	54.0	073	0809	
41	58° 00.2'	166° 14.4'	Same	56.4	073	1632	

< indicate gaps of more than 12 hours

TABLE 2 AIRSONDE SOUNDINGS

No.	Date (Mar., 1979)	Time (GMT)	Lat. (N)	Long. (W)	Air Temp (°C)	Wind Speed (m/sec)	Wind Direction (True)	Max ht. (m)	Comments
1	2	2000	58°28.6'	165°56.1'	-10.5	6	025	-	Bad Antenna connection
2	3	0223	58°25.0'	165°59.0'	-11.2	10	015	4039	20 km into the ice
3	3	1230	58°11.2'	166°01.5'	- 9.5	8	027	5329	10 km into the ice
4	3	2118	58°21.5'	166°08.8'	-12.0	10	010	4761	6/8 ice coverage
5	3	2302	58°16.4'	166°16.2'	-12.1	13	006	5130	isolated ice bands
6	3	0147	57°59.8'	166°47.1'	-10.0	14	010	-	bad airsonde
7	4	0406	57°40.2'	167°25.8'	-10.0	14	020	4749	90 km S.W. of ice edge
8	5	0243	58°11.2'	167°21.9'	- 9.5	13	025	3402	4 km S.W. of ice edge, Case A
9	5	0345	58°01.6'	167°33.1'	-10.9	9	042	4646	20 km S.W. of ice edge, Case A
10	5	0453	57°49.9'	167°47.9'	-11.0	12	040	5009	50 km S.W. of ice edge, Case A
11	5	0634	57°41.7'	168°01.9'	- 5.5	12	035	4062	70 km S.W. of ice edge, Case A
12	10	2049	59°32.2'	172°36.0'	- 2.0	10	010	5390	in ice bands
13	12	0425	58°53.7'	170°13.2'	- 2.5	9	020	5378	near ice edge
14	13	2105	58°03.4'	166°11.0'	- 6.0	5	335	5407	near ice edge
15	14	2022	57°58.8'	166°16.0'	- 5.5	8	055	4449	near ice edge
16	14	2248	57°58.5'	166°16.6'	- 3.9	7	050	5063	near ice edge, NASA overflight Case B
17	14	2337	57°55.3'	166°19.5'	- 3.0	5	025	4605	6 km S. of ice edge, Case B
18	15	0020	57°51.6'	166°20.8'	- 5.0	5	006	2400	13 km S. of ice edge, Case B
19	15	0055	57°46.9'	166°21.6'	- 4.5	5	033	539	22 km S. of ice edge, (burst)
20	15	0118	57°42.2'	166°19.4'	- 3.5	5	029	4736	30 km S. of ice edge, Case B
21	15	0216	57°29.4'	166°14.1'	- 2.1	7	019	4874	53 km S. of ice edge, Case B
22	15	0334	57°12.2'	166°07.4'	- 1.6	5	005	5503	87 km S. of ice edge, Case B
23	15	0435	56°58.6'	166°02.9'	- 1.6	5	005	5564	111 km S. of ice edge, Case B

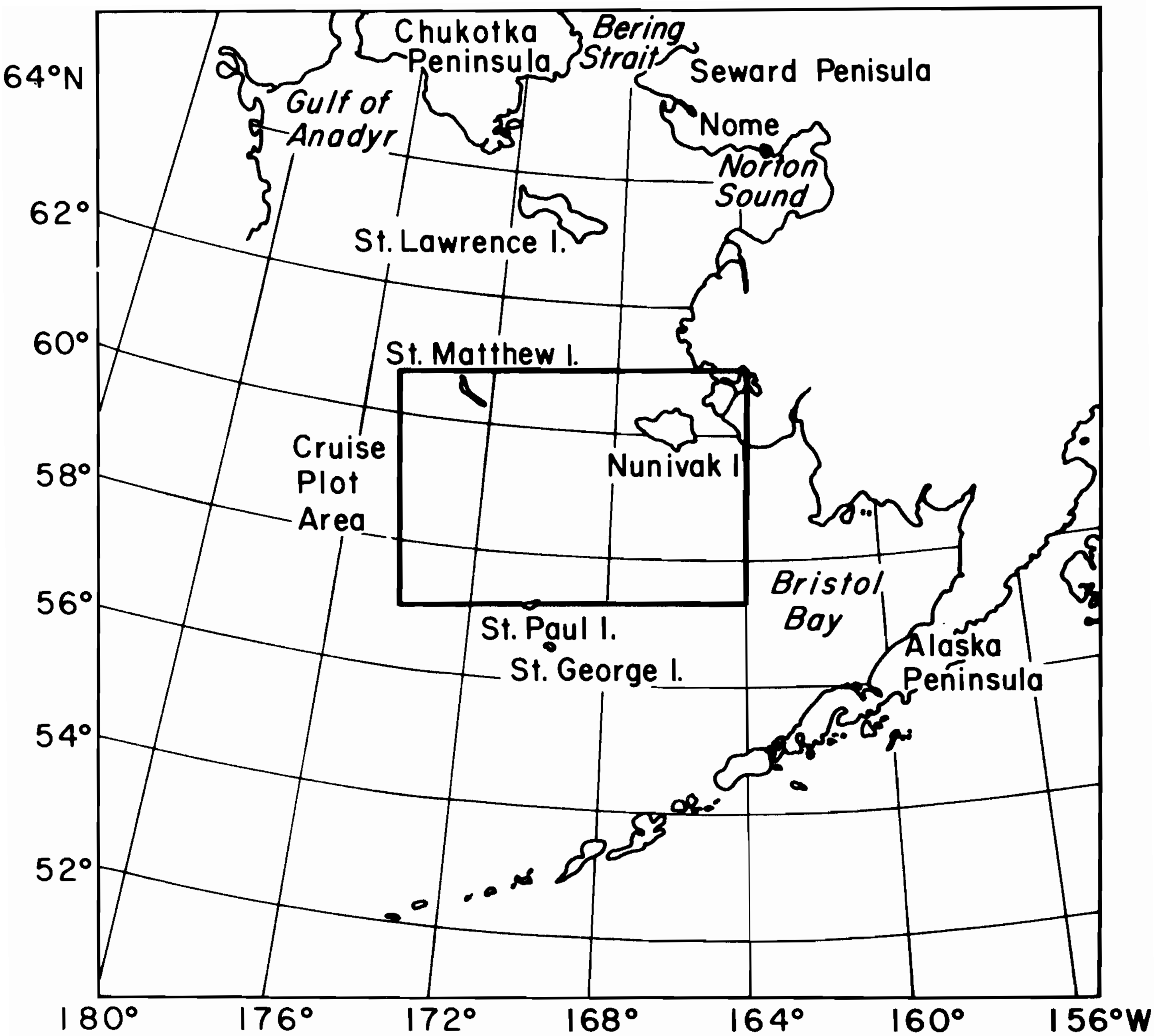


Figure 1. Cruise region in the Bering Sea, March 1979.

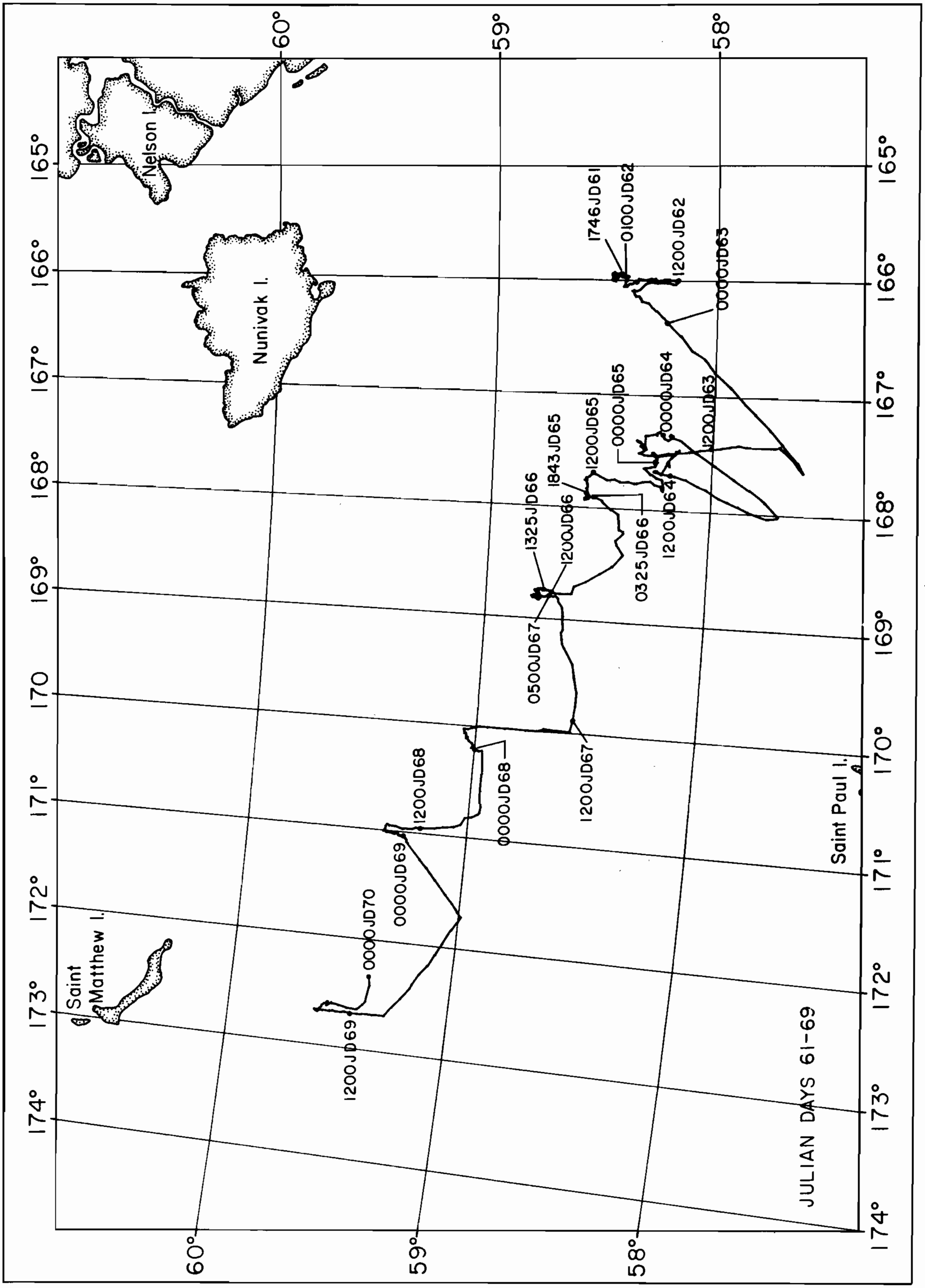


Figure 2a. Ship's cruise track. Positions at times in GMT and Julian Day are marked.

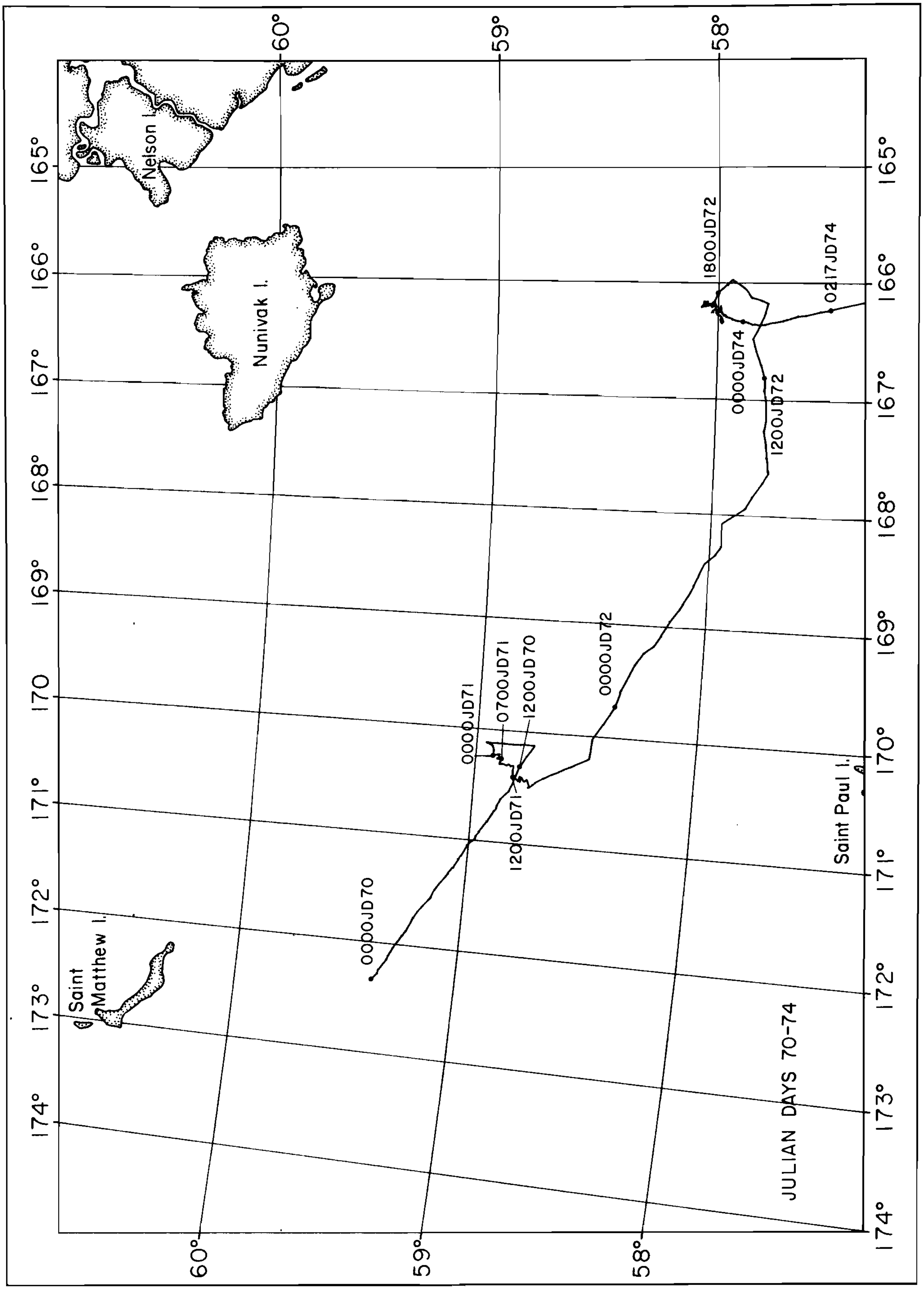


Figure 2b. Ship's cruise track. Positions at times in GMT and Julian Day are marked.

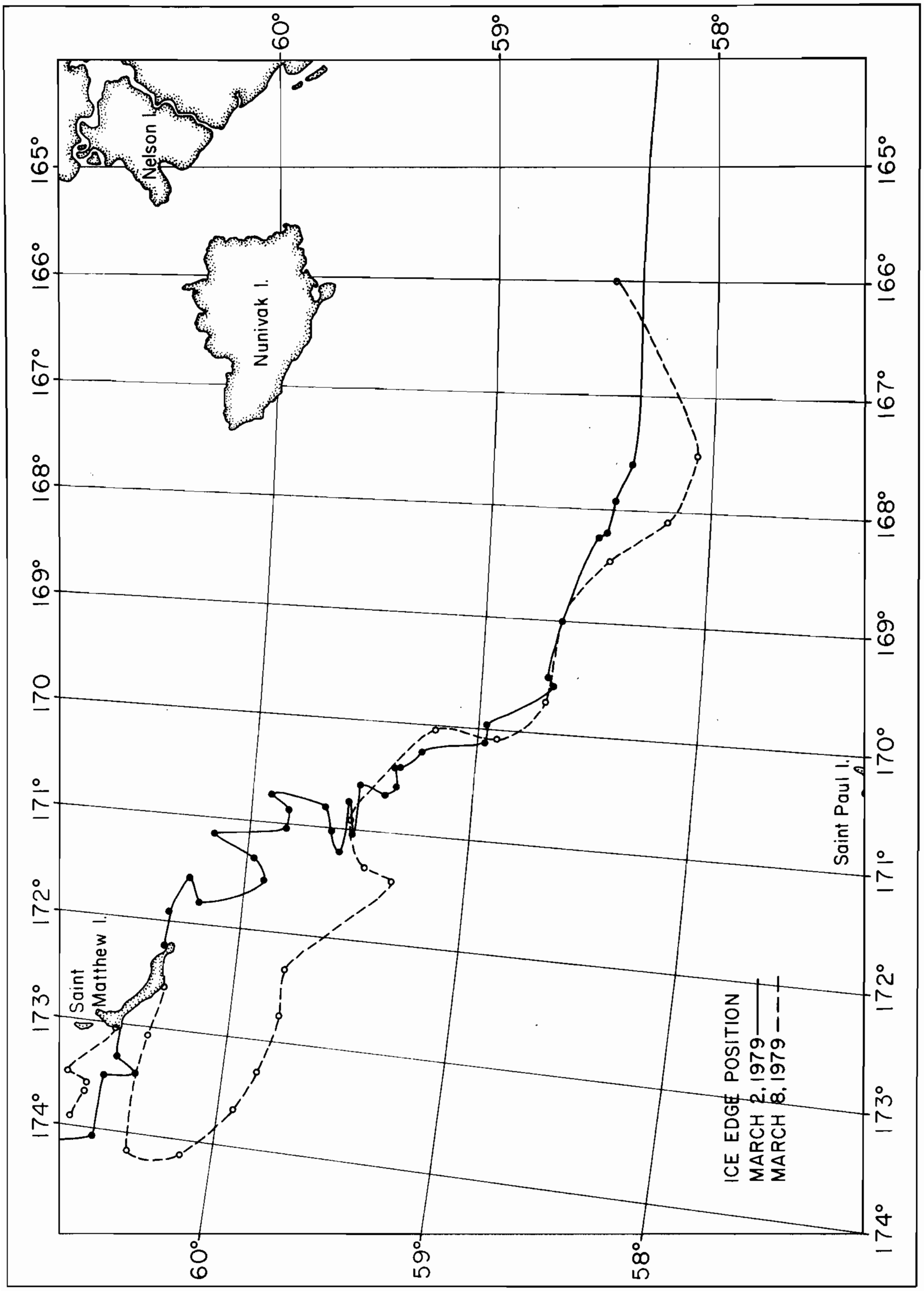


Figure 3. Aerial reconnaissance of the position of the ice edge on March 2 and March 8, 1979.

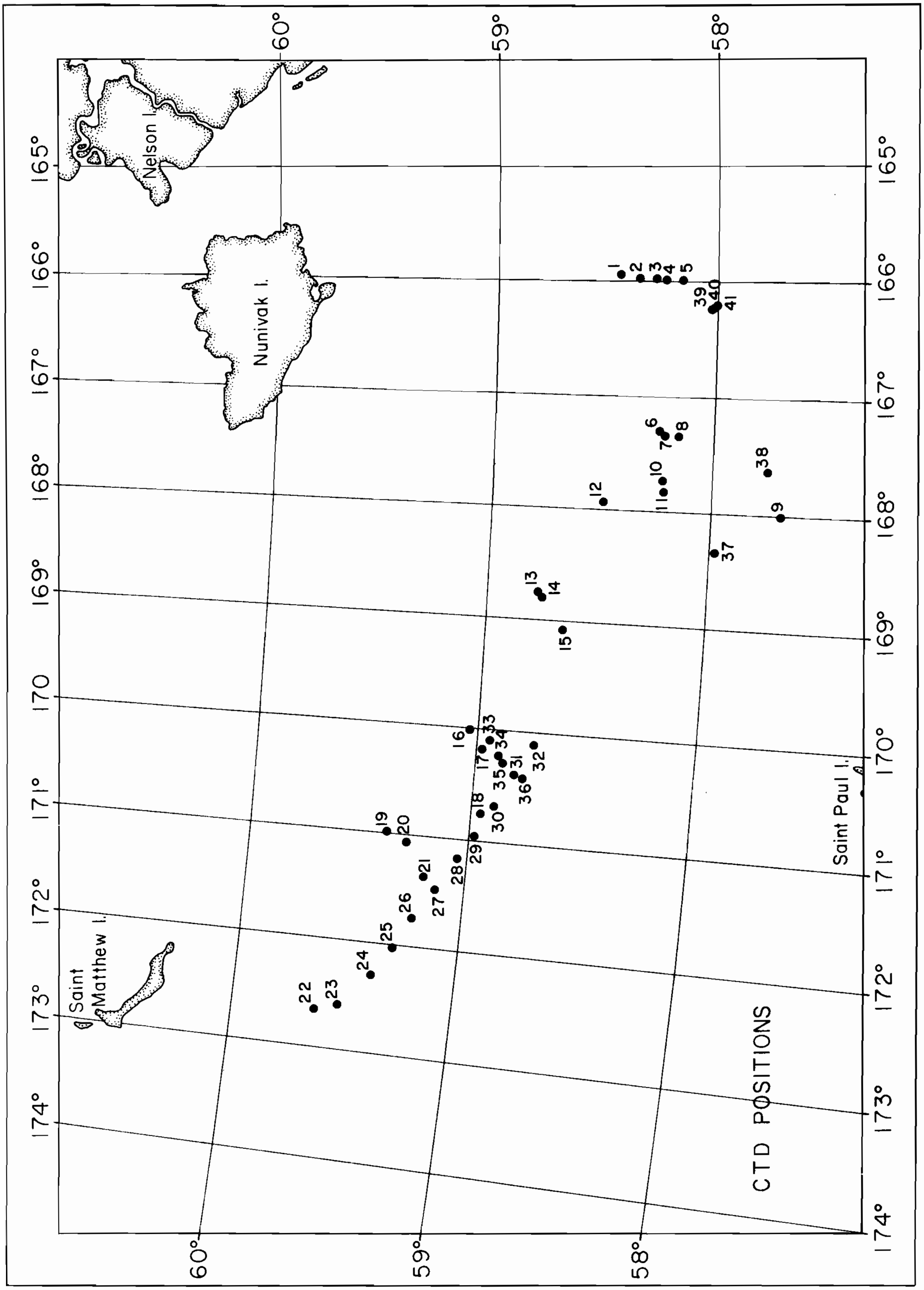


Figure 4. Locations of CTD stations.

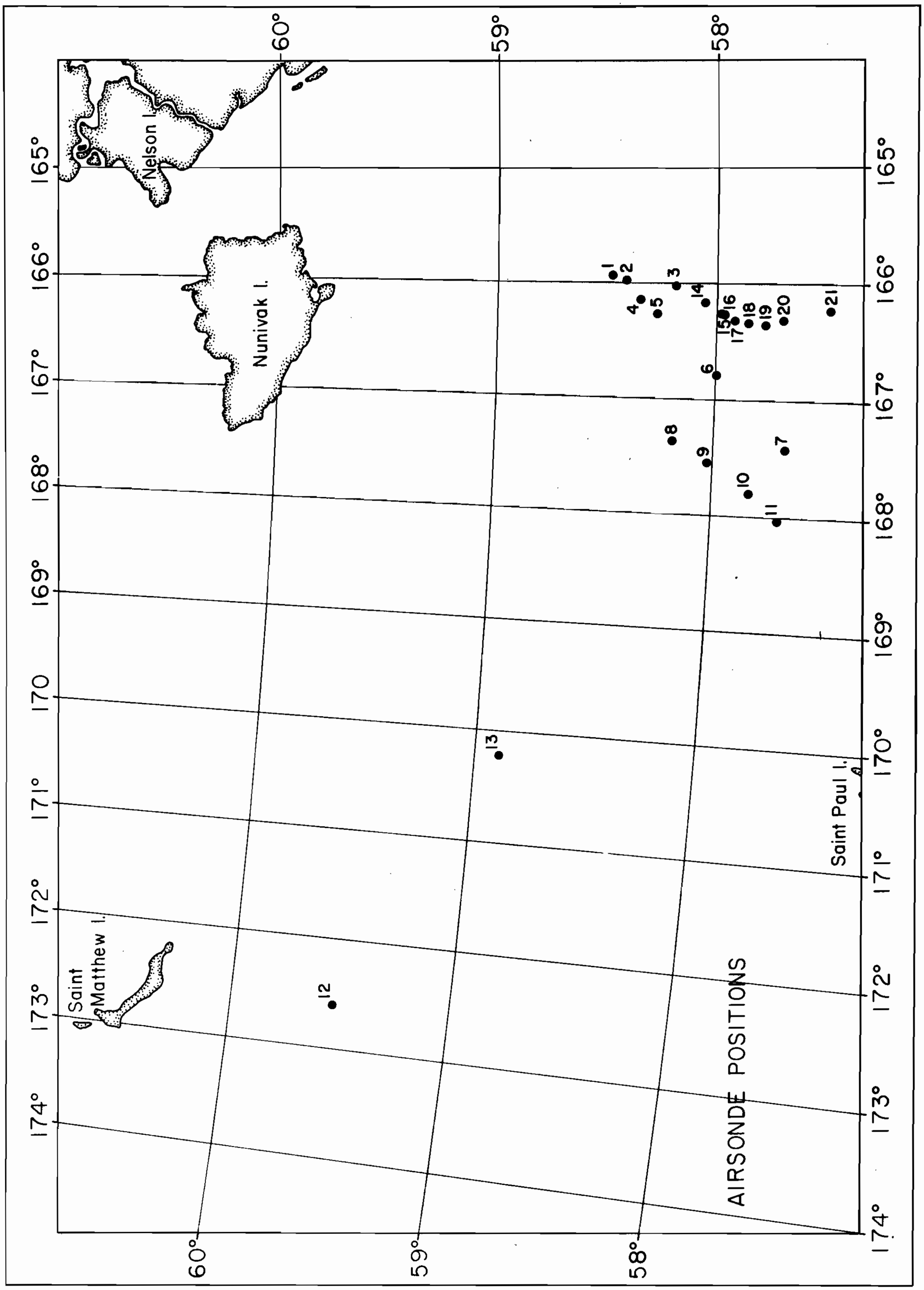


Figure 5. Locations of airsonde launches.

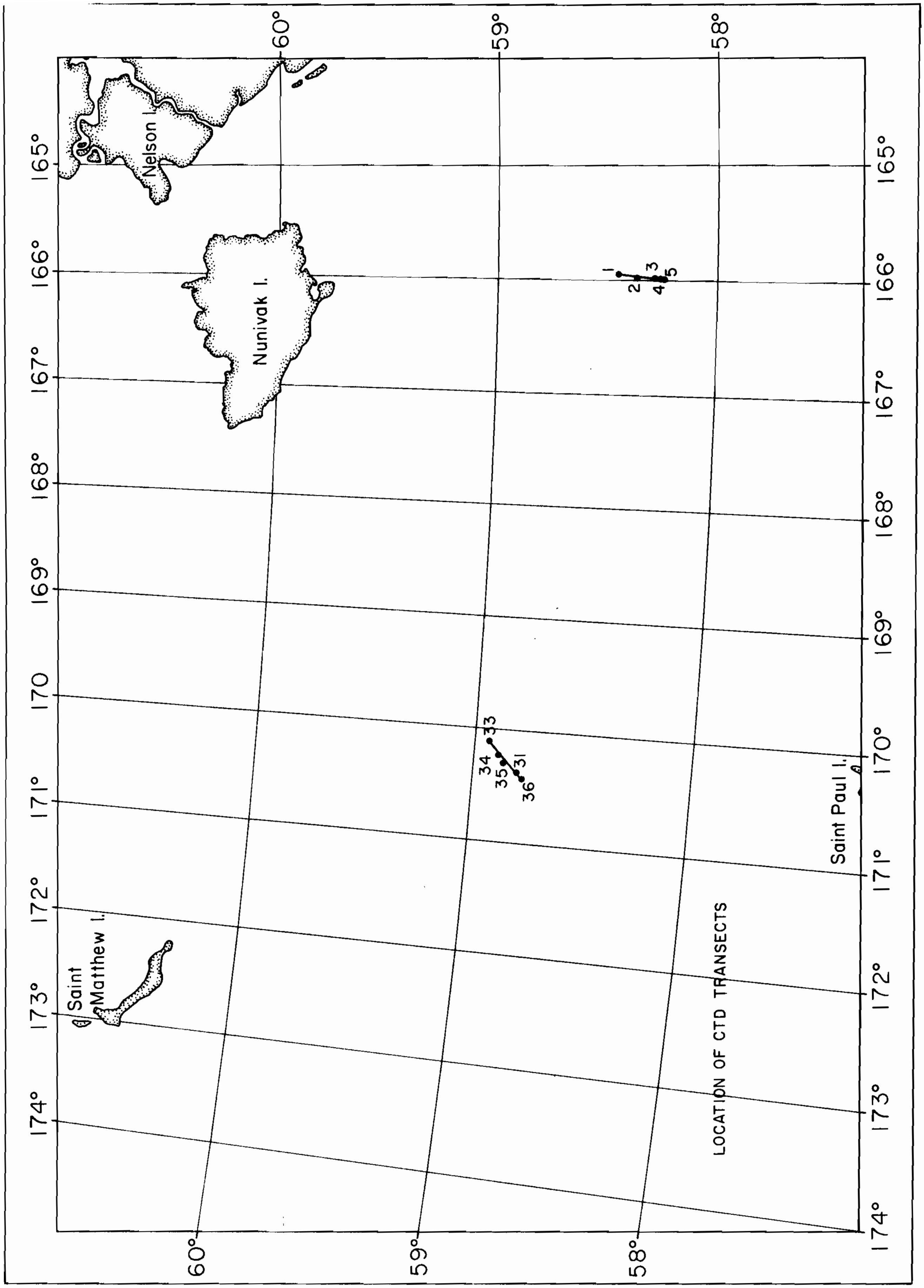


Figure 6. Location of CTD transects.

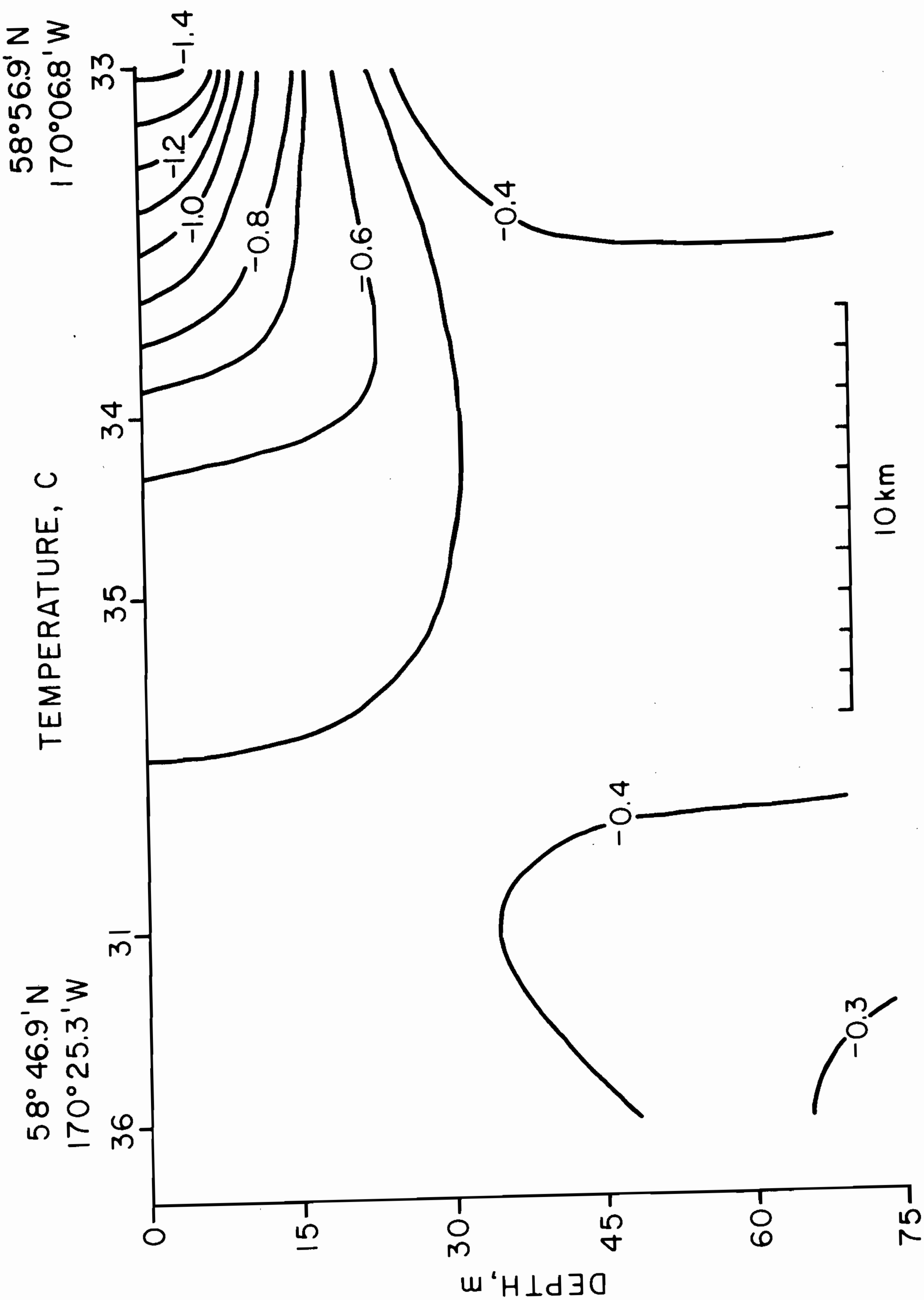


Figure 7a. CTD transect showing a surface lens of meltwater. Numbers on the horizontal axis are CTD stations. Isotherms, isohalines and isopleths are labeled.

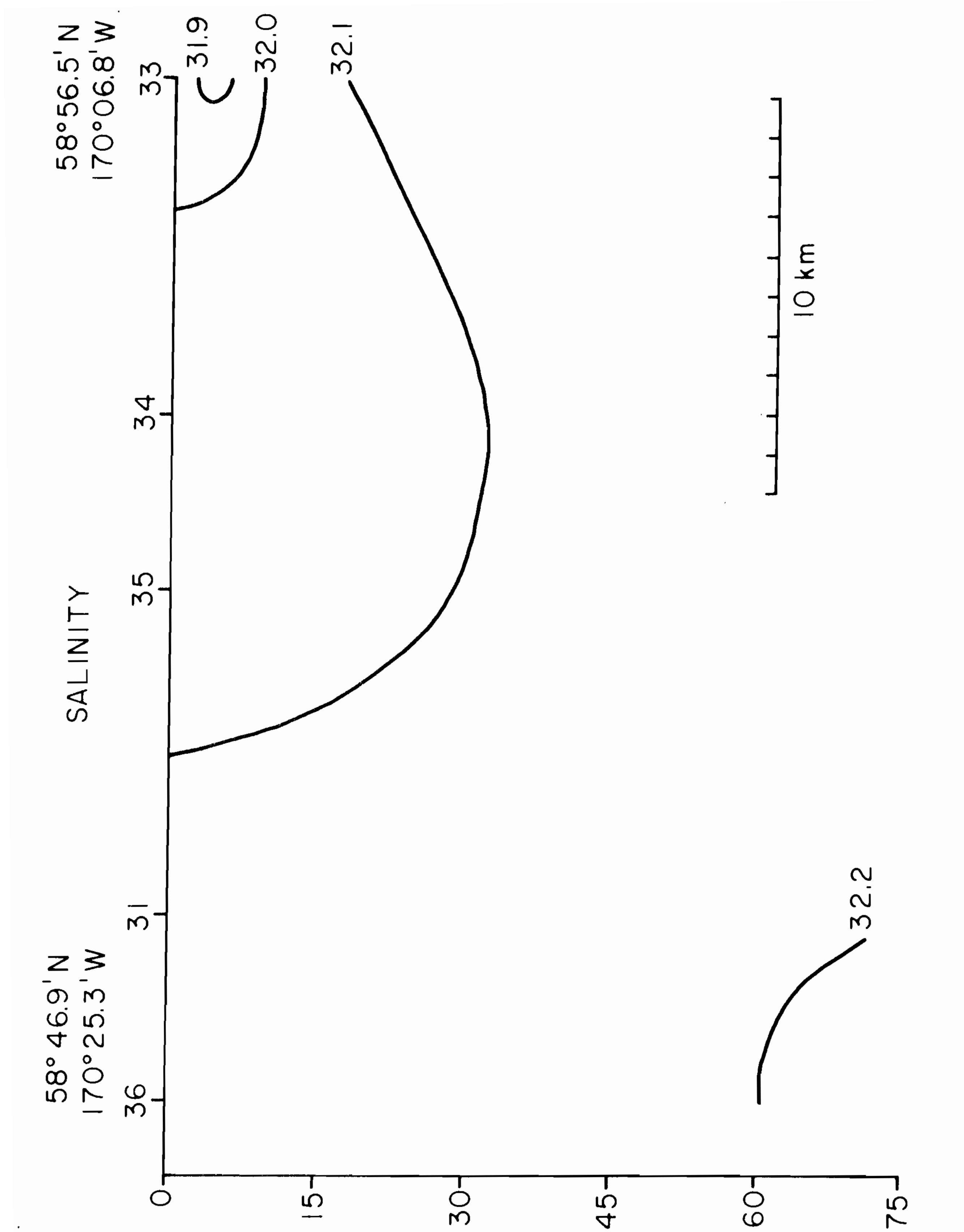


Figure 7b. CTD transect showing a surface lens of meltwater. Numbers on the horizontal axis are CTD stations. Isotherms, isohalines and isopleths are labeled.

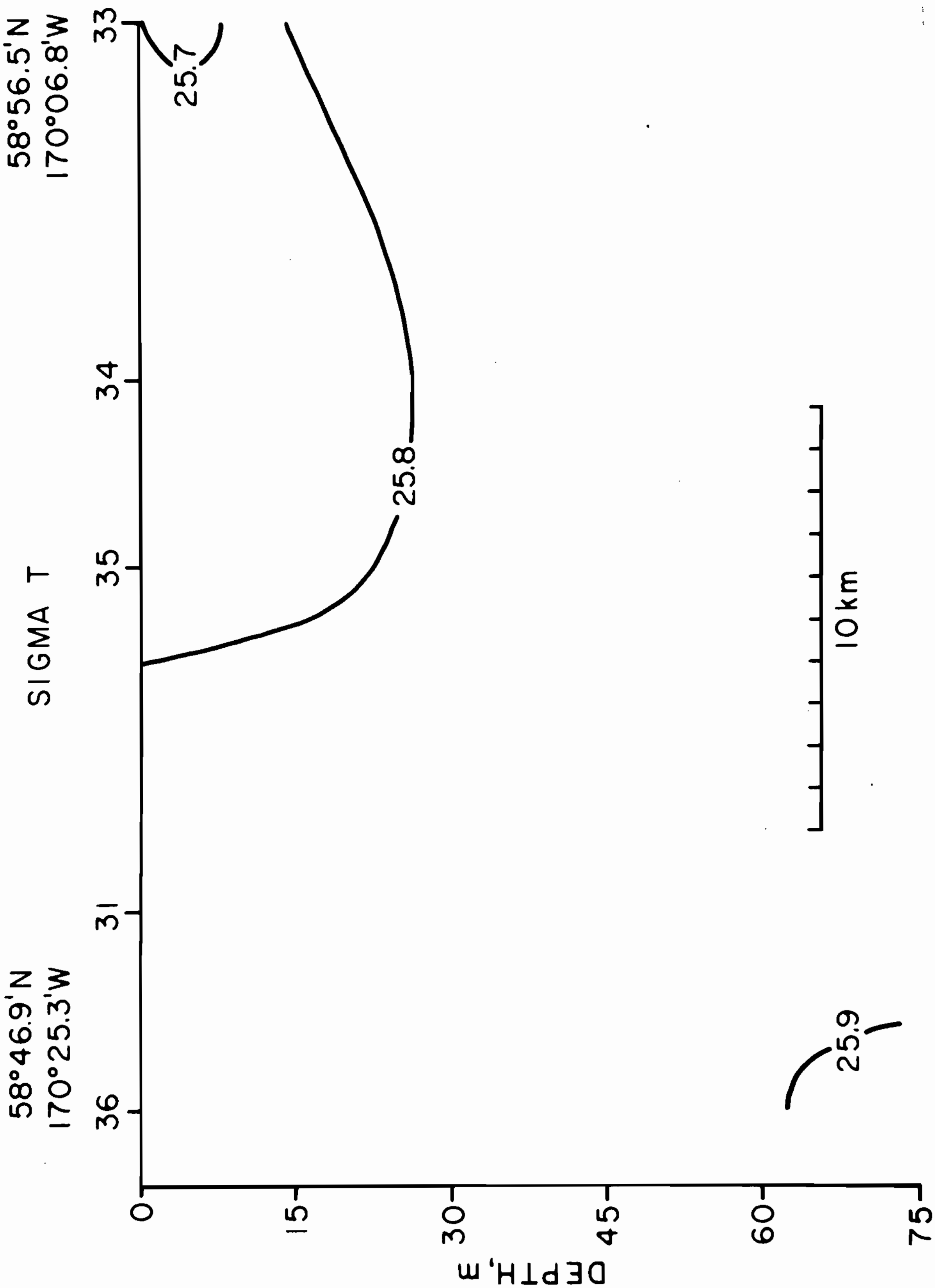


Figure 7c. CTD transect showing a surface lens of meltwater. Numbers on the horizontal axis are CTD stations. Isotherms, isohalines and isopleths are labeled.

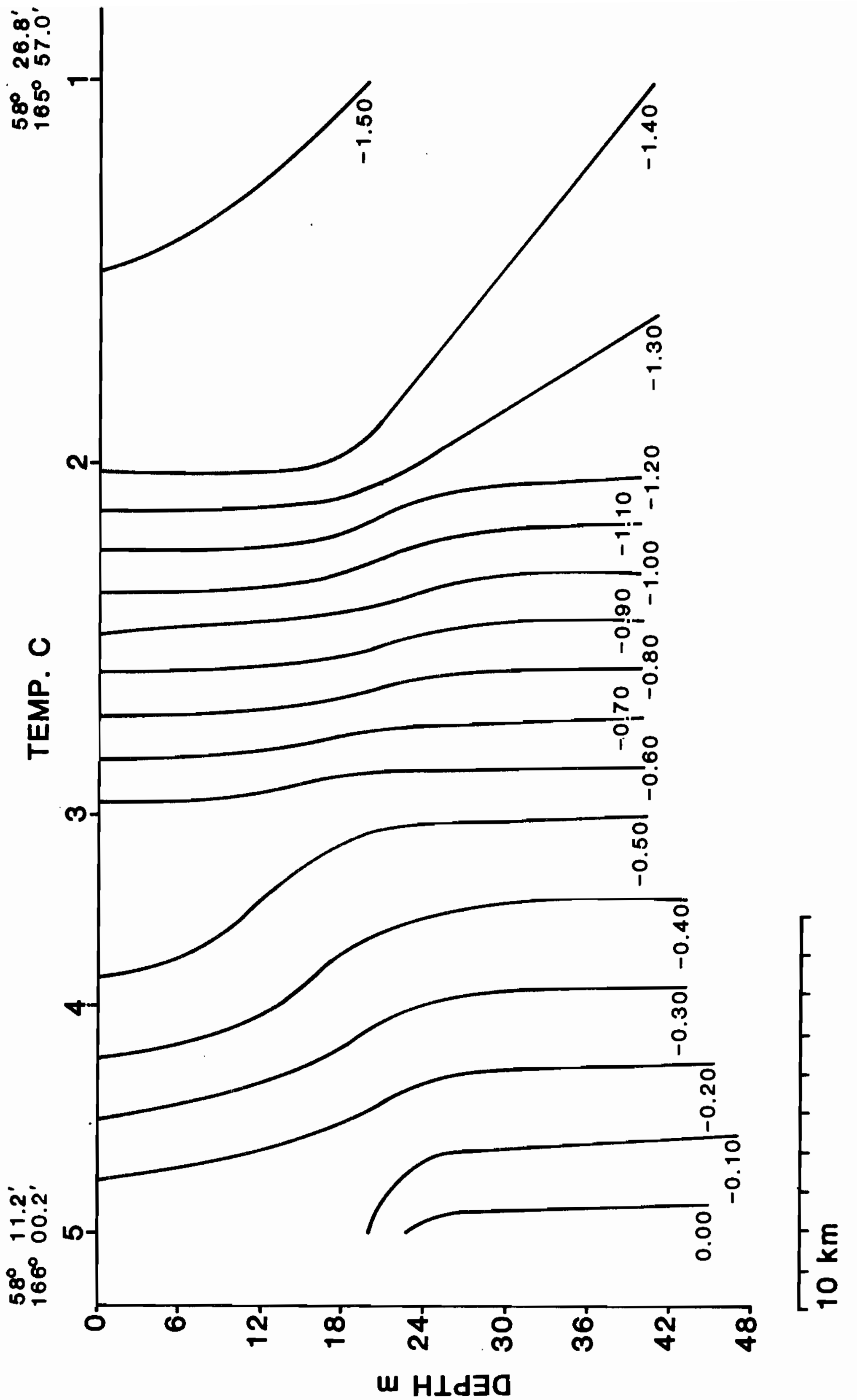


Figure 8a. CTD transect taken at the beginning of the cruise, showing a front. This is the only time during the cruise such a feature was seen.

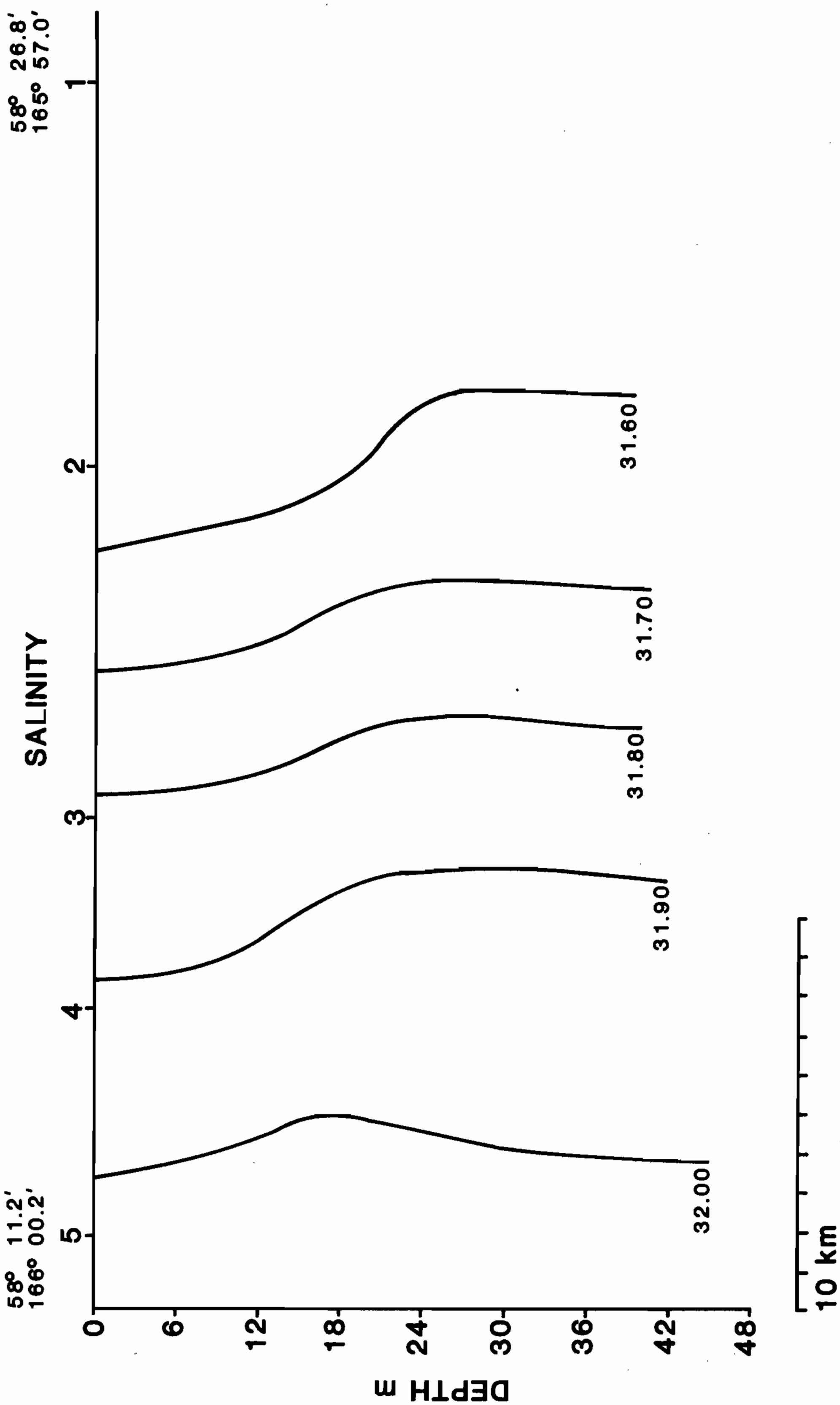


Figure 8b. CTD transect taken at the beginning of the cruise, showing a front. This is the only time during the cruise such a feature was seen.

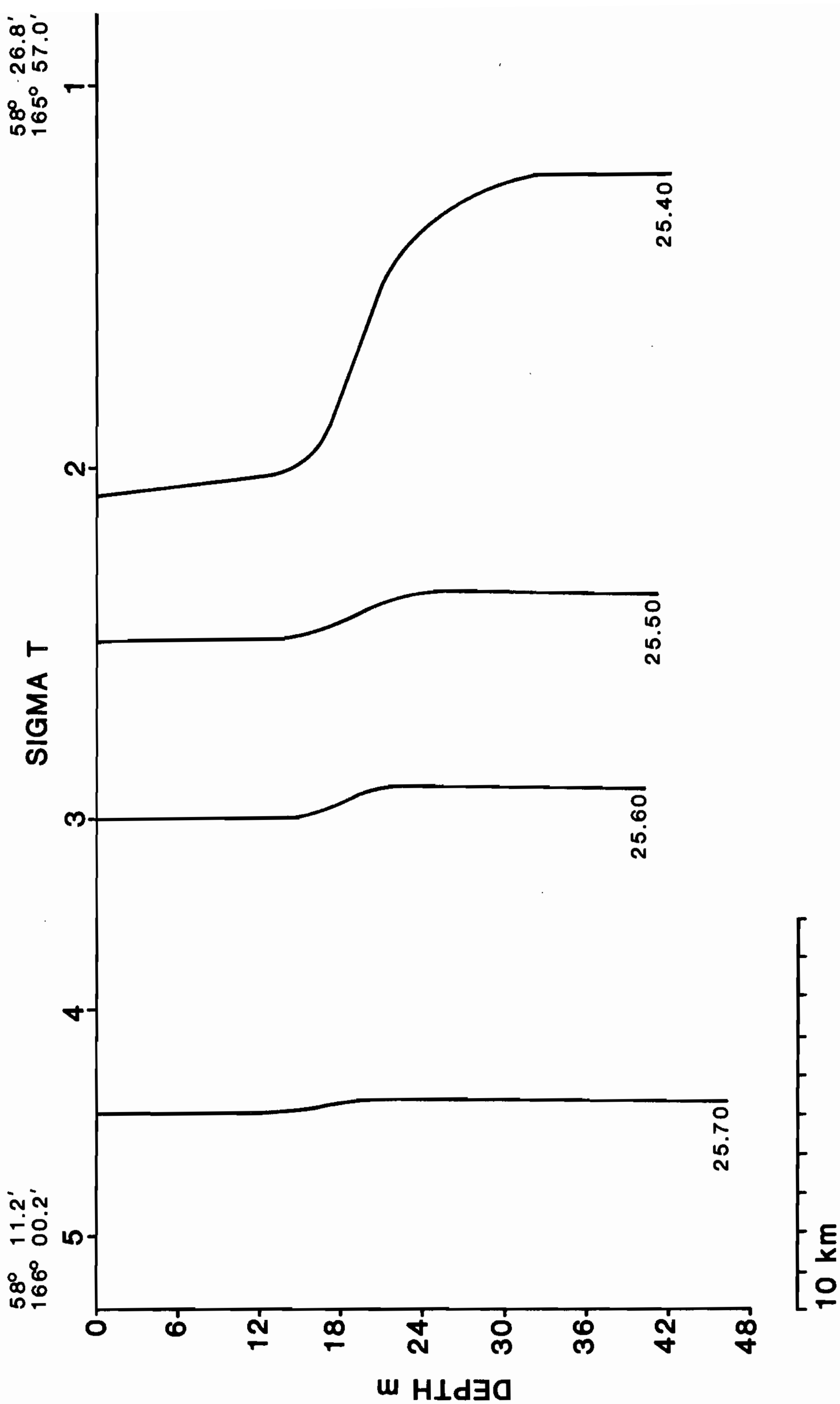


Figure 8c. CTD transect taken at the beginning of the cruise, showing a front. This is the only time during the cruise such a feature was seen.

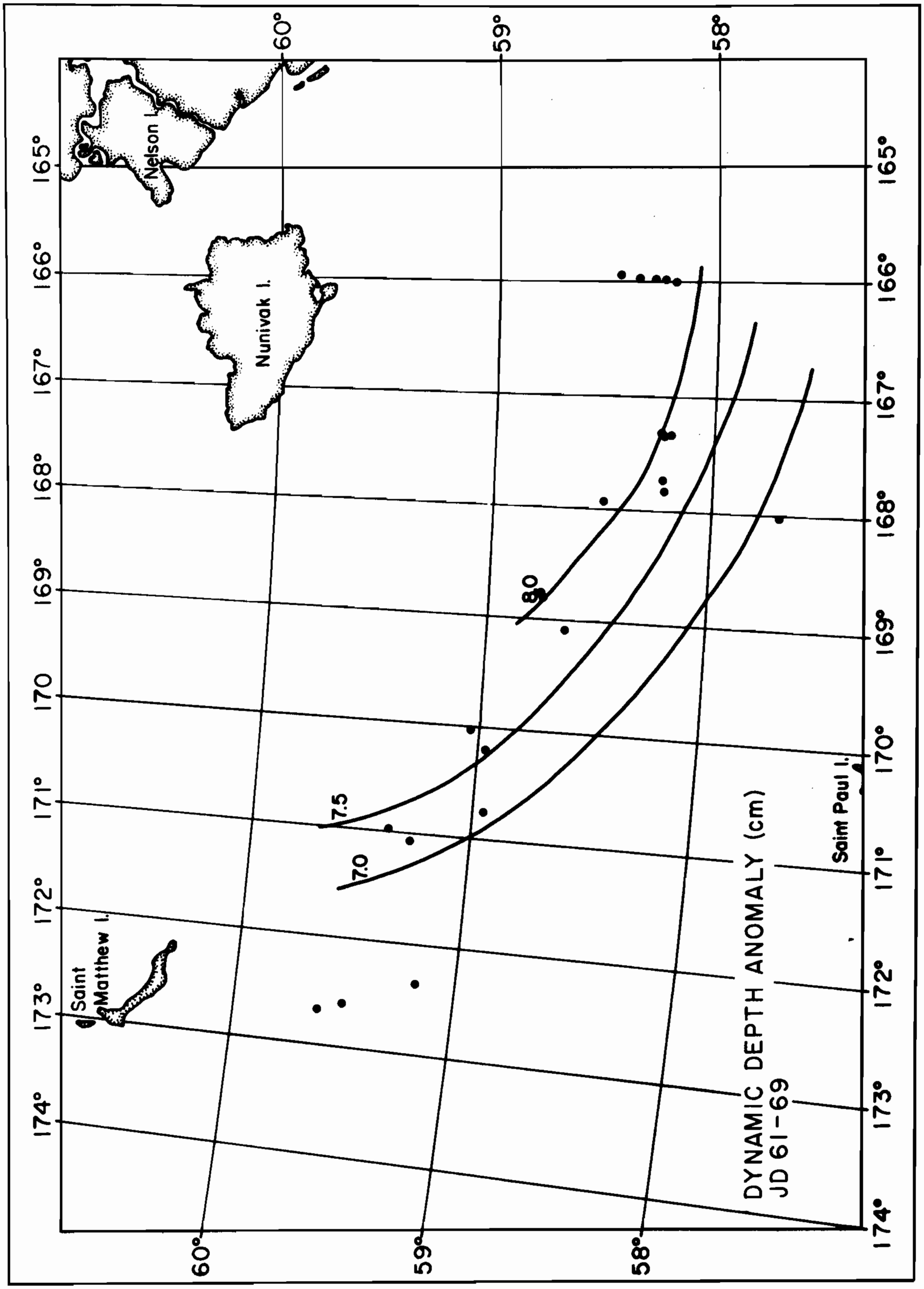


Figure 9a. Dynamic depth anomaly at 35 m, in dynamic centimeters.

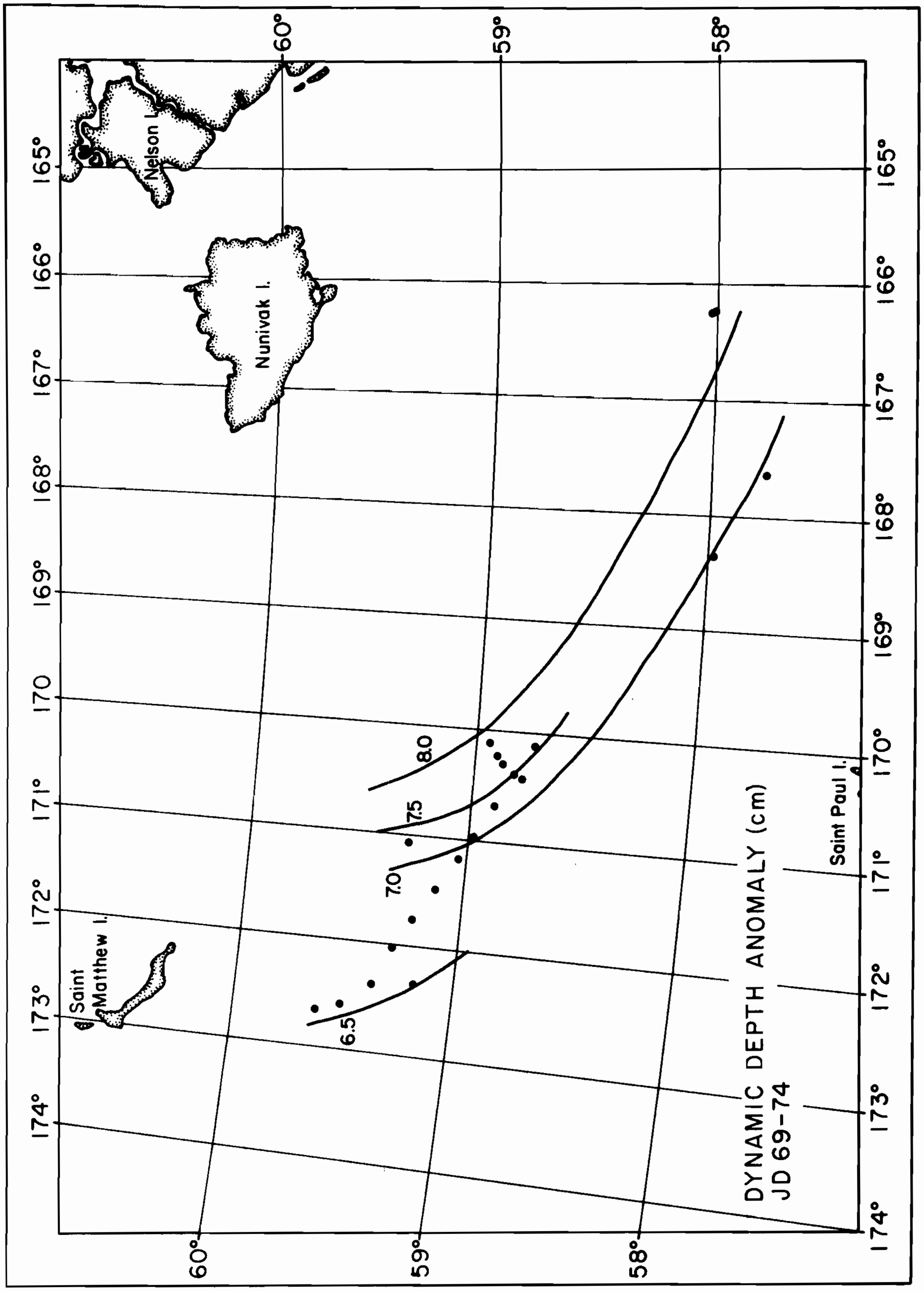


Figure 9b. Dynamic depth anomaly at 35 m, in dynamic centimeters.

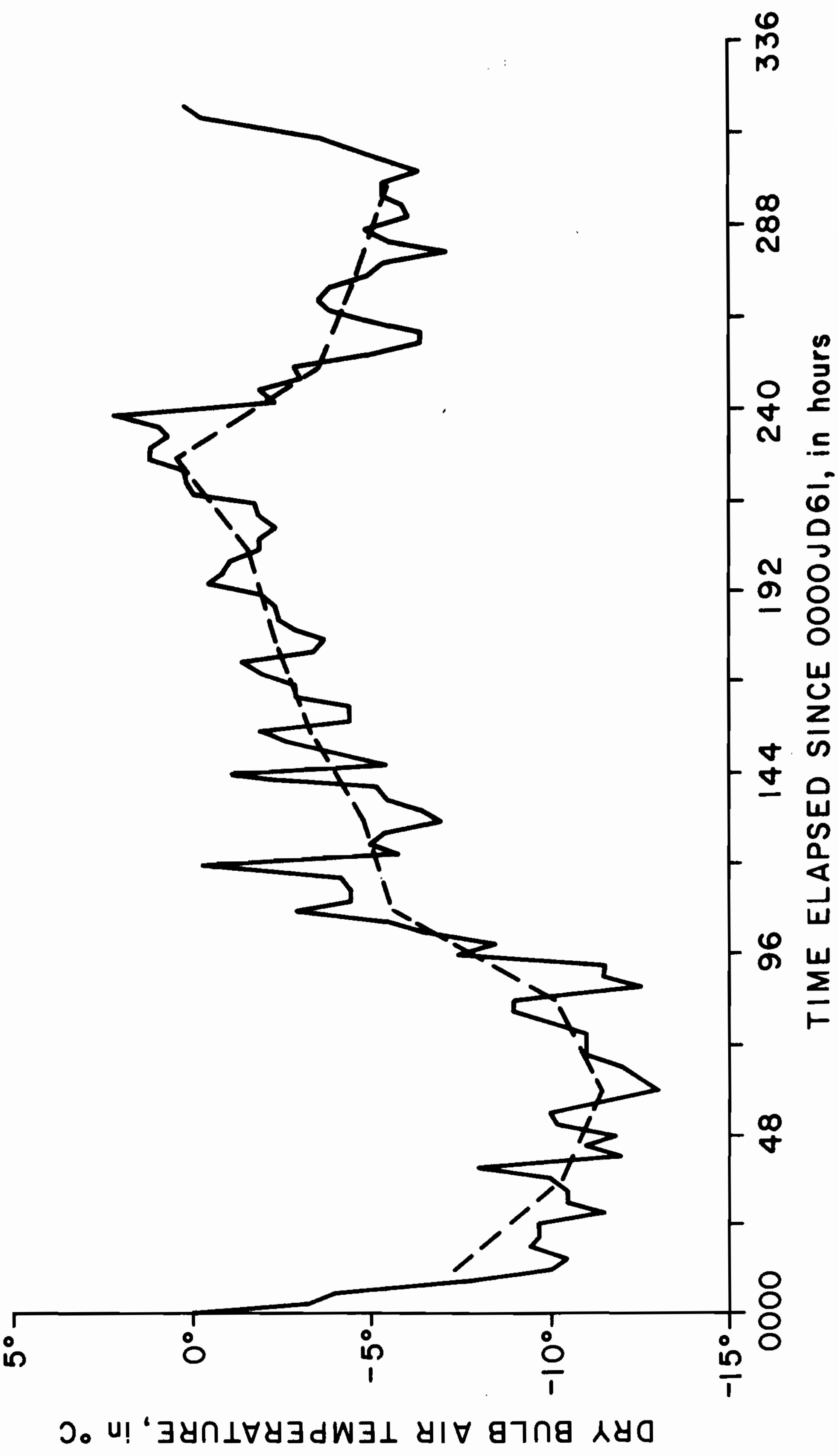


Figure 10a. Air temperature and pressure. Dry bulb temperature.

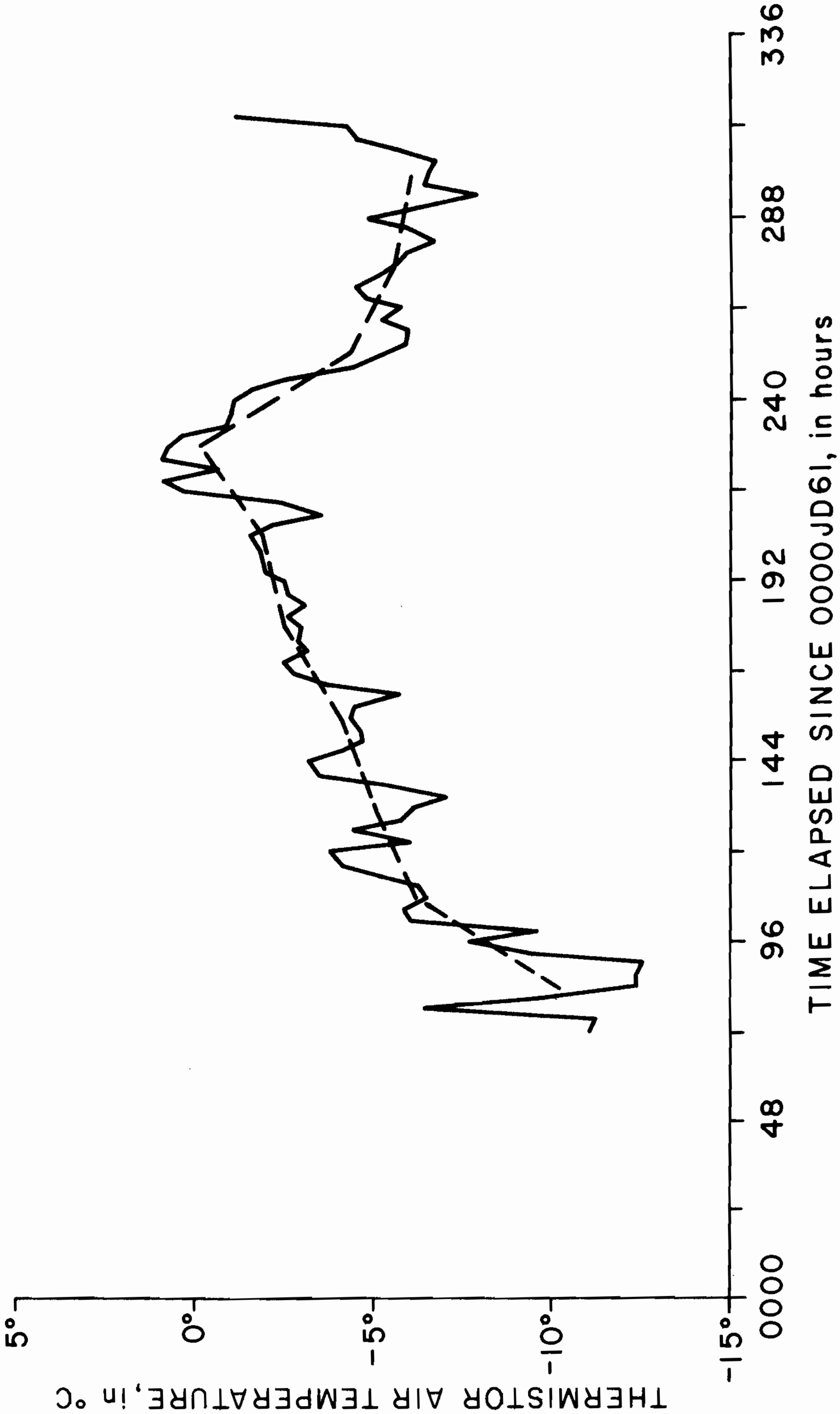


Figure 10b. Air temperature and pressure. Thermistor temperature.

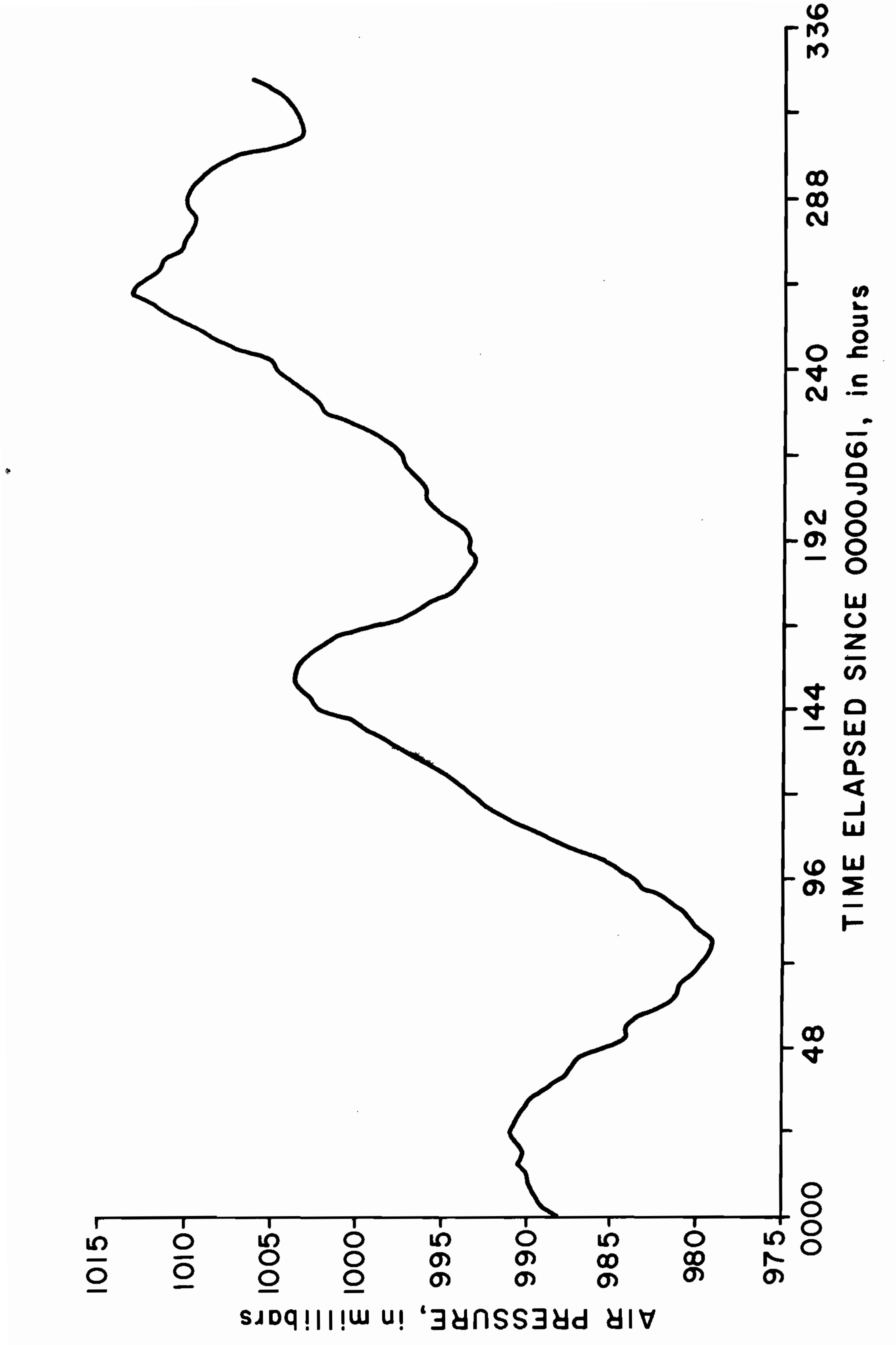


Figure 10c. Air temperature and pressure. Surface pressure.

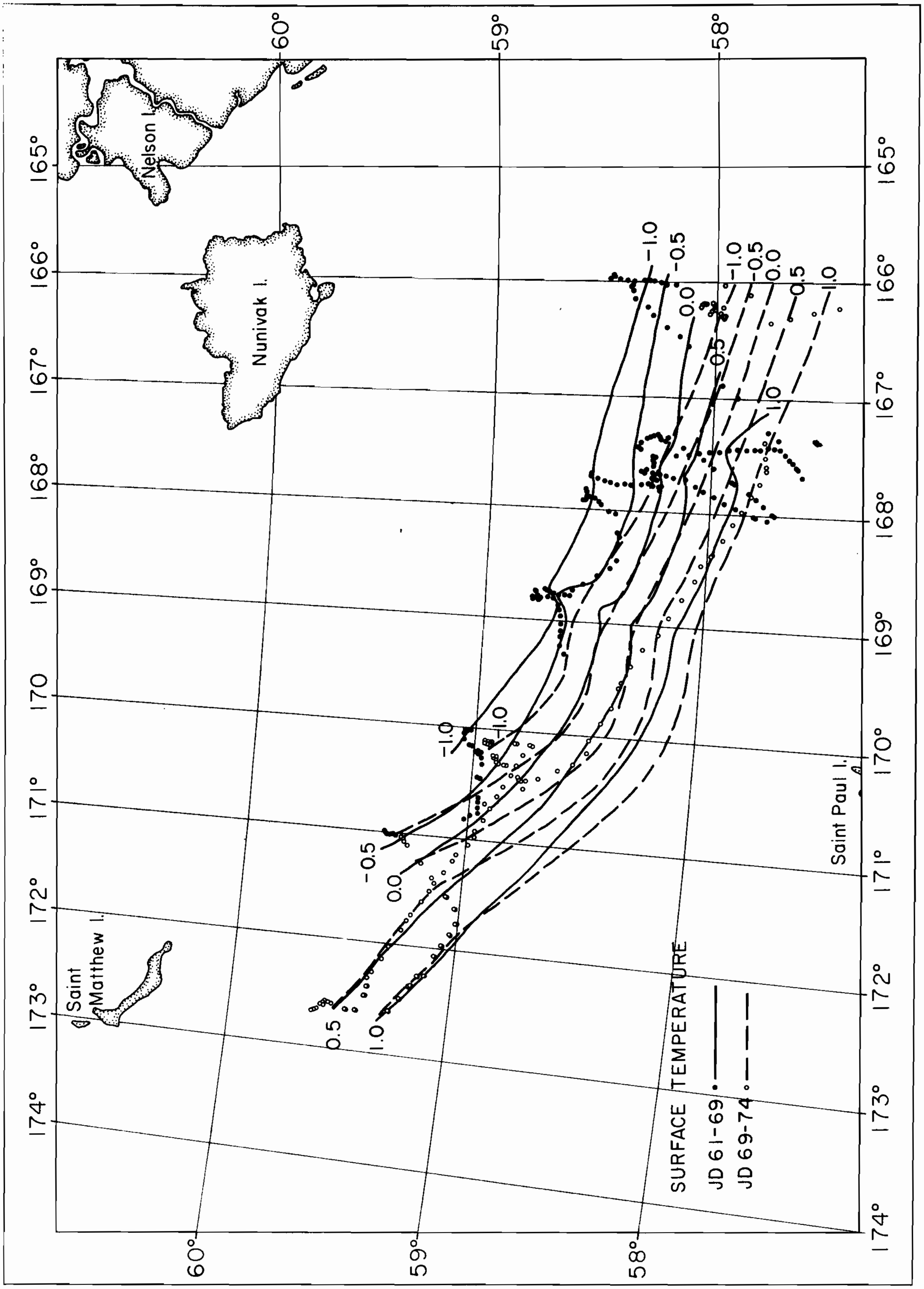


Figure 11. Sea surface isotherms.

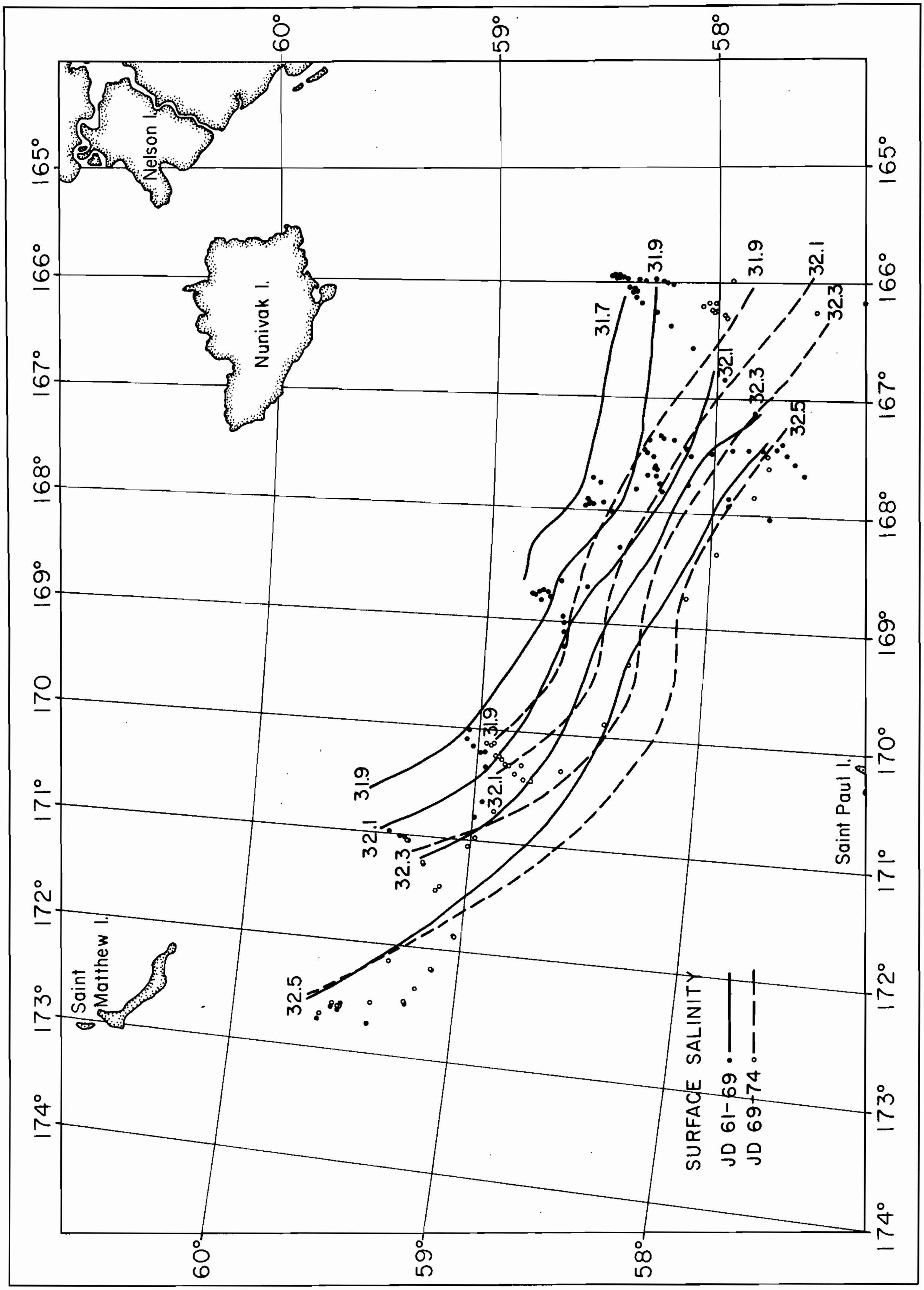


Figure 12. Sea surface isohalines.

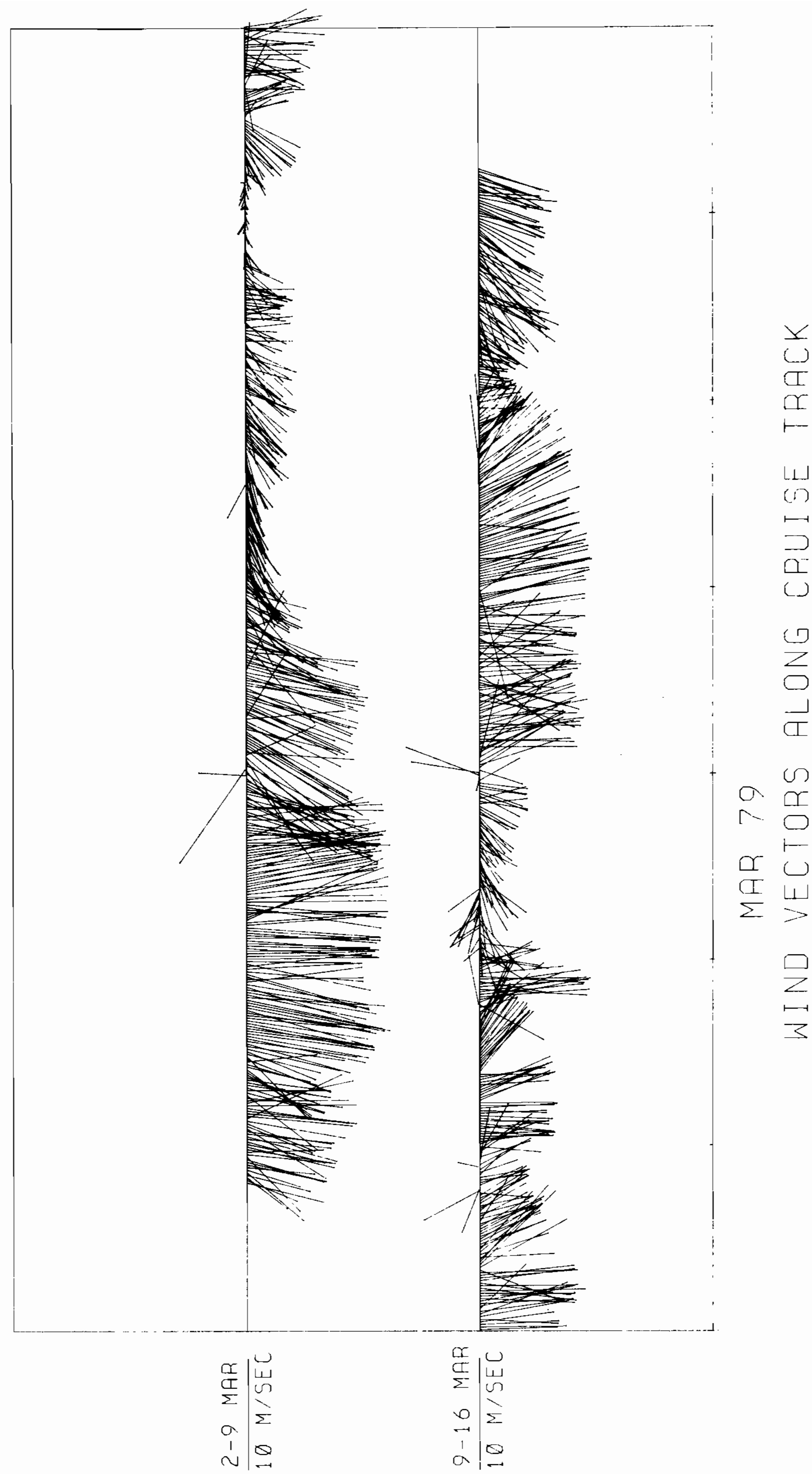


Figure 13. True wind magnitude and direction calculated from relative wind magnitude and direction data. Direction is the vector direction rather than the meteorological convention's direction.

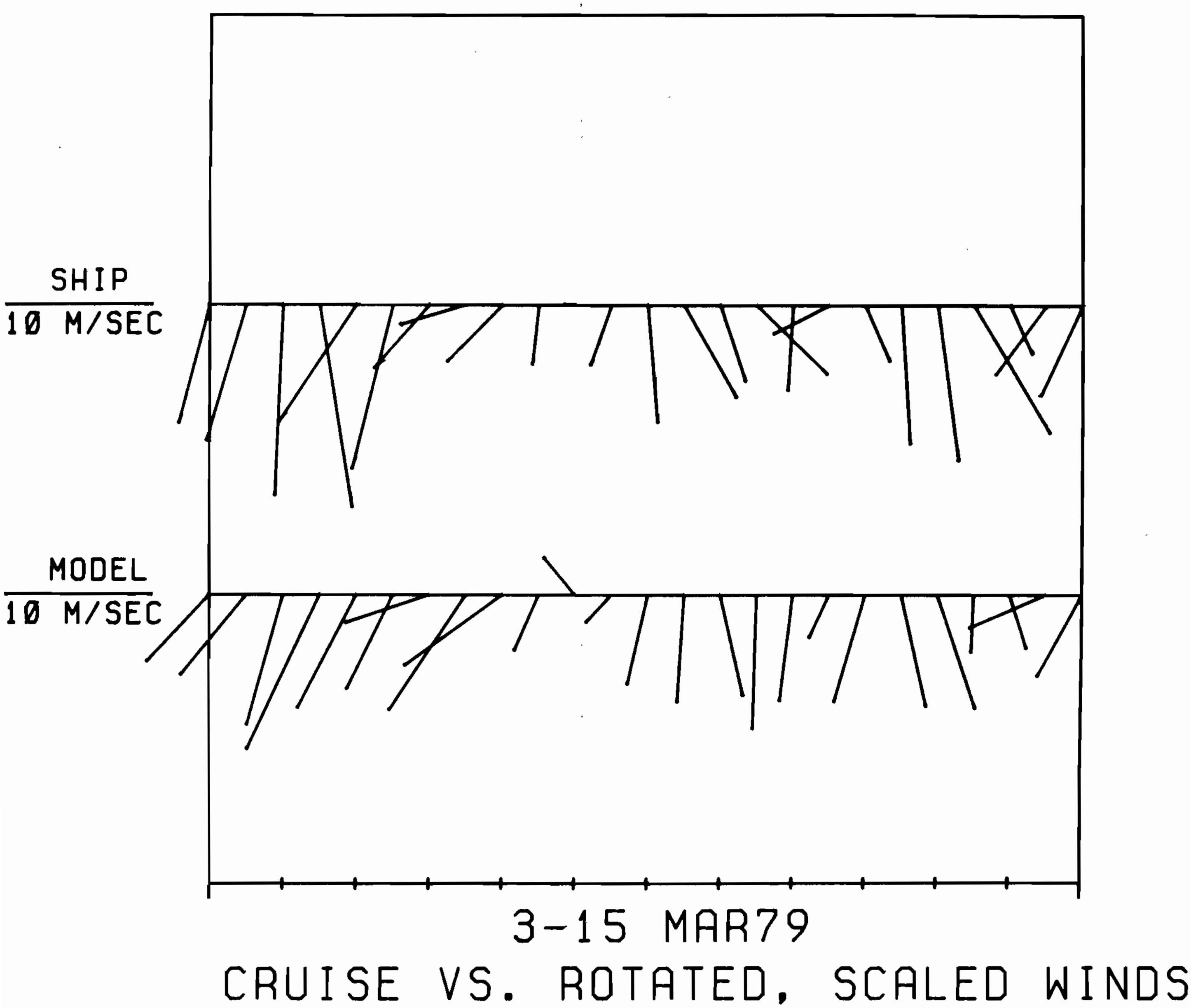


Figure 14a. Calculated surface wind compared to winds measured at the ship and three surface stations.

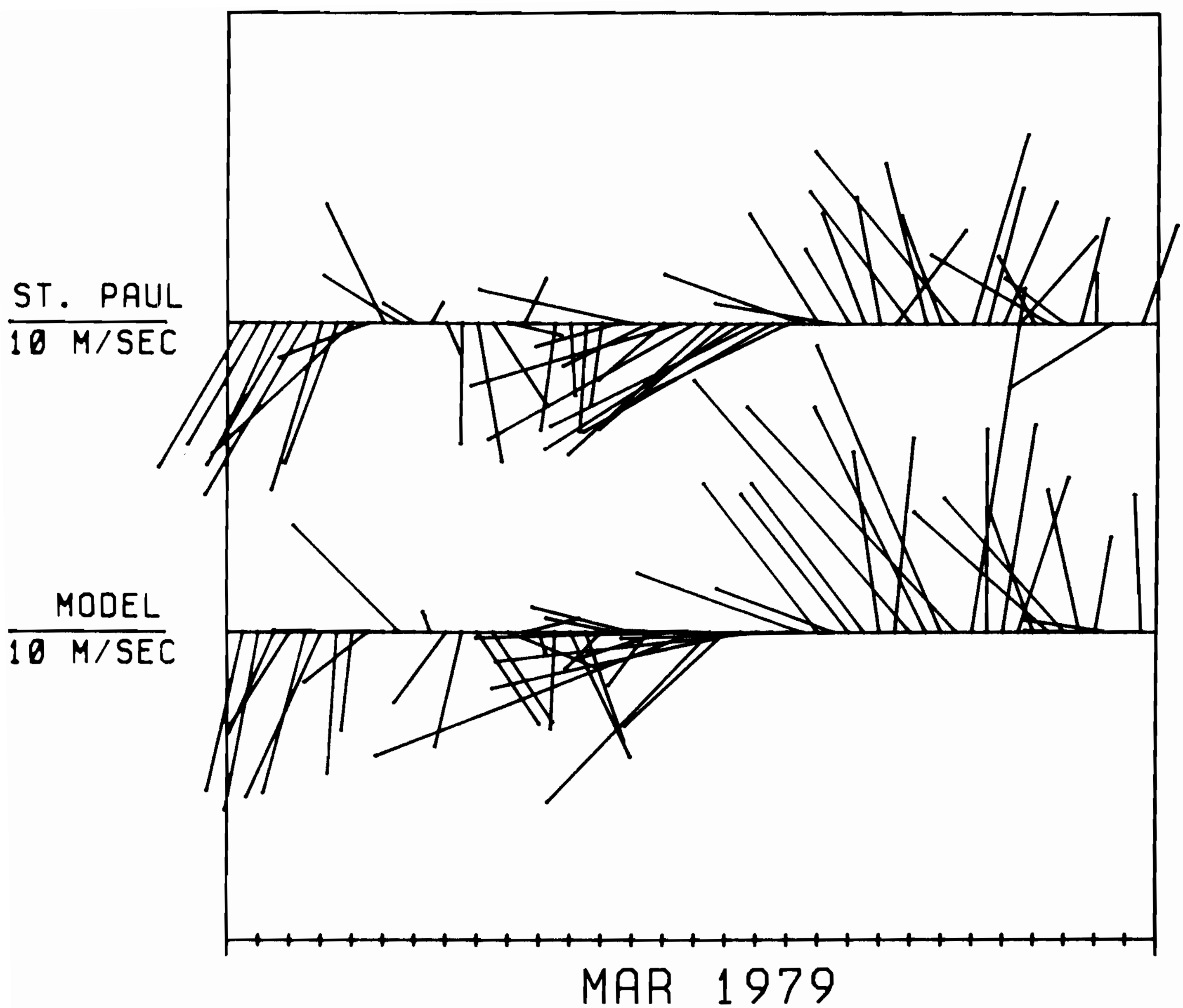


Figure 14b. Calculated surface wind compared to winds measured at the ship and three surface stations.

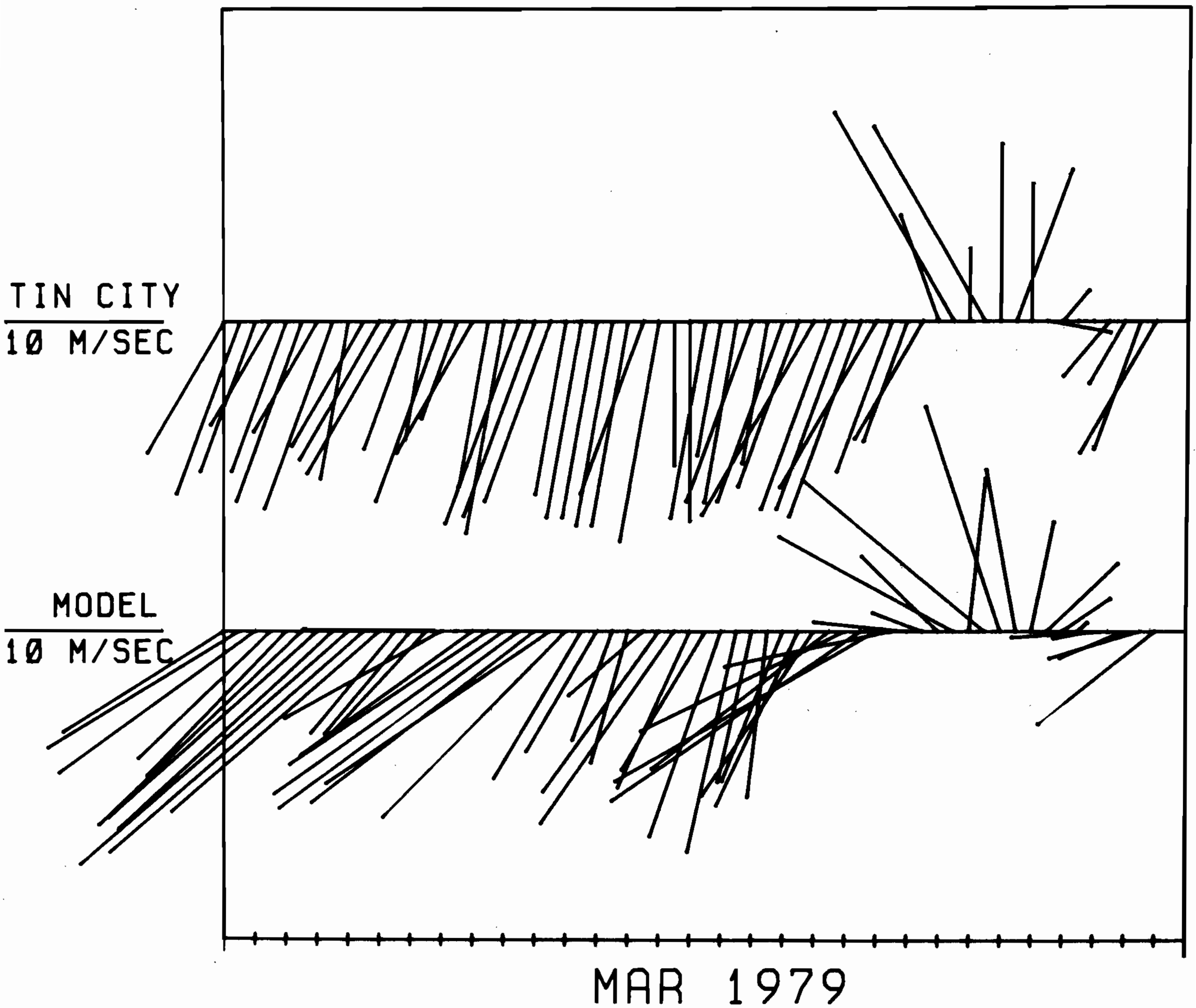


Figure 14c. Calculated surface wind compared to winds measured at the ship and three surface stations.

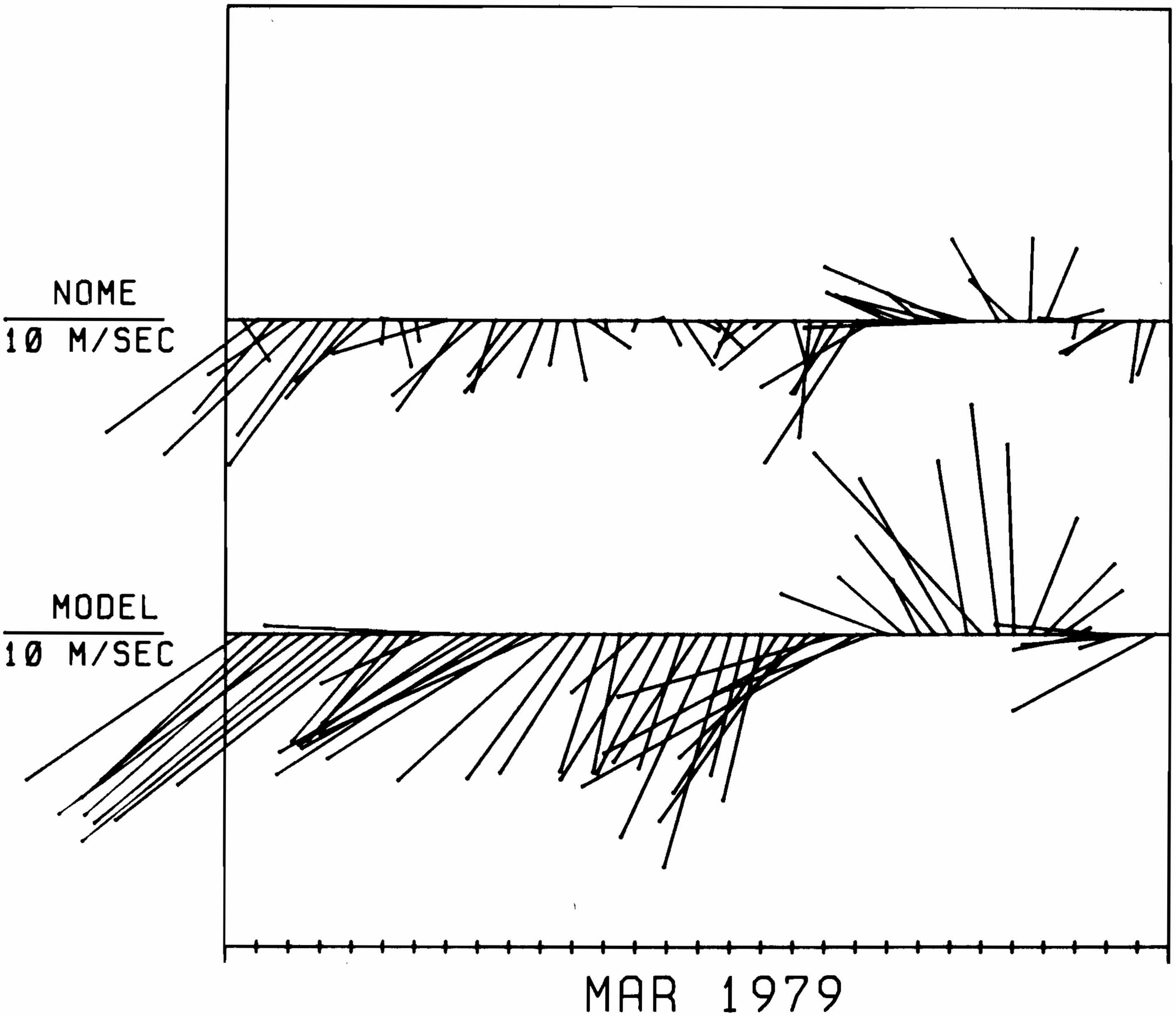


Figure 14d. Calculated surface wind compared to winds measured at the ship and three surface stations.

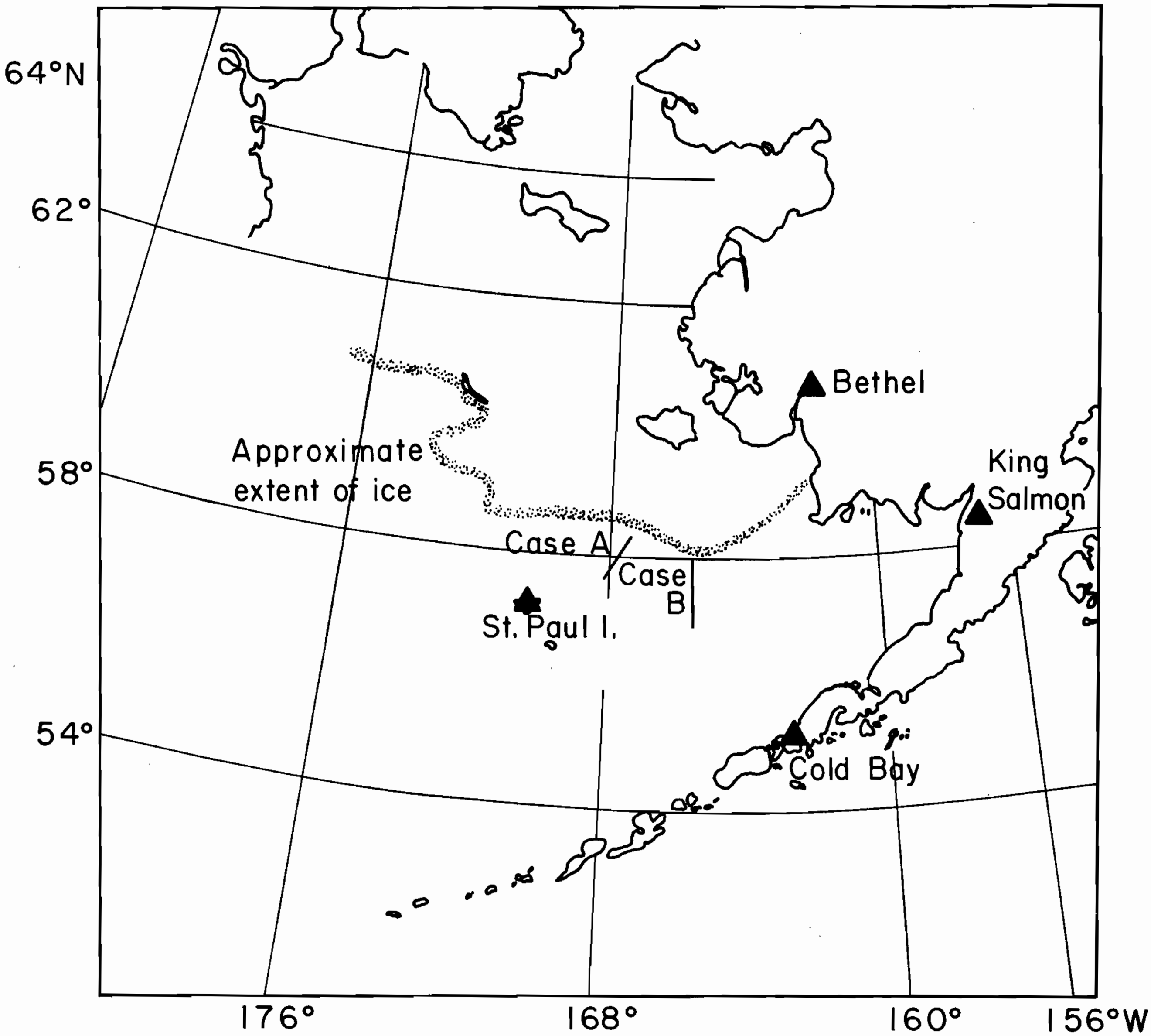


Figure 15. Map of the Bering Sea and the locations of cases A and B.

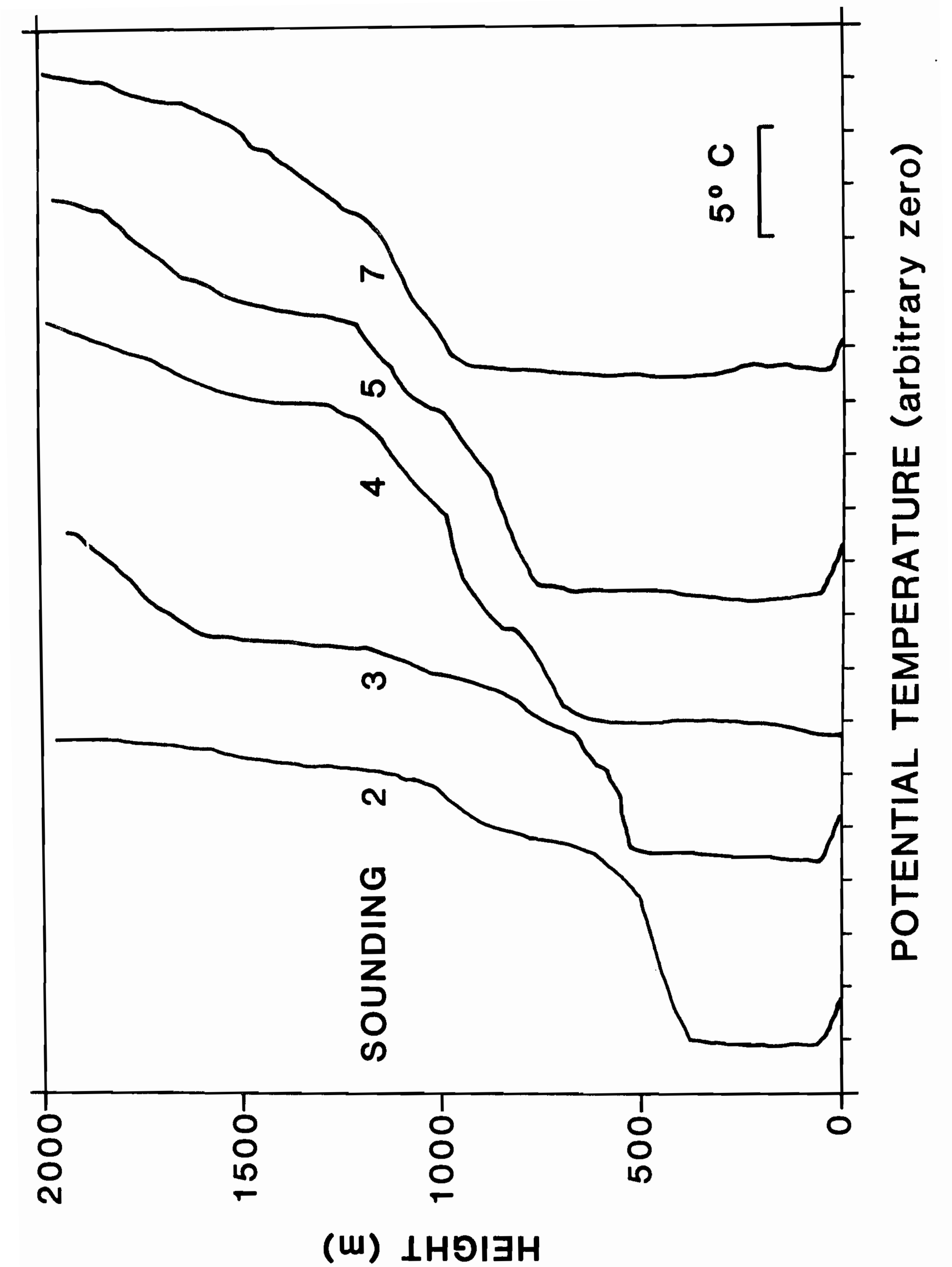


Figure 16a. Potential temperature for all soundings. The zero point on the abscissa is different for each sounding.

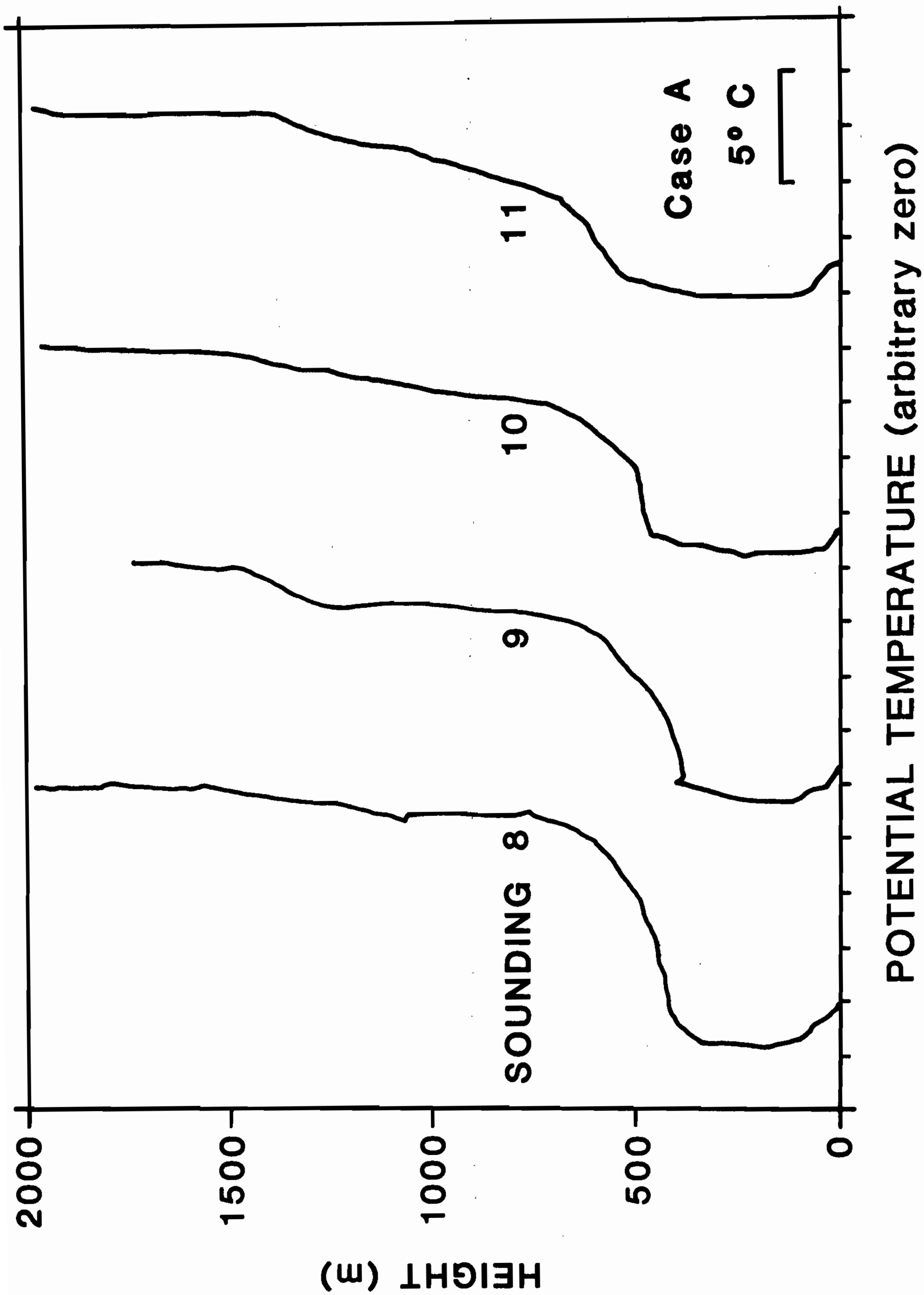


Figure 16b. Potential temperature for all soundings. The zero point on the abscissa is different for each sounding.

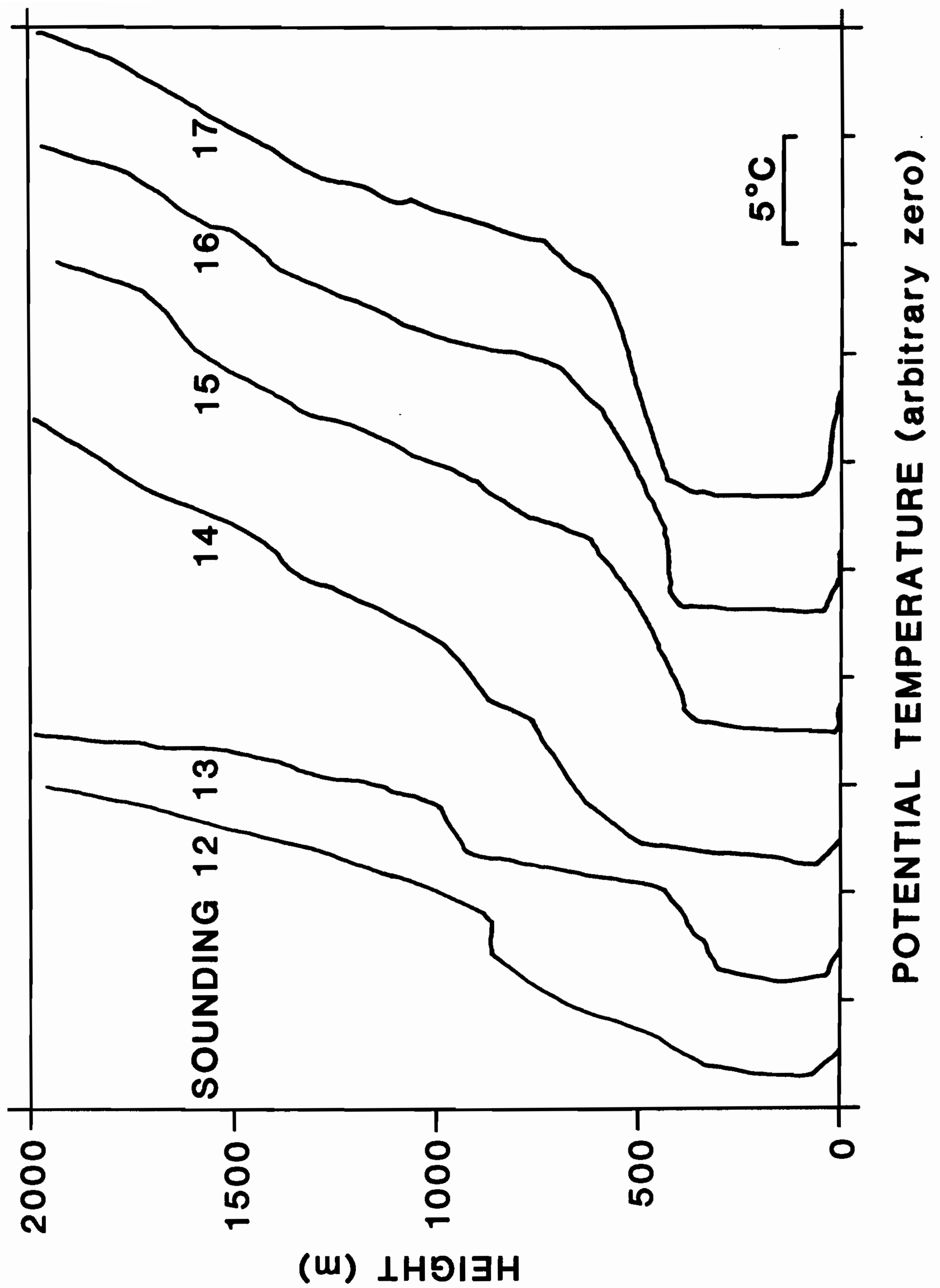


Figure 16c. Potential temperature for all soundings. The zero point on the abscissa is different for each sounding.

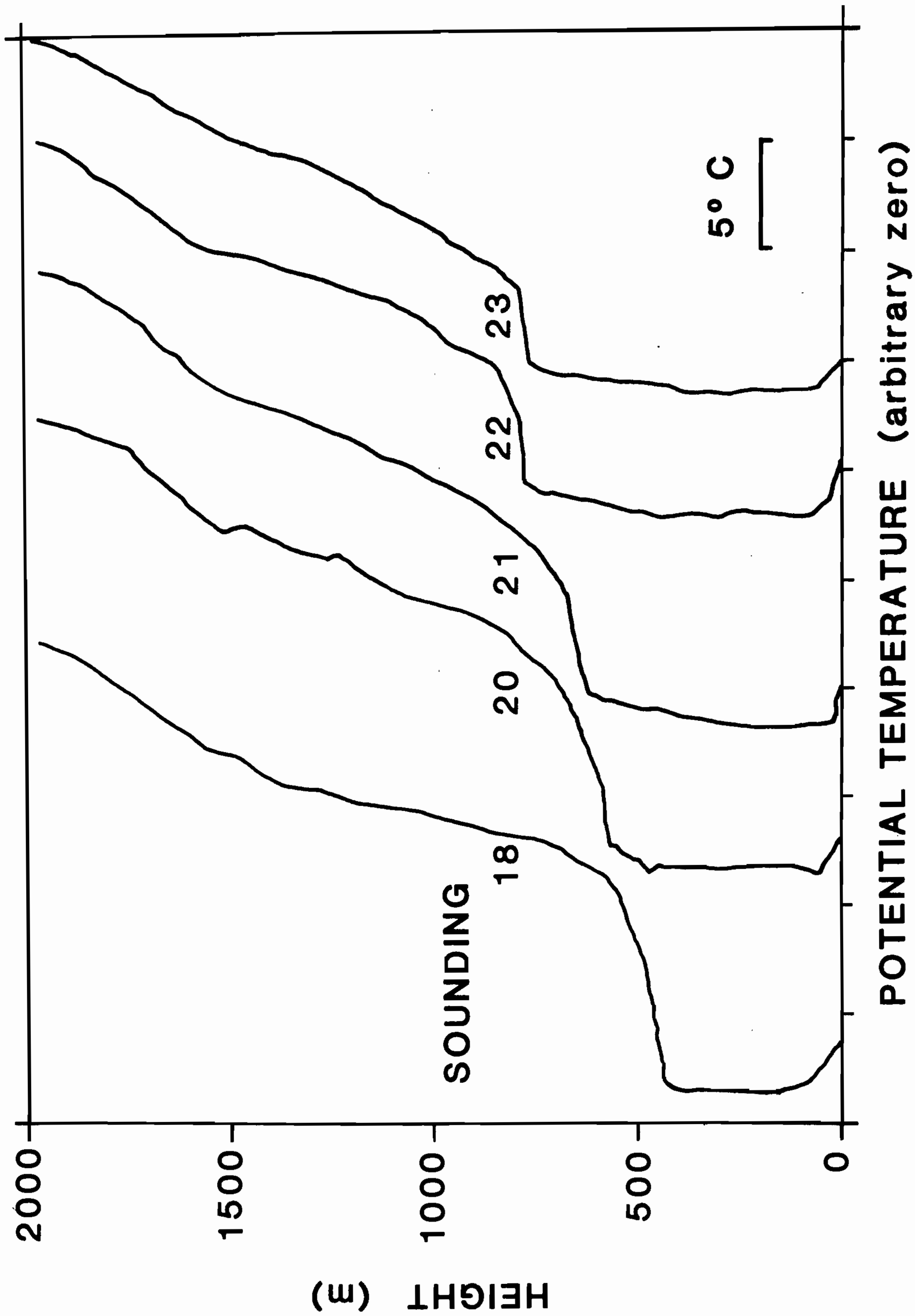


Figure 16d. Potential temperature for all soundings. The zero point on the abscissa is different for each sounding.

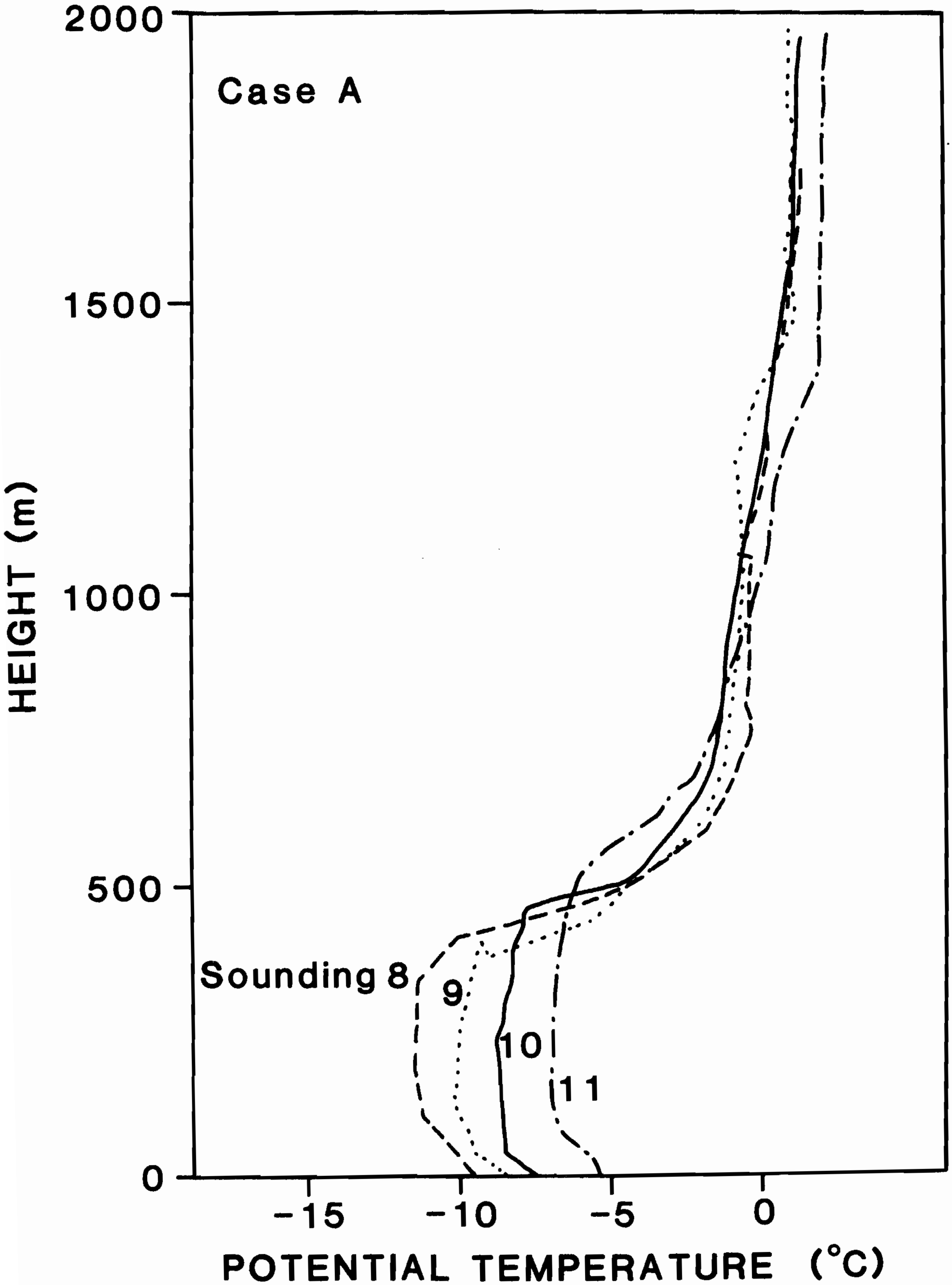


Figure 17. Potential temperature for Case A, one origin.

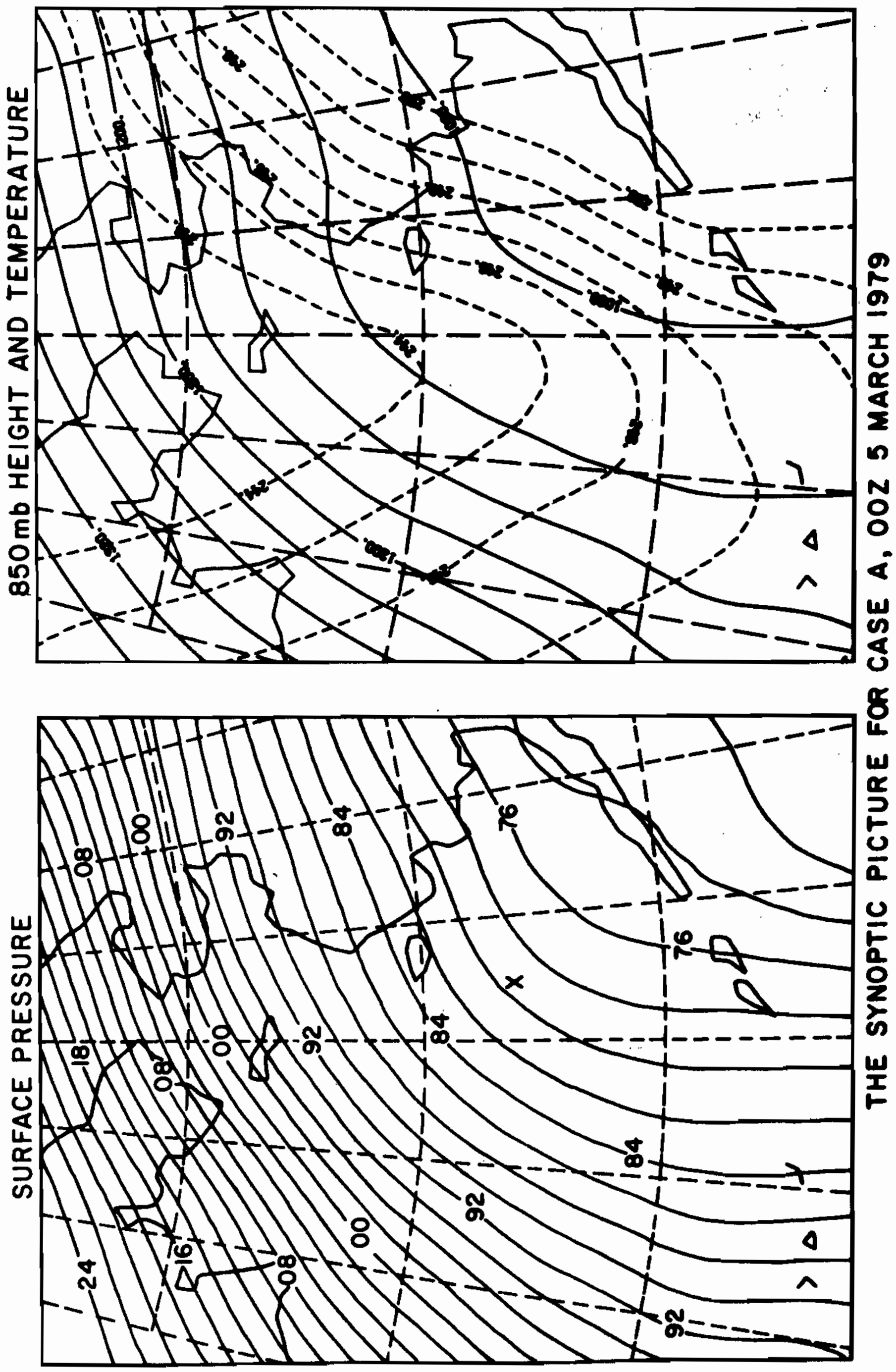


Figure 18. Surface pressure and 850-mb maps for Case A, 00Z 5 March 1979.

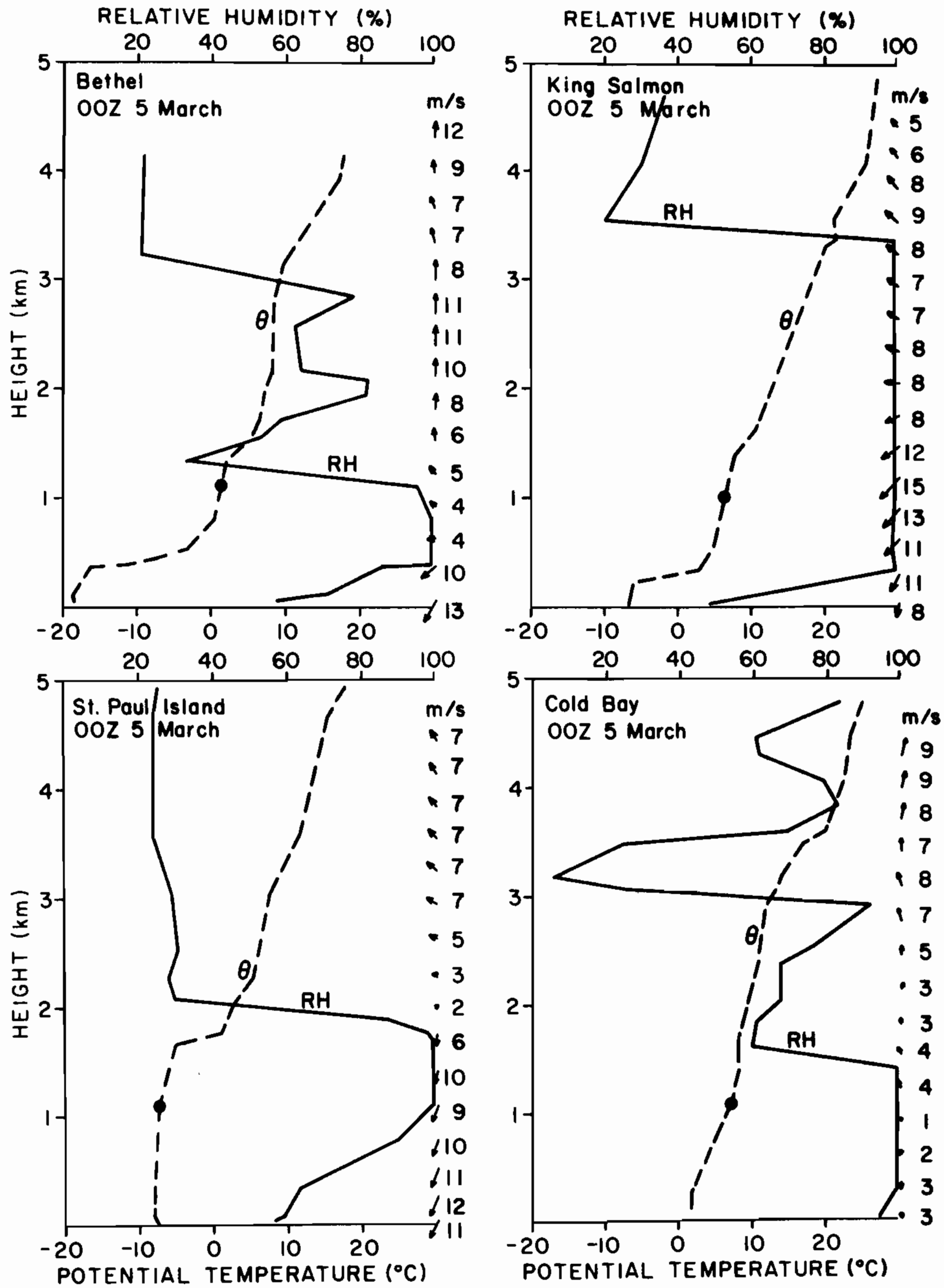


Figure 19. Upper air soundings from the National Weather Service, 00Z 5 March. The dots indicate the 850-mb level.

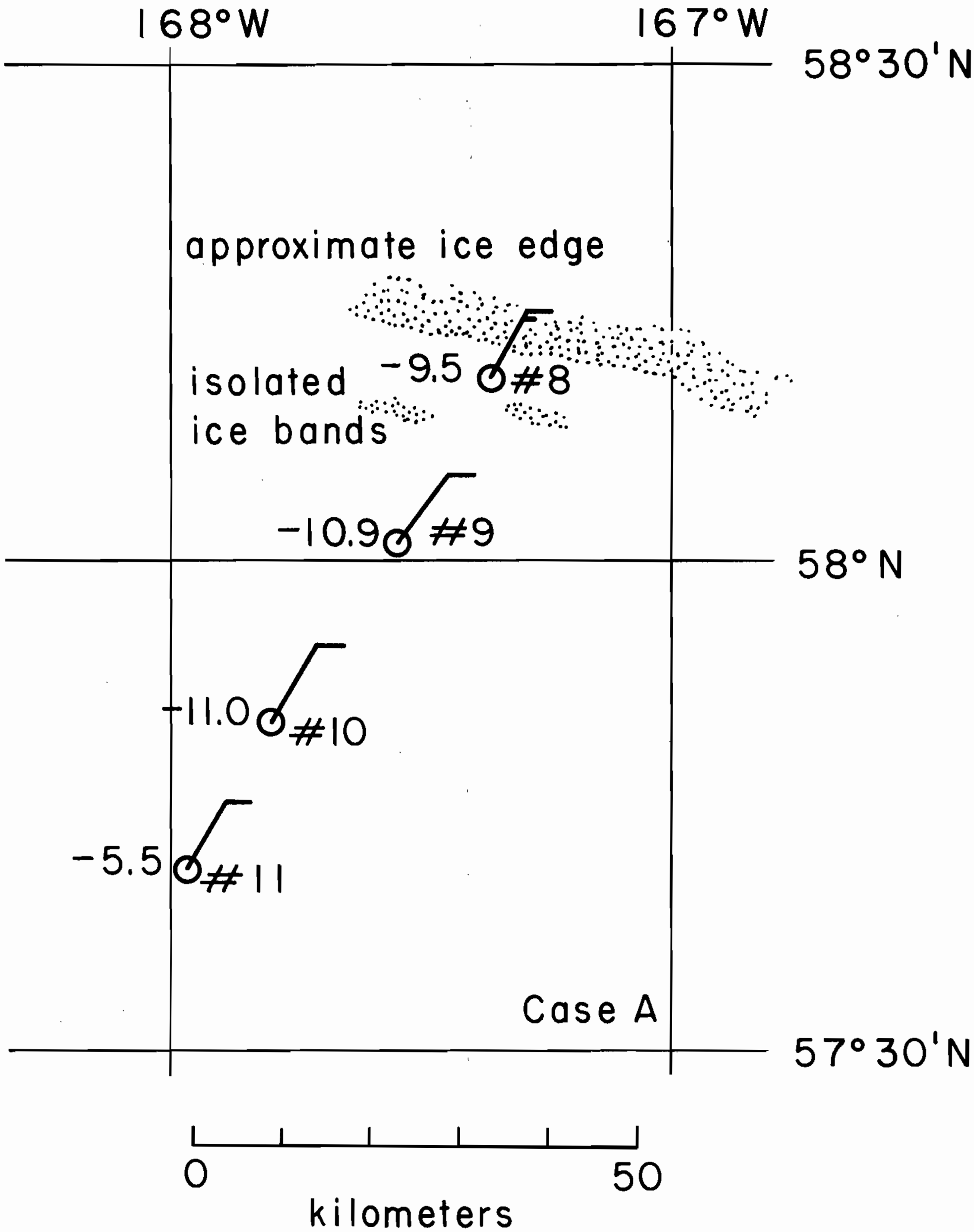


Figure 20. Map of the locations of soundings used in Case A.

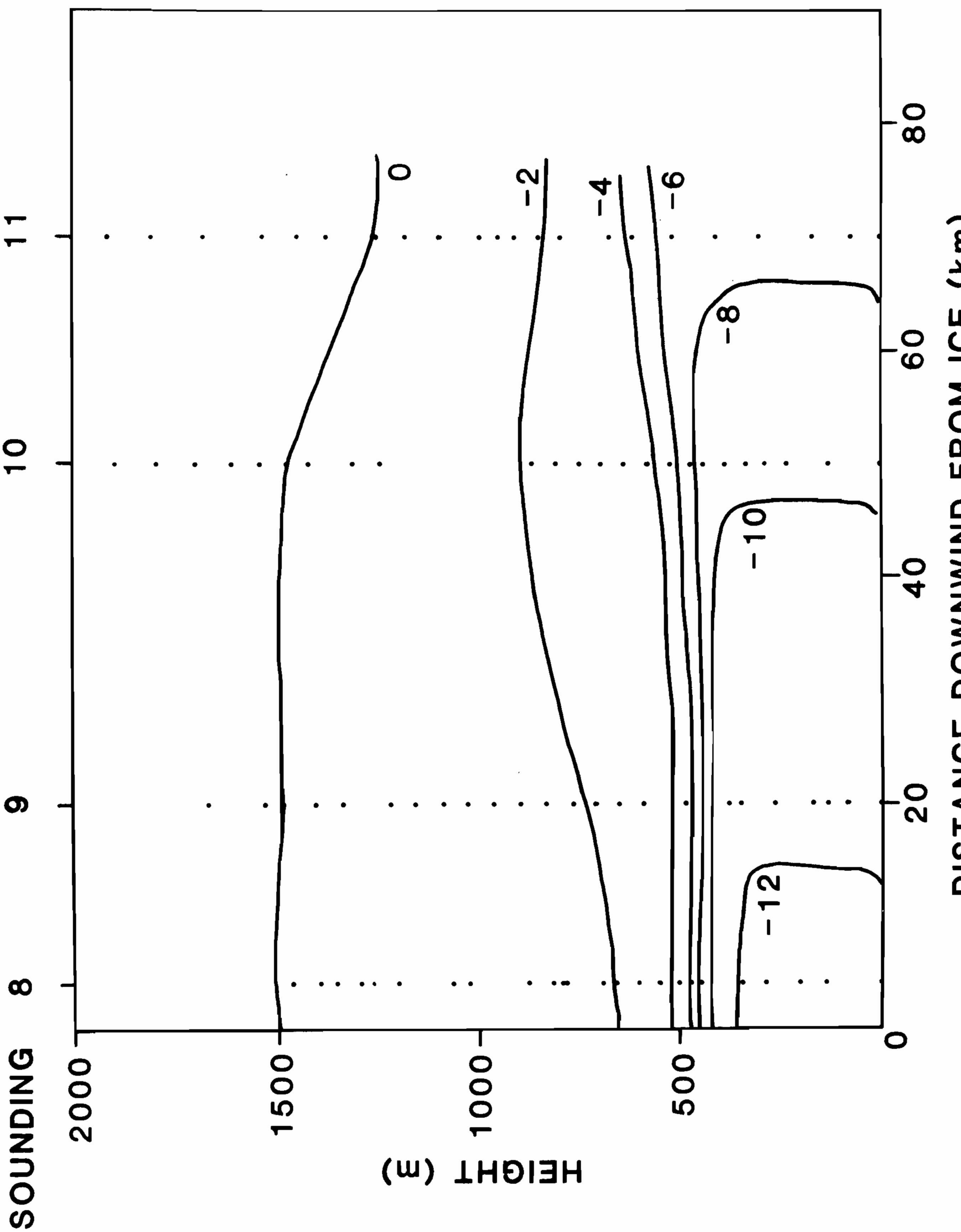


Figure 21. Cross section of potential temperature for Case A.

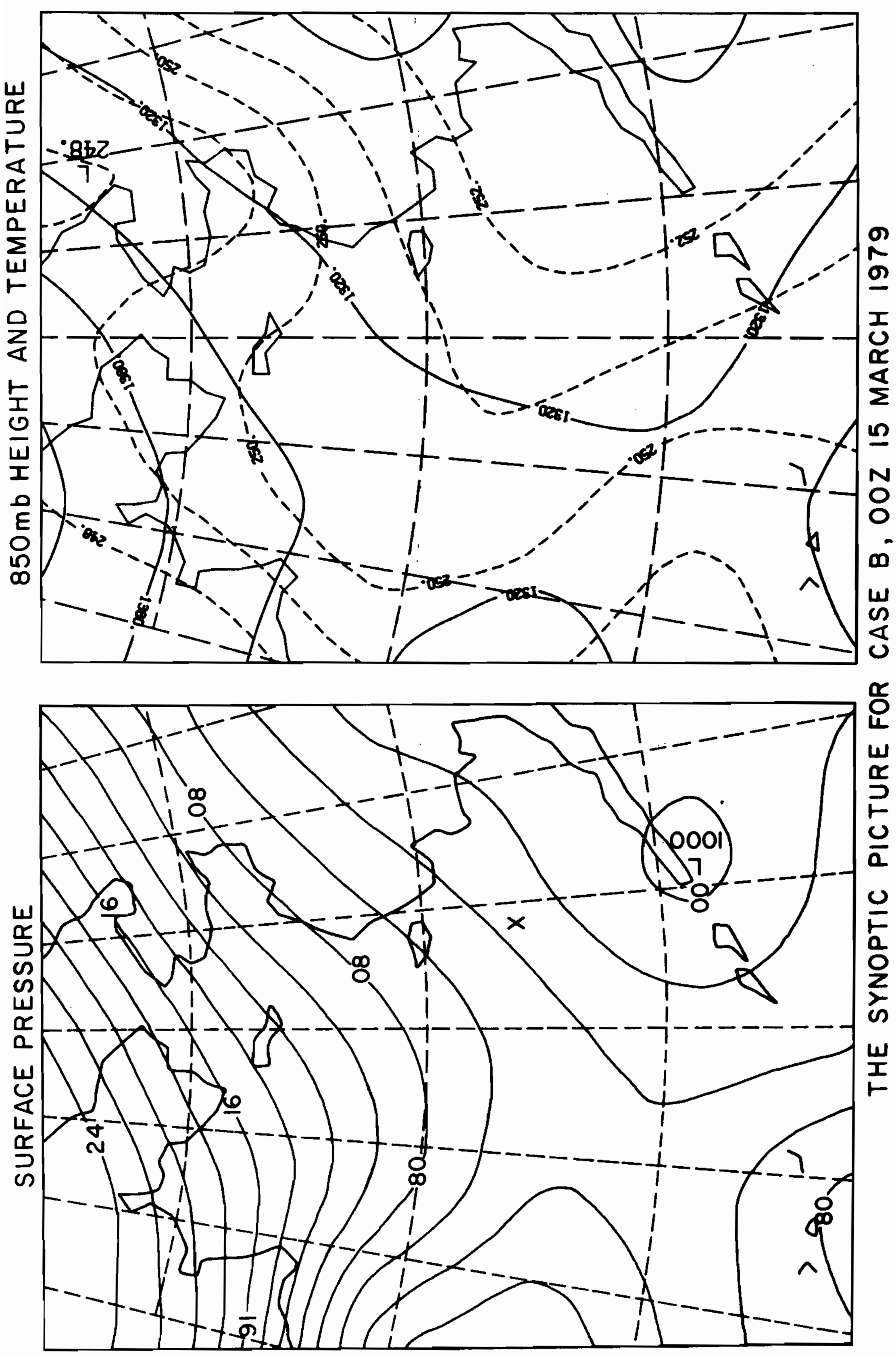


Figure 22. Surface pressure and 850-mb maps for Case B, 00Z 15 March 1979.

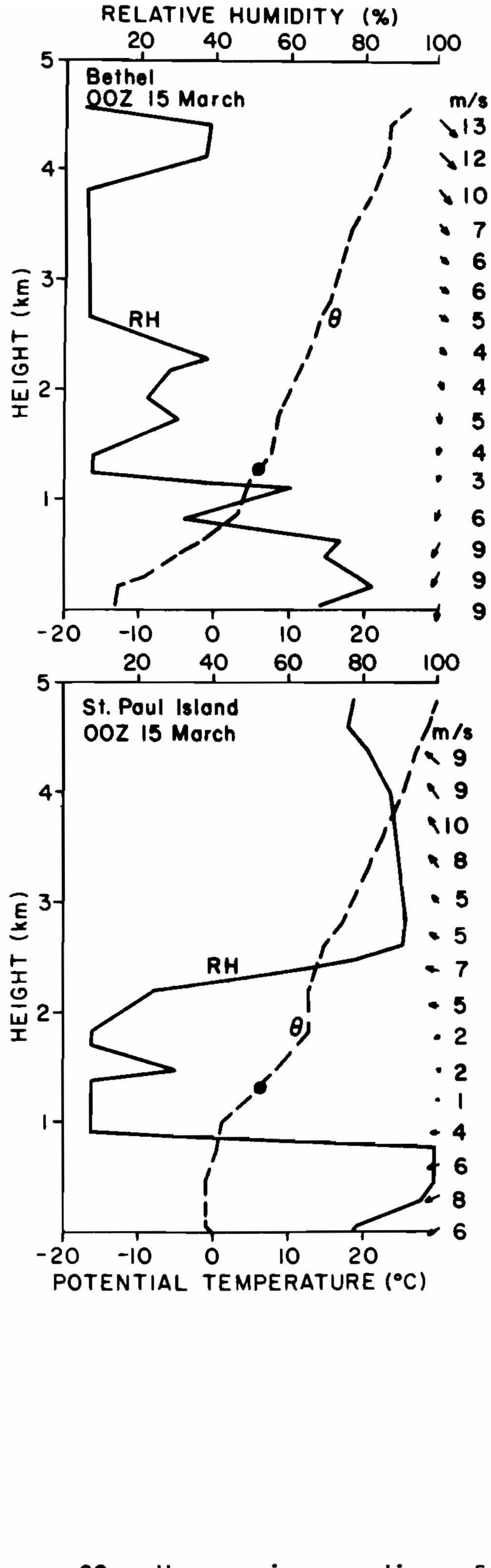


Figure 23. Upper air soundings from the National Weather Service, 00Z 15 March. The dots indicate the 850-mb level.

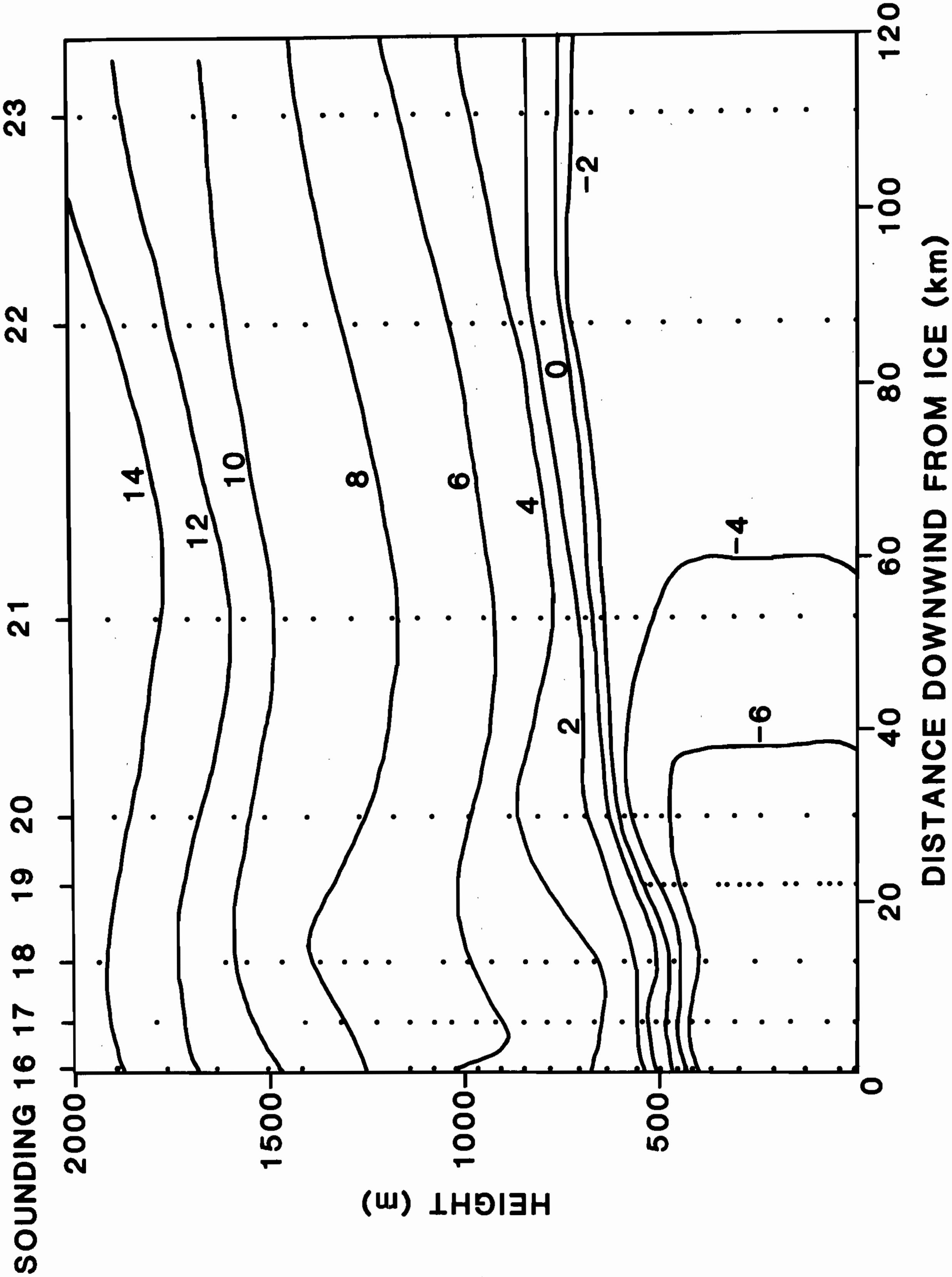


Figure 24. Cross section of potential temperature for Case B.

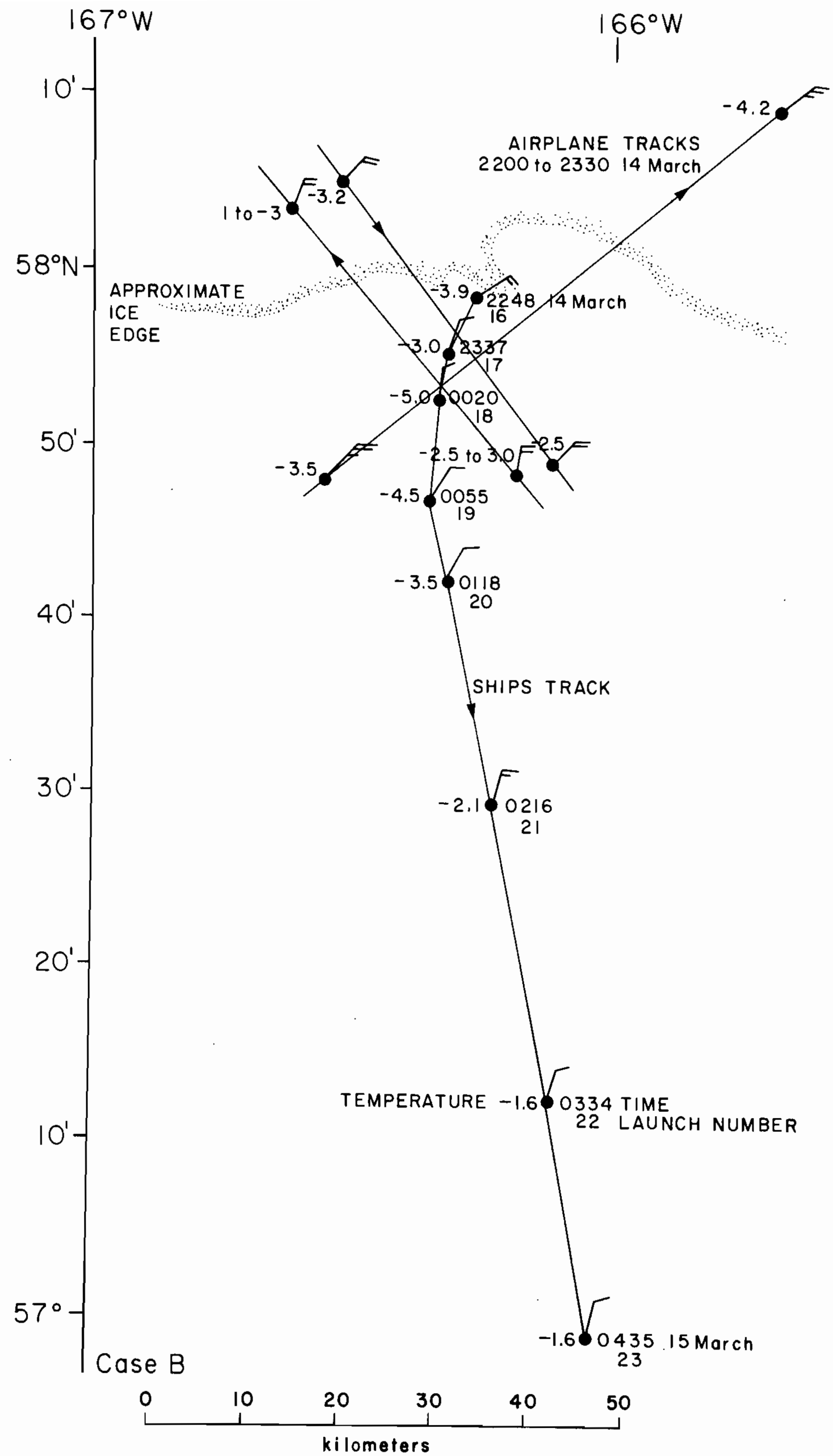


Figure 25. Map of the locations of the soundings for Case B with wind and temperature observations plotted at the time of each launch and similar observations from the aircraft at 100 m, 350 m, and 680 m.

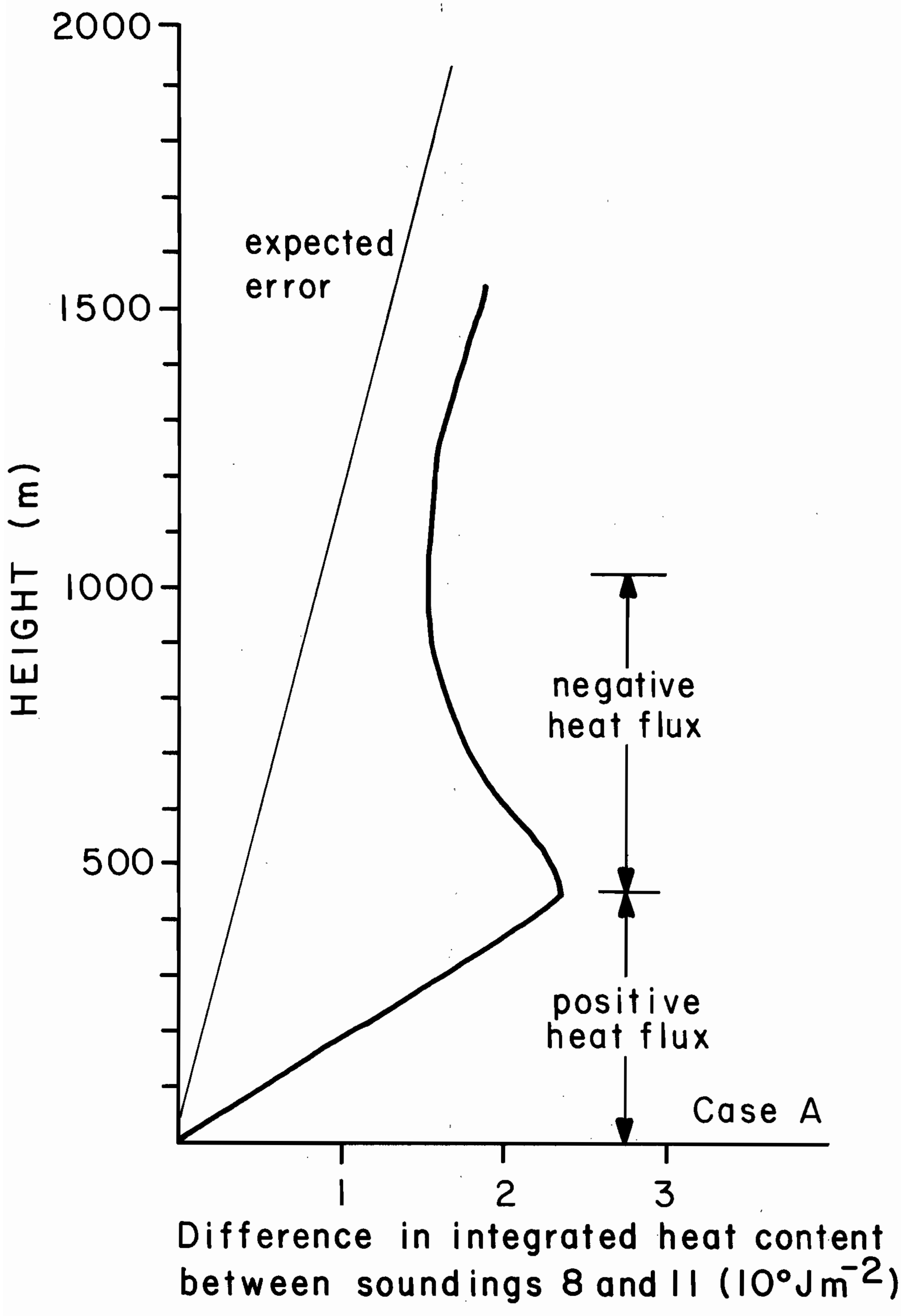


Figure 26. Integrated difference in heat content between the first and last soundings for Case A.

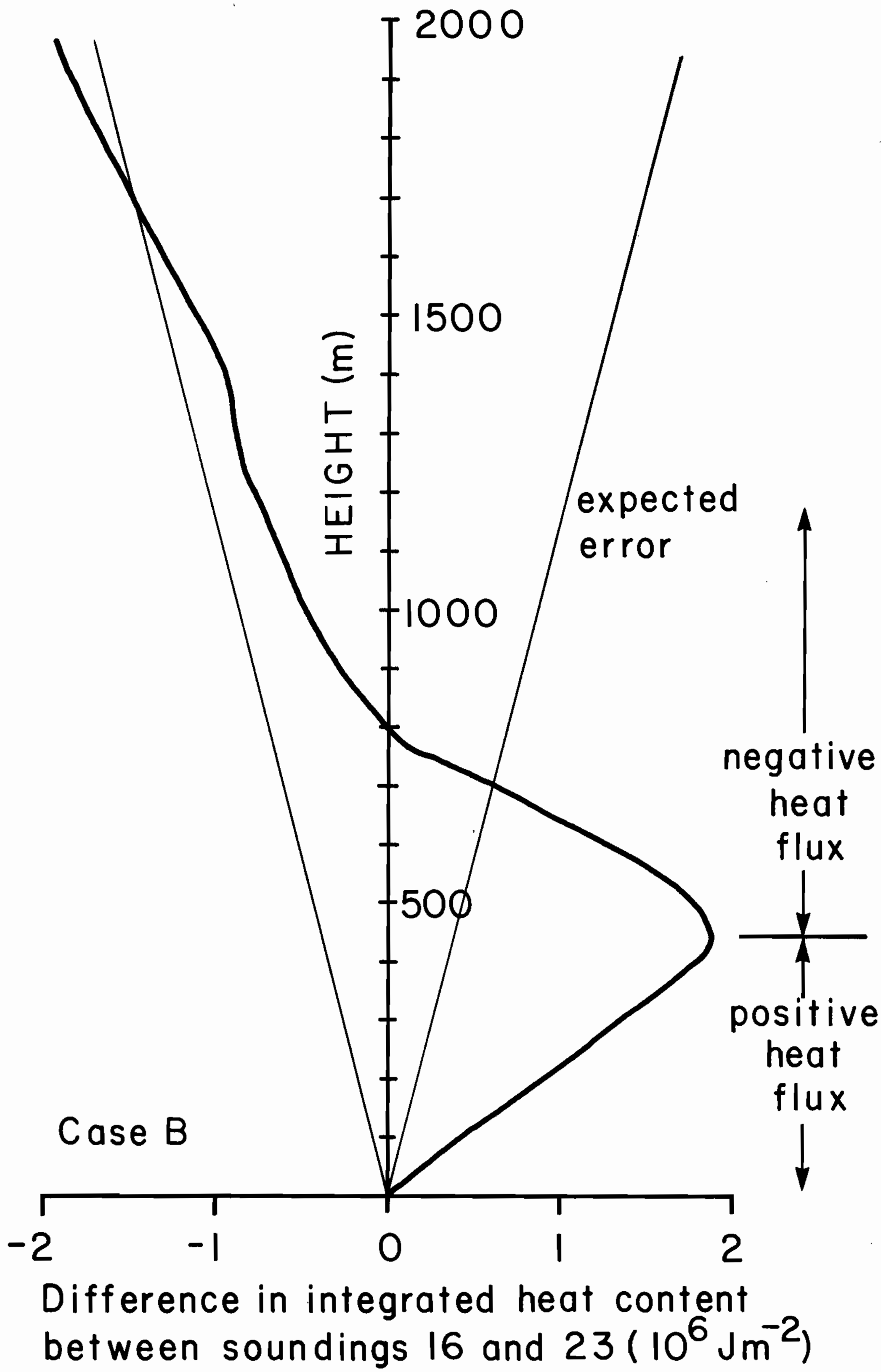
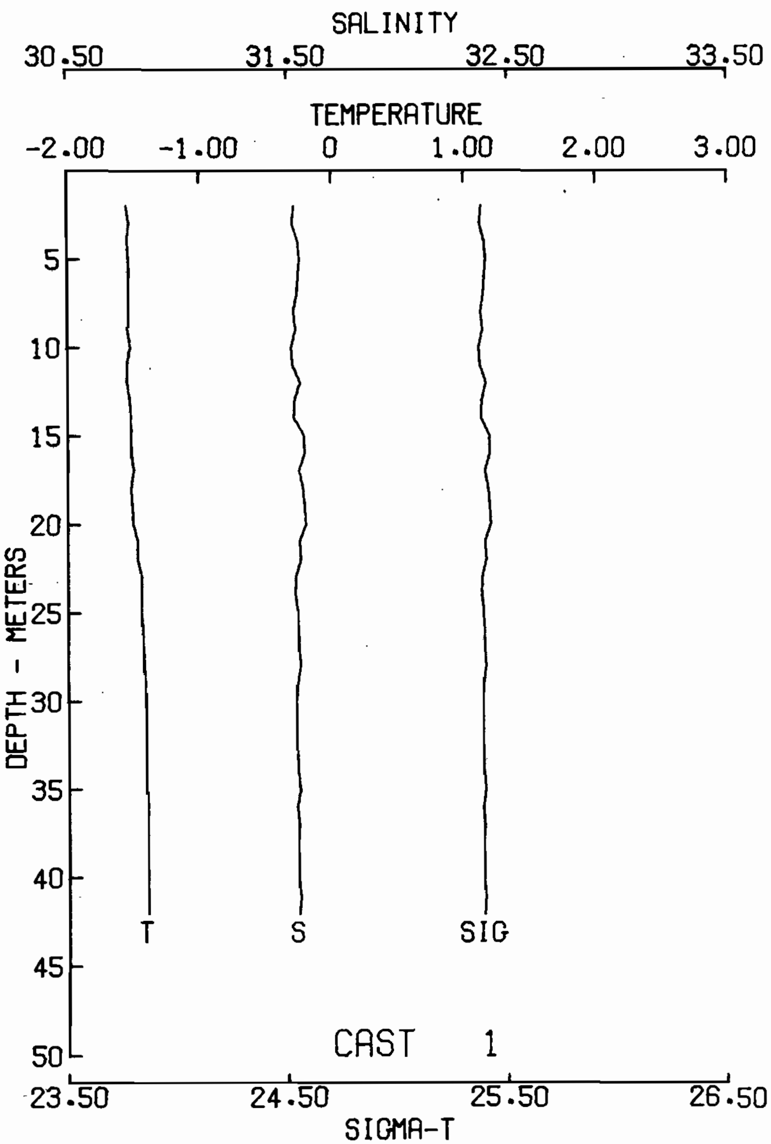


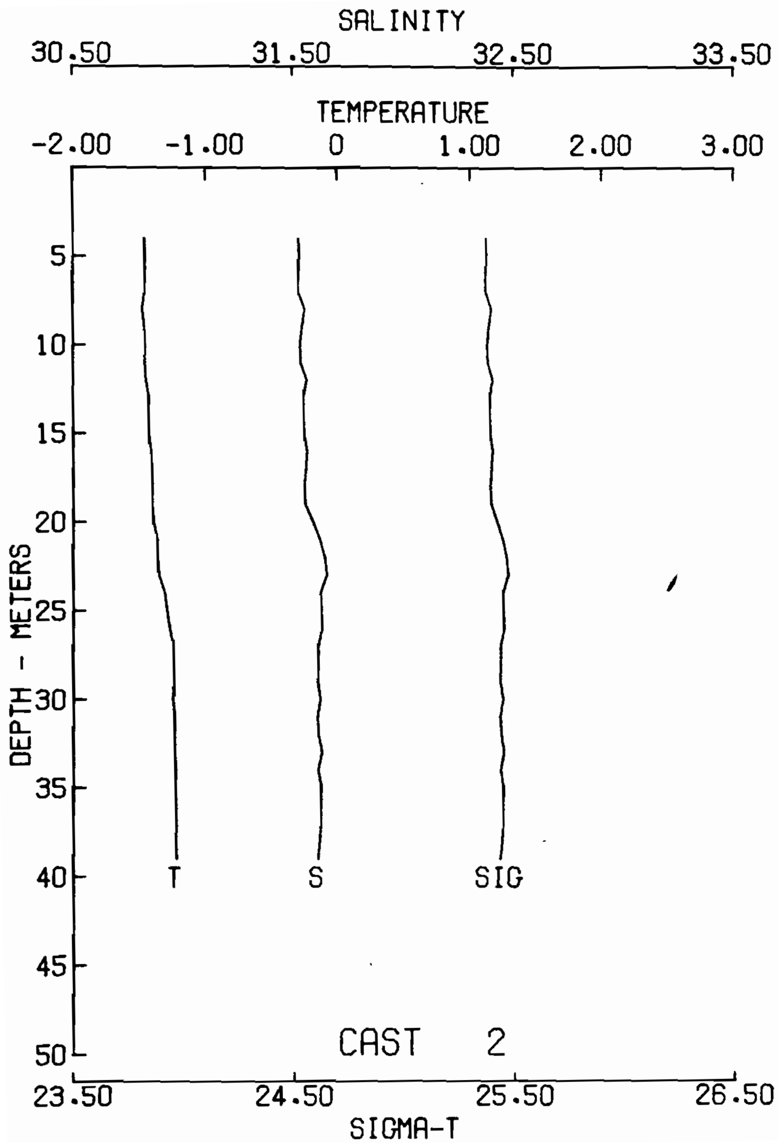
Figure 27. Integrated difference in heat content between the first and last soundings for Case B.

APPENDIX A: SALINITY, TEMPERATURE, AND DENSITY PROFILES, CTD CASTS 1-41.



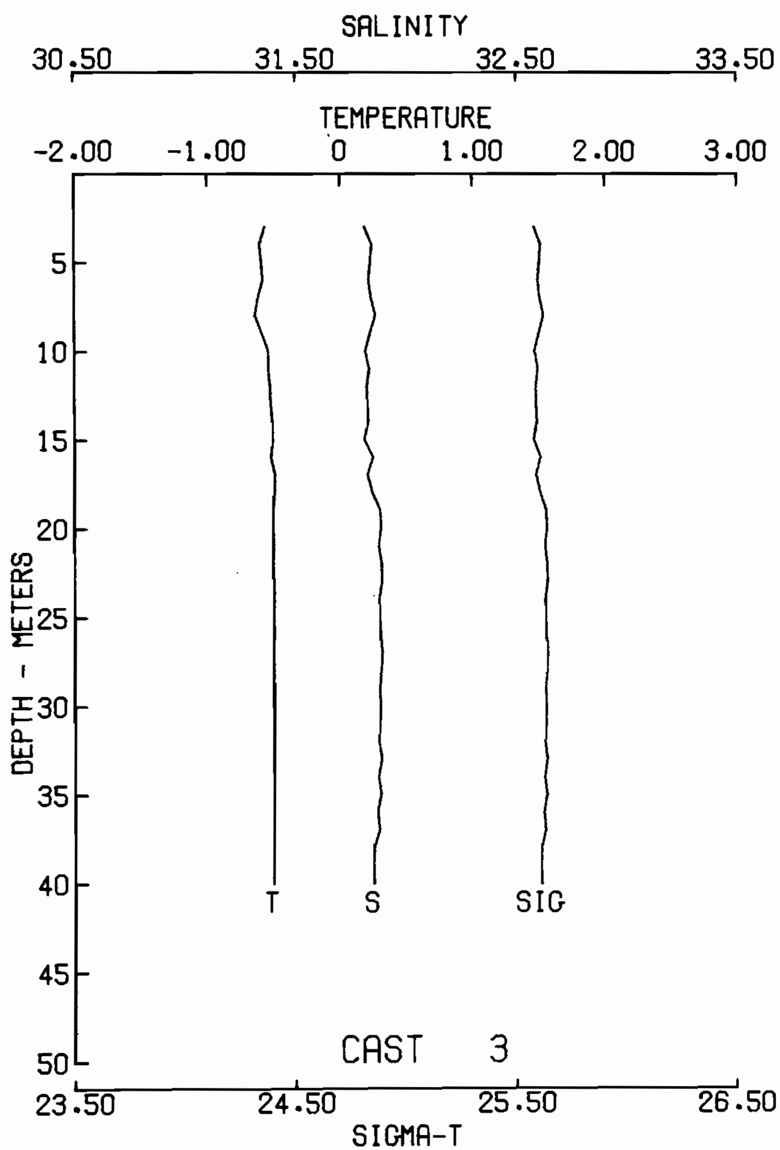
CAST RP4-SU-79A- 1 DATE 3 MAR 79 TIME 9 GMT
LAT 58 26.8N LONG 165 57.0W WEATHER SEA STATE 0
BAROMETER 91 WIND DIR 35 T SPD 16 KT VISIBILITY 8
CLOUD AMOUNT DRY -9.7 WET -10. DEPTH 43 M

DEPTH (M)	TEMPERATURE (C)	SALINITY (PPT)	SIGMA-T	DELTA-D (DYN M)
0	-1.55	31.52	25.38	.000
2	-1.55	31.53	25.36	
5	-1.54	31.56	25.40	.013
10	-1.52	31.52	25.37	.026
15	-1.52	31.57	25.42	.039
20	-1.50	31.58	25.42	.052
25	-1.44	31.54	25.39	.065
30	-1.41	31.54	25.38	.078
35	-1.41	31.55	25.40	.091
40	-1.40	31.55	25.39	.104
42	-1.40	31.55	25.39	



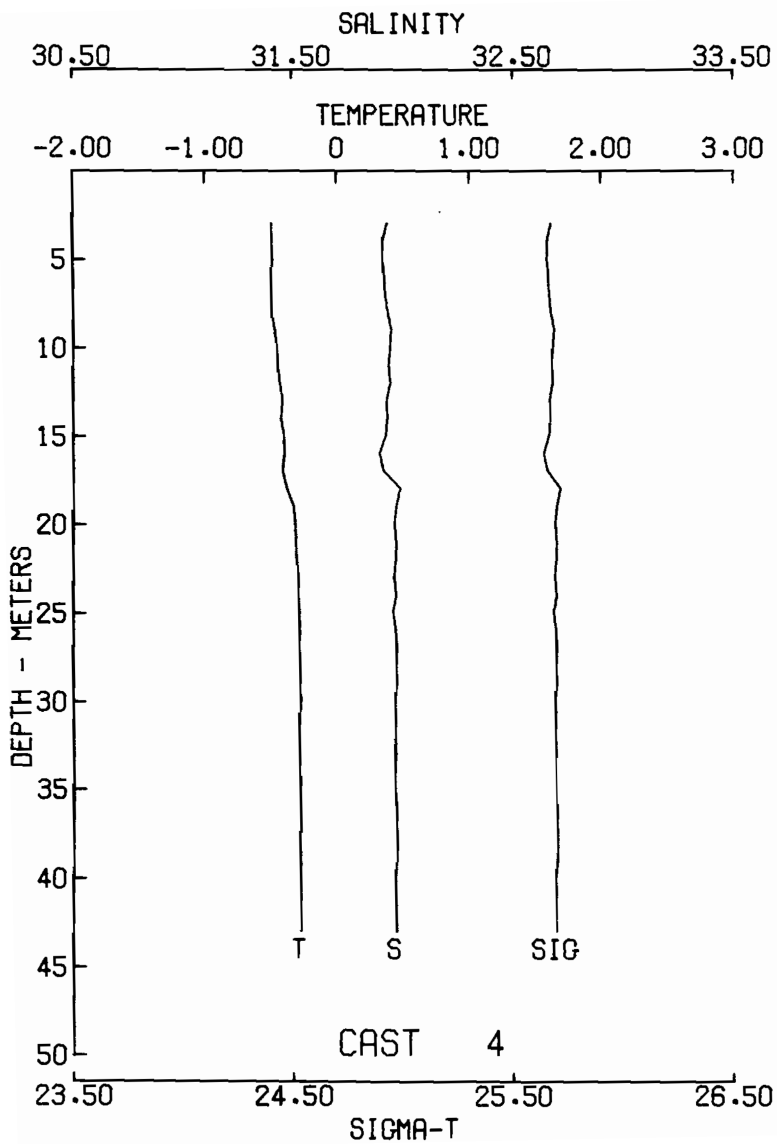
CAST RP4-SU-79A- 2 DATE 3 MAR 79 TIME 652 GMT
LAT 58 21.7N LONG 165 58.9W WEATHER SEA STATE 0
BAROMETER 90 WIND DIR 25 T SPD 17 KT VISIBILITY 7
CLOUD AMOUNT DRY -11. WET -12 DEPTH 40 M

DEPTH (M)	TEMPERATURE (C)	SALINITY (PPT)	SIGMA-T	DELTA-D (DYN M)
0	-1.45	31.53	25.38	.000
4	-1.45	31.52	25.37	
5	-1.45	31.53	25.38	.013
10	-1.45	31.53	25.38	.026
15	-1.43	31.55	25.39	.039
20	-1.39	31.59	25.42	.052
25	-1.28	31.63	25.45	.065
30	-1.24	31.62	25.45	.077
35	-1.23	31.62	25.45	.090
39	-1.22	31.61	25.44	



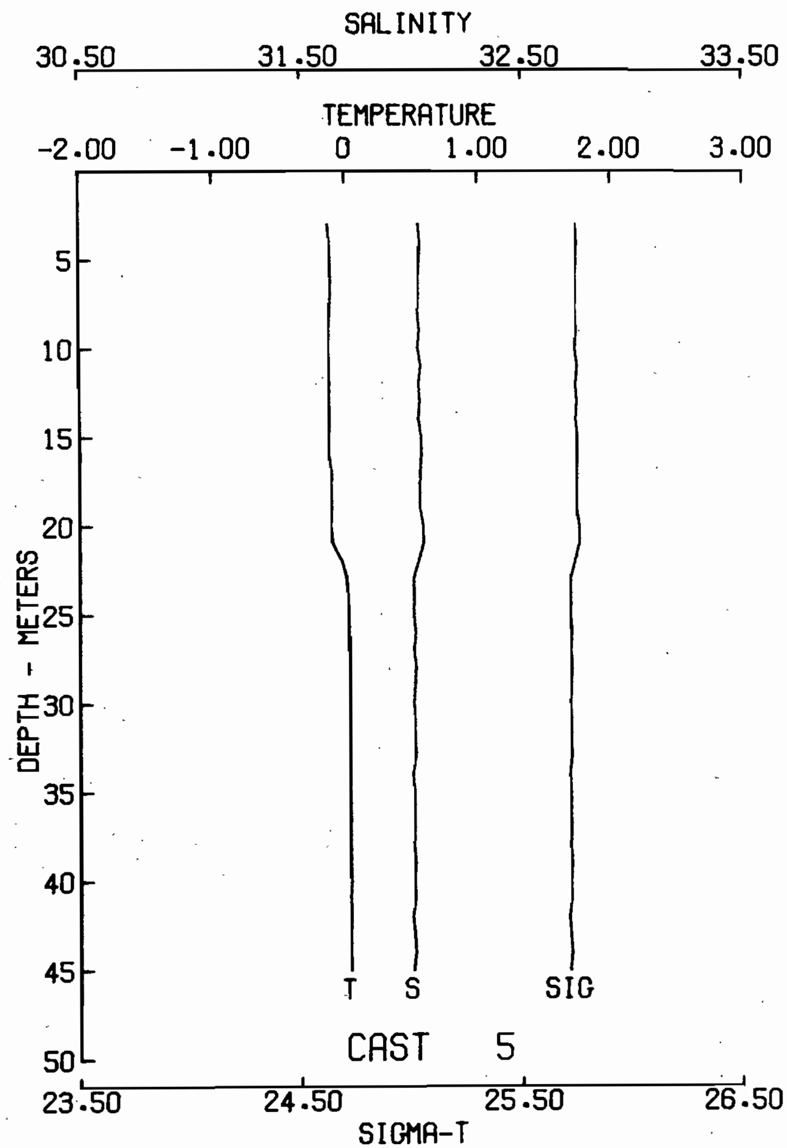
CAST RP4-SU-79A- 3 DATE 3 MAR 79 TIME 909 GMT
LAT 58 16.9N LONG 165 59.2W WEATHER SEA STATE 0
BAROMETER 90 WIND DIR 40 T SPD 13 KT VISIBILITY 8
CLOUD AMOUNT DRY -11. WET -11. DEPTH 42 M

DEPTH (M)	TEMPERATURE (C)	SALINITY (PPT)	SIGMA-T	DELTA-D (DYN M)
0	-.55	31.81	25.58	.000
3	-.57	31.81	25.58	
5	-.60	31.84	25.60	.012
10	-.54	31.81	25.58	.024
15	-.51	31.81	25.58	.036
20	-.51	31.88	25.64	.048
25	-.50	31.88	25.63	.060
30	-.50	31.88	25.63	.072
35	-.50	31.88	25.64	.083
40	-.50	31.85	25.61	.098



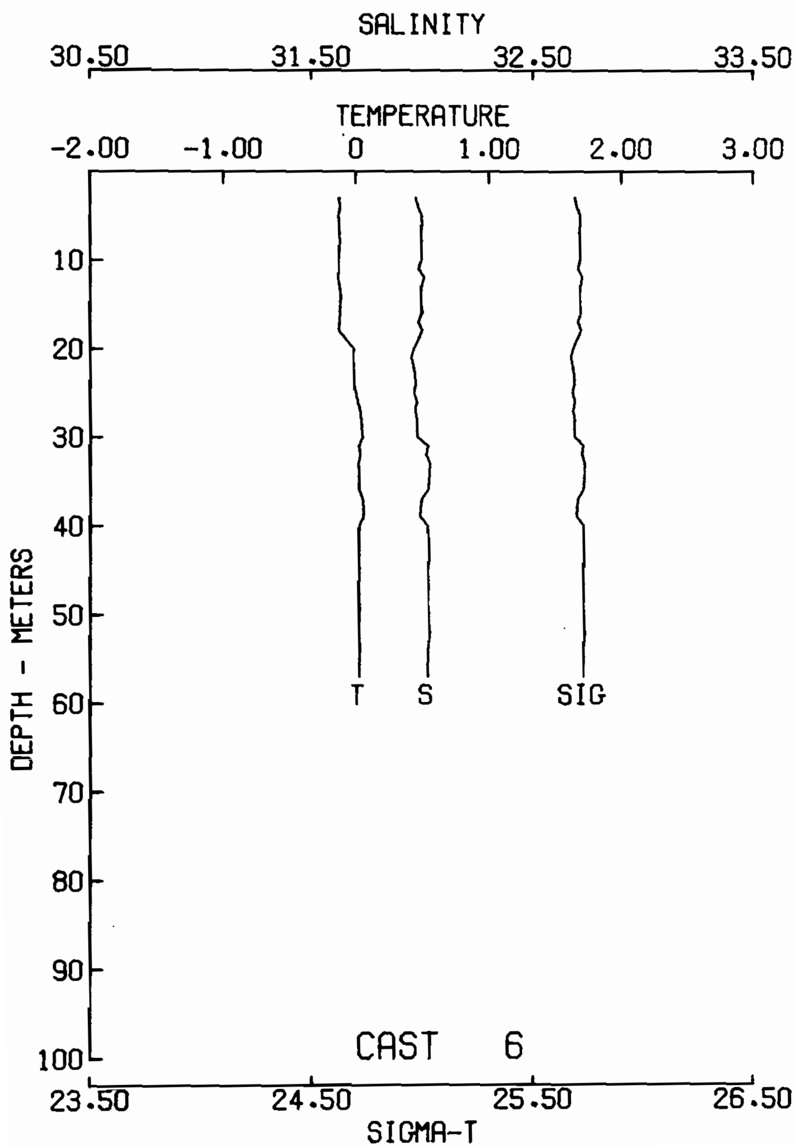
CAST RP4-SU-79A- 4 DATE 3 MAR 79 TIME 1035 GMT
LAT 58 14.3N LONG 165 59.6W WEATHER SEA STATE 0
BAROMETER 89 WIND DIR 38 T SPD 16 KT VISIBILITY 7
CLOUD AMOUNT DRY -10. WET -11. DEPTH 45 M

DEPTH (M)	TEMPERATURE (C)	SALINITY (PPT)	SIGMA-T	DELTA-D (DYN M)
0	-.49	31.92	25.67	.000
3	-.49	31.93	25.67	
5	-.48	31.91	25.65	.012
10	-.45	31.94	25.68	.023
15	-.40	31.92	25.66	.035
20	-.31	31.96	25.69	.047
25	-.29	31.95	25.68	.058
30	-.28	31.96	25.69	.070
35	-.28	31.96	25.69	.081
40	-.28	31.96	25.69	.093
43	-.28	31.97	25.69	



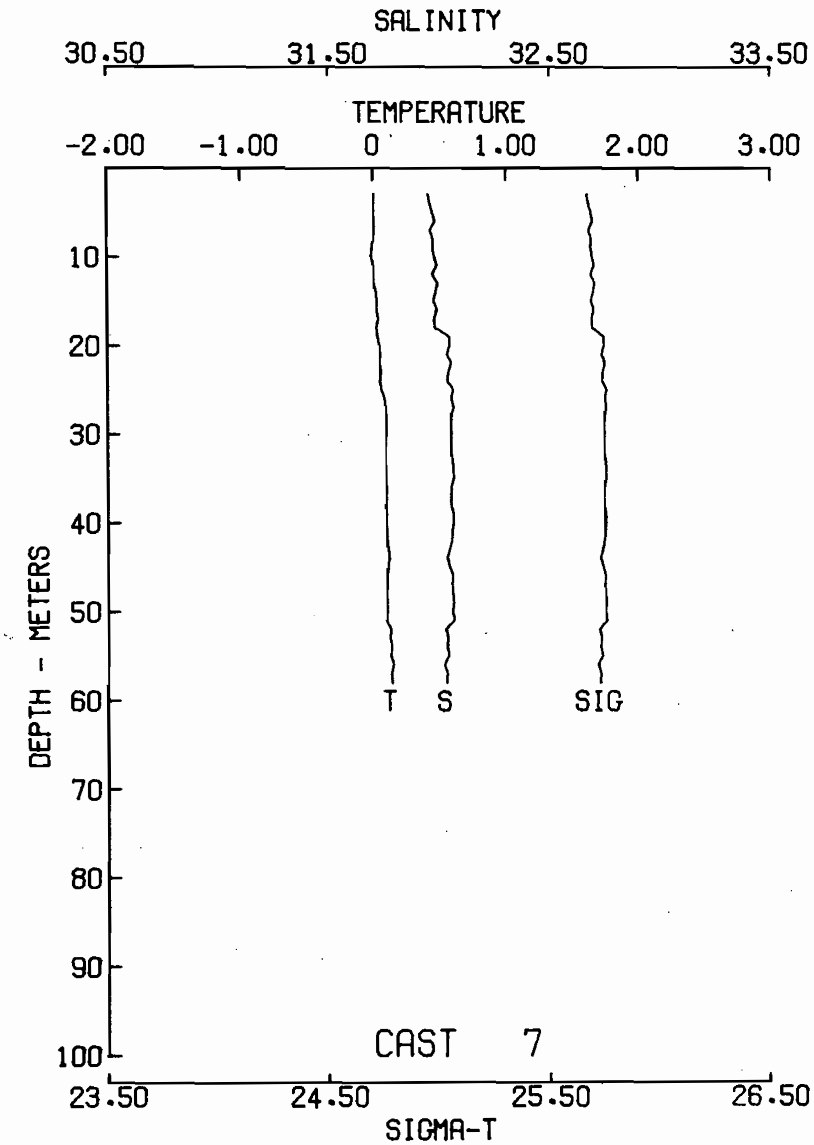
CAST RP4-SU-79A- 5 DATE 3 MAR 79 TIME 1152 GMT
LAT 58 11.2N LONG 166 00.2W WEATHER SEA STATE 0
BAROMETER 89 WIND DIR 35 T SPD 18 KT VISIBILITY 7
CLOUD AMOUNT DRY -10. WET -11. DEPTH M

DEPTH (M)	TEMPERATURE (C)	SALINITY (PPT)	SIGMA-T	DELTA-D (DYN M)
0	-.13	32.04	25.75	.000
3	-.12	32.03	25.74	
5	-.11	32.04	25.74	.011
10	-.12	32.03	25.74	.023
15	-.12	32.04	25.75	.034
20	-.11	32.05	25.76	.045
25	.02	32.01	25.72	.056
30	.04	32.01	25.72	.068
35	.04	32.01	25.72	.079
40	.04	32.01	25.72	.091
45	.04	32.01	25.71	.104



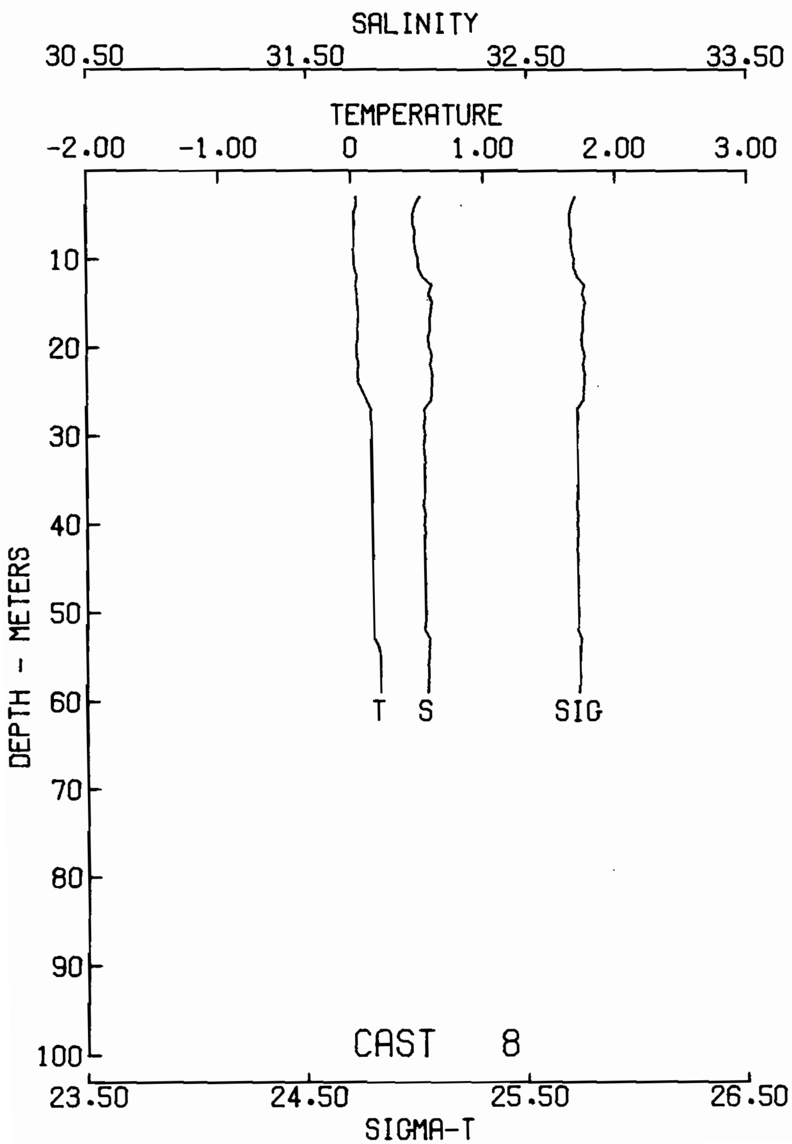
CAST RP4-SU-79A- 6 DATE 4 MAR 79 TIME 2246 GMT
LAT 58 15.0N LONG 167 18.8W WEATHER SEA STATE 0
BAROMETER 80 WIND DIR 41 T SPD 30 KT VISIBILITY 4
CLOUD AMOUNT DRY -11. WET -12. DEPTH M

DEPTH (M)	TEMPERATURE (C)	SALINITY (PPT)	SIGMA-T	DELTA-D (DYN M)
0	-.12	31.95	25.68	.000
3	-.13	31.97	25.69	
5	-.13	32.00	25.71	.012
10	-.13	31.99	25.71	.023
15	-.12	31.99	25.71	.034
20	-.02	31.96	25.68	.046
25	.00	31.96	25.68	.058
30	.05	31.98	25.69	.069
35	.02	32.03	25.73	.080
40	.03	32.02	25.73	.092
45	.02	32.02	25.73	.103
50	.03	32.02	25.73	.115
55	.03	32.02	25.73	.126
57	.03	32.02	25.73	



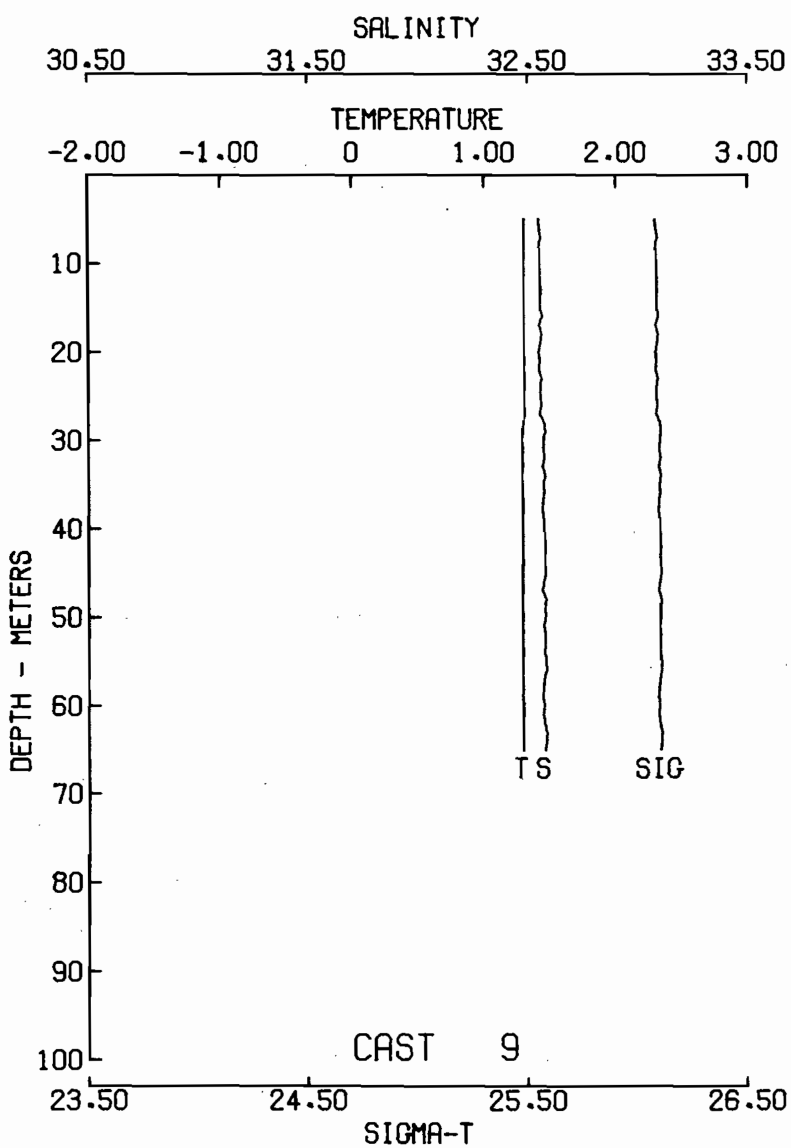
CAST RP4-SU-79A- 7 DATE 5 MAR 79 TIME 13 GMT
LAT 58 13.8N LONG 167 21.3W WEATHER SEA STATE 2
BAROMETER 80 WIND DIR 52 T SPD 28 KT VISIBILITY 4
CLOUD AMOUNT DRY -11. WET -12. DEPTH M

DEPTH (M)	TEMPERATURE (C)	SALINITY (PPT)	SIGMA-T	DELTA-D (DYN M)
0	-.00	31.94	25.66	.000
3	.00	31.95	25.67	
5	.00	31.97	25.69	.012
10	-.01	31.98	25.69	.023
15	.03	31.97	25.69	.035
20	.05	32.05	25.75	.046
25	.06	32.06	25.76	.057
30	.10	32.05	25.75	.069
35	.09	32.06	25.76	.080
40	.10	32.06	25.75	.091
45	.11	32.04	25.74	.103
50	.10	32.06	25.75	.114
55	.13	32.04	25.74	.125
58	.14	32.03	25.73	



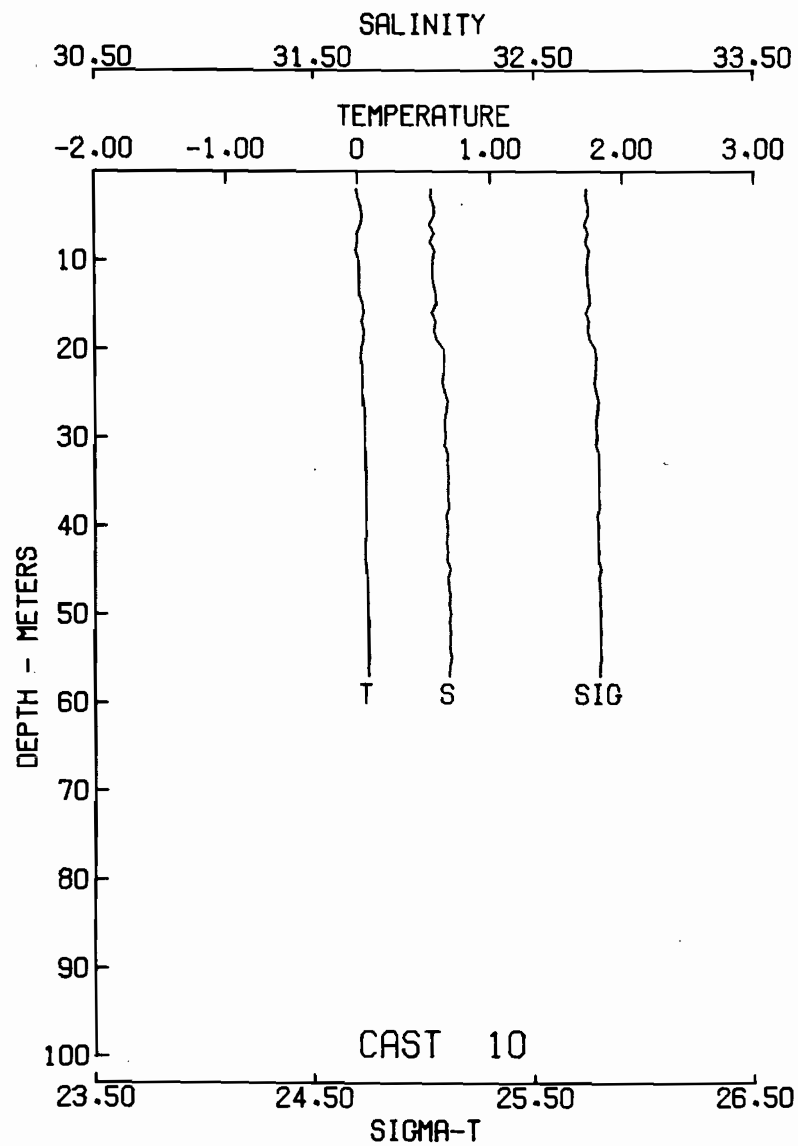
CAST RP4-SU-79A- 8 DATE 5 MAR 79 TIME 213 GMT
LAT 58 11.9N LONG 167 21.0W WEATHER SEA STATE 2
BAROMETER 79 WIND DIR 25 T SPD 25 KT VISIBILITY 5
CLOUD AMOUNT DRY -9.5 WET -11. DEPTH M

DEPTH (M)	TEMPERATURE (C)	SALINITY (PPT)	SIGMA-T	DELTA-D (DYN M)
0	.06	32.02	25.72	.000
3	.04	32.01	25.72	
5	.02	31.98	25.69	.011
10	.02	32.00	25.71	.023
15	.05	32.07	25.76	.034
20	.04	32.05	25.75	.046
25	.09	32.06	25.76	.057
30	.16	32.03	25.73	.068
35	.16	32.03	25.73	.079
40	.16	32.03	25.73	.091
45	.17	32.03	25.73	.102
50	.16	32.04	25.73	.113
55	.22	32.05	25.74	.125
59	.22	32.04	25.74	



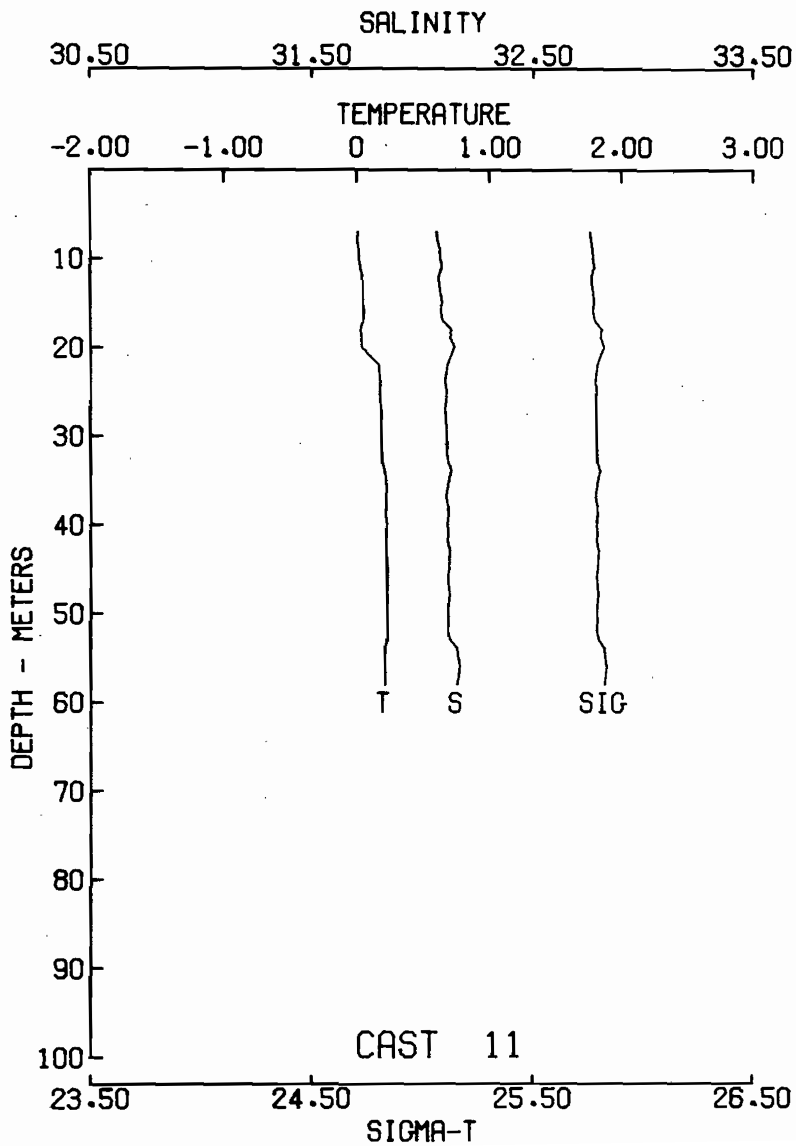
CAST RP4-SU-79A- 9 DATE 5 MAR 79 TIME 614 GMT
LAT 57 41.4N LONG 168 00.8W WEATHER SEA STATE 3
BAROMETER 79 WIND DIR 40 T SPD 24 KT VISIBILITY 5
CLOUD AMOUNT DRY -10. WET -11. DEPTH 71 M

DEPTH (M)	TEMPERATURE (C)	SALINITY (PPT)	SIGMA-T	DELTA-D (DYN M)
0	1.31	32.52	26.06	.000
5	1.31	32.55	26.08	
10	1.30	32.55	26.09	.019
15	1.30	32.56	26.09	.029
20	1.30	32.55	26.08	.039
25	1.31	32.56	26.09	.048
30	1.29	32.57	26.10	.058
35	1.29	32.57	26.10	.068
40	1.29	32.57	26.10	.077
45	1.29	32.56	26.11	.087
50	1.30	32.58	26.11	.096
55	1.30	32.58	26.11	.106
60	1.30	32.57	26.10	.116
65	1.30	32.58	26.11	.127



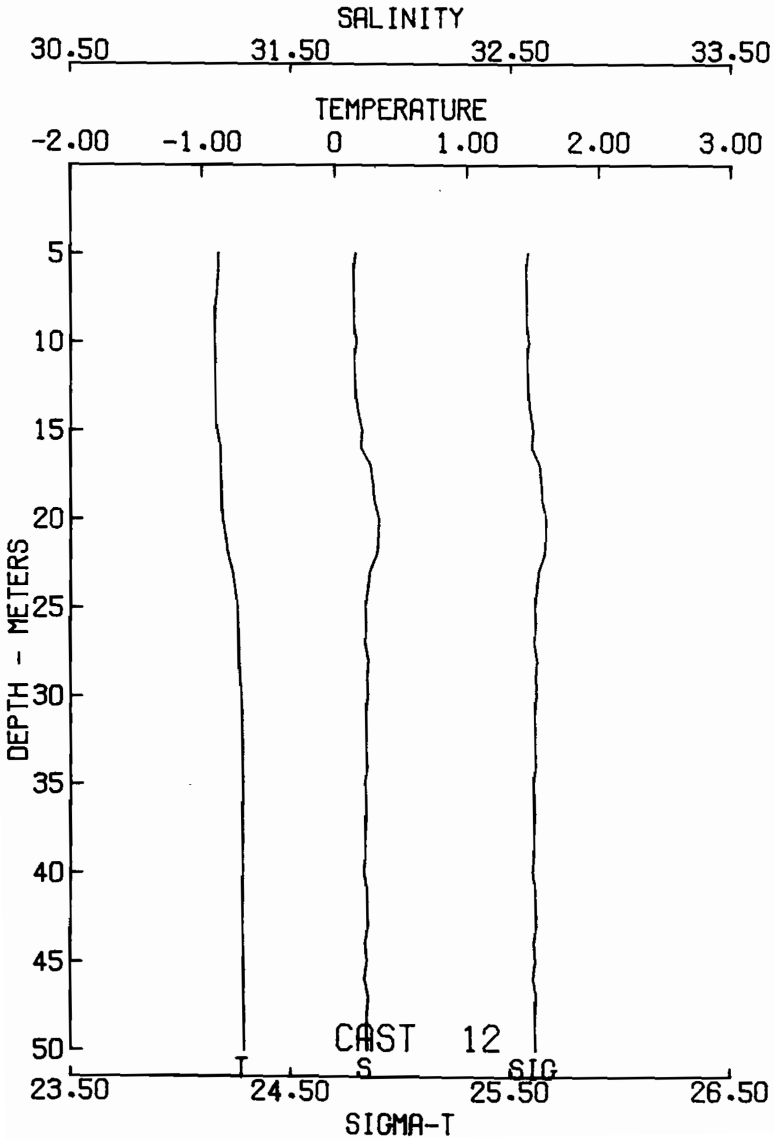
CAST RP4-SU-79A- 10 DATE 6 MAR 79 TIME 511 GMT
LAT 58 13.8N LONG 167 44.0W WEATHER SEA STATE 2
BAROMETER 86 WIND DIR 68 T SPD 13 KT VISIBILITY 6
CLOUD AMOUNT DRY -7.2 WET -7.5 DEPTH 62 M

DEPTH (M)	TEMPERATURE (C)	SALINITY (PPT)	SIGMA-T	DELTA-D (DYN M)
0	.00	32.03	25.74	.000
2	-.01	32.03	25.74	
5	.04	32.05	25.75	.011
10	.01	32.04	25.74	.023
15	.04	32.06	25.75	.034
20	.03	32.08	25.78	.045
25	.03	32.09	25.78	.056
30	.05	32.10	25.79	.067
35	.06	32.11	25.79	.078
40	.06	32.11	25.79	.089
45	.07	32.12	25.80	.101
50	.08	32.12	25.80	.112
55	.09	32.12	25.81	.123
57	.08	32.11	25.80	



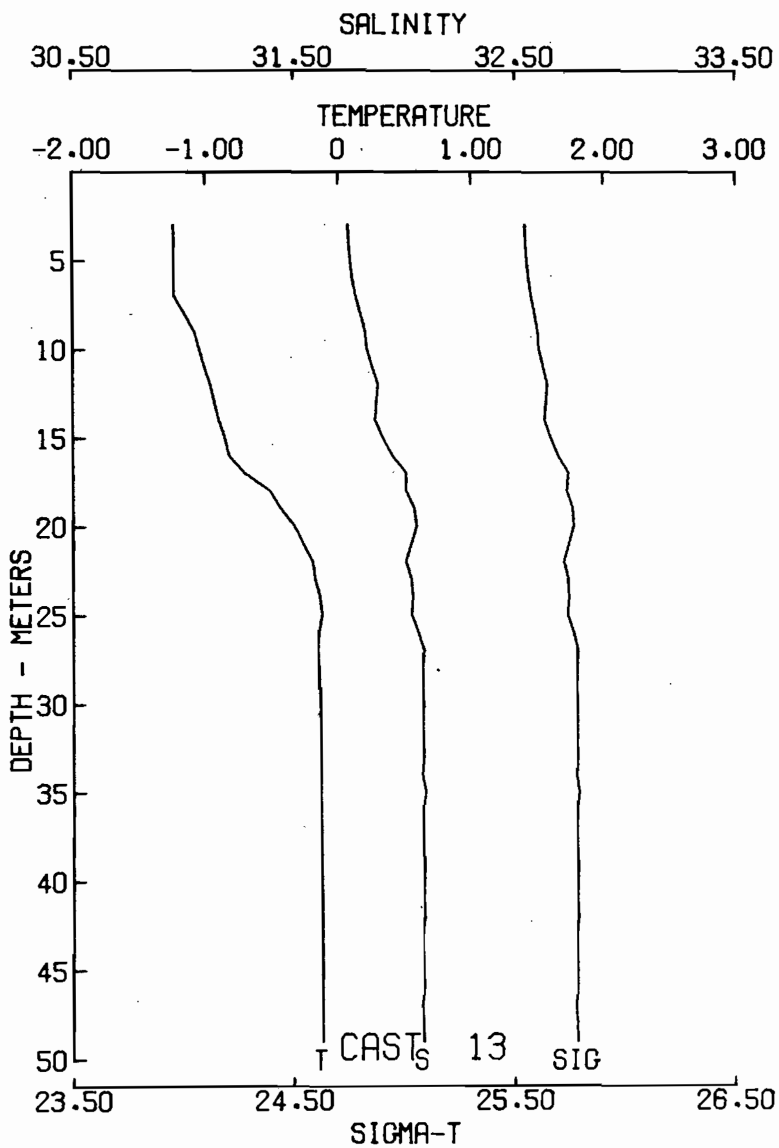
CAST RP4-SU-79A- 11   DATE 6 MAR 79   TIME 554 GMT
LAT 58 13.6N   LONG 167 49.8W   WEATHER   SEA STATE 0
BAROMETER 86   WIND DIR 75 T   SPD 13 KT   VISIBILITY 7
CLOUD   AMOUNT   DRY -6.5   WET -7.4   DEPTH 58 M

DEPTH (M)	TEMPERATURE (C)	SALINITY (PPT)	SIGMA-T	DELTA-D (DYN M)
7	.01	32.06	25.76	
10	.02	32.08	25.77	.022
15	.05	32.08	25.78	.034
20	.03	32.14	25.82	.045
25	.17	32.11	25.79	.056
30	.18	32.11	25.79	.067
35	.22	32.12	25.80	.078
40	.23	32.11	25.79	.089
45	.23	32.12	25.79	.100
50	.23	32.11	25.79	.111
55	.21	32.16	25.83	.122
58	.22	32.16	25.83	



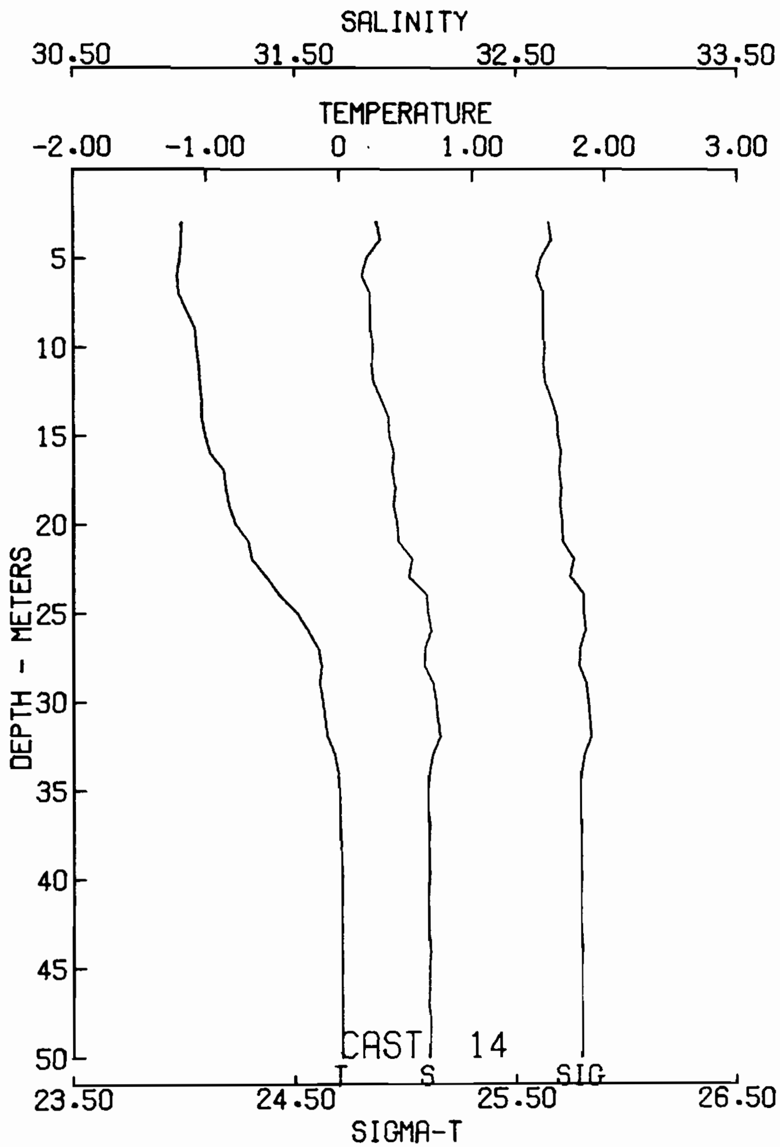
CAST RP4-SU-79A- 12 DATE 7 MAR 79 TIME 406 GMT
LAT 58 29.8N LONG 167 56.1W WEATHER SEA STATE 0
BAROMETER 94 WIND DIR 0 T SPD 10 KT VISIBILITY 8
CLOUD AMOUNT DRY -5.0 WET -6.0 DEPTH M

DEPTH (M)	TEMPERATURE (C)	SALINITY (PPT)	SIGMA-T	DELTA-D (DYN M)
0	-.85	31.82	25.59	.000
5	-.88	31.80	25.58	
10	-.91	31.80	25.58	.024
15	-.88	31.82	25.60	.036
20	-.84	31.90	25.66	.048
25	-.73	31.84	25.61	.060
30	-.70	31.85	25.62	.072
35	-.69	31.84	25.61	.084
40	-.69	31.83	25.60	.096
45	-.69	31.85	25.61	.107
50	-.66	31.85	25.61	.119
52	-.68	31.84	25.61	



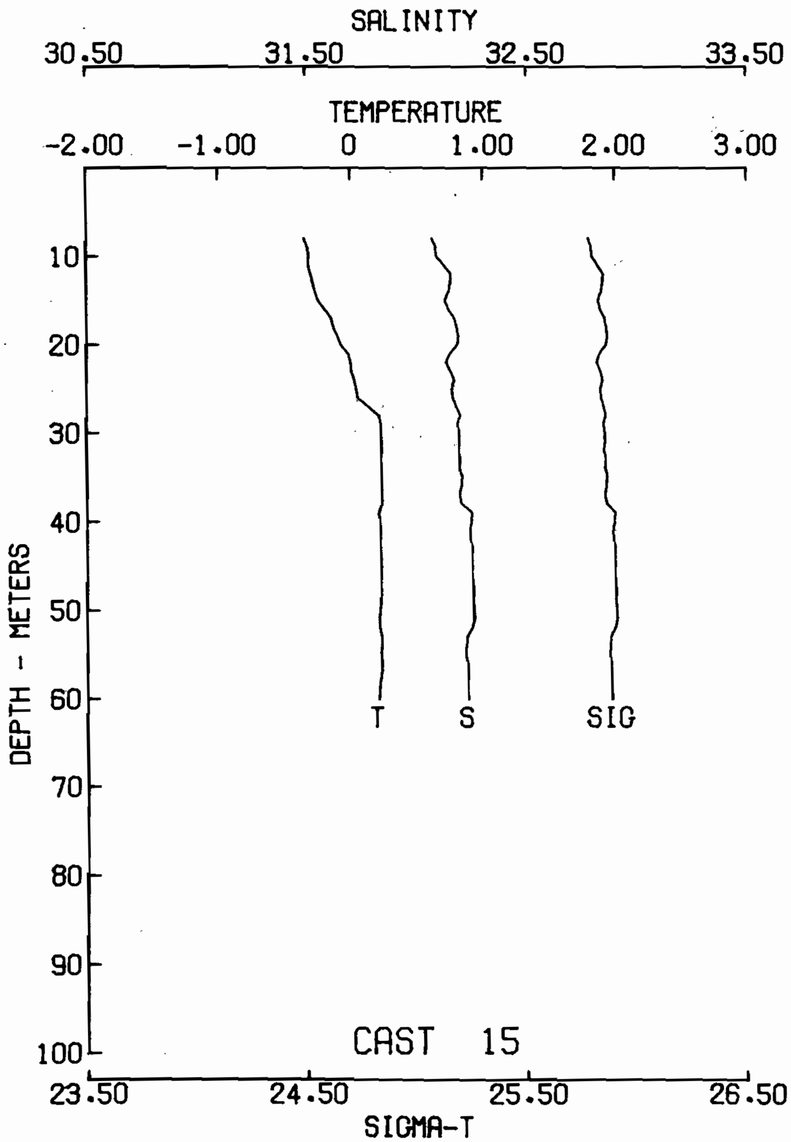
CAST RP4-SU-79A- 13 DATE 7 MAR 79 TIME 1636 GMT
LAT 58 45.9N LONG 168 45.1W WEATHER SEA STATE 0
BAROMETER 99 WIND DIR 50 T SPD 8 KT VISIBILITY 7
CLOUD AMOUNT DRY -7.0 WET -7.5 DEPTH 49 M

DEPTH (M)	TEMPERATURE (C)	SALINITY (PPT)	SIGMA-T	DELTA-D (DYN M)
0	-1.24	31.72	25.52	.000
3	-1.24	31.74	25.55	
5	-1.24	31.75	25.55	.012
10	-1.05	31.83	25.61	.024
15	-.85	31.90	25.66	.036
20	-.33	32.05	25.77	.047
25	-.12	32.03	25.74	.059
30	-.14	32.08	25.78	.070
35	-.13	32.09	25.79	.081
40	-.13	32.09	25.79	.092
45	-.12	32.09	25.78	.103
49	-.12	32.09	25.78	



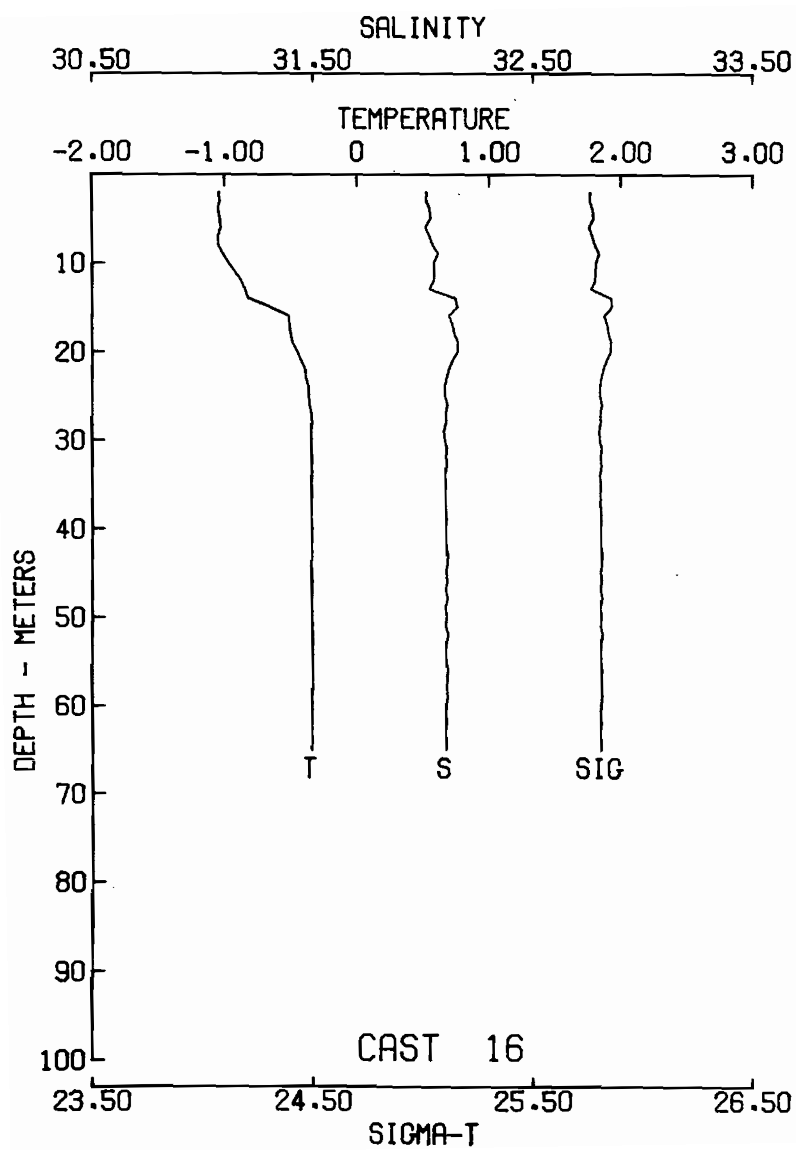
CAST RP4-SU-79A- 14 DATE 6 MAR 79 TIME 403 GMT
LAT 58 45.1N LONG 168 47.8W WEATHER SEA STATE 0
BAROMETER 3 WIND DIR T SPD 0 KT VISIBILITY 7
CLOUD AMOUNT DRY -5.2 WET -5.7 DEPTH 51 M

DEPTH (M)	TEMPERATURE (C)	SALINITY (PPT)	SIGMA-T	DELTA-D (DYN M)
0	-1.16	31.92	25.68	.000
3	-1.18	31.87	25.65	
5	-1.19	31.83	25.61	.012
10	-1.07	31.85	25.63	.024
15	-1.01	31.92	25.69	.035
20	-.78	31.96	25.71	.047
25	-.33	32.10	25.80	.058
30	-.13	32.13	25.82	.069
35	-.00	32.10	25.79	.080
40	.02	32.11	25.80	.091
45	.02	32.11	25.80	.102
50	.03	32.11	25.80	.113
51	.03	32.11	25.79	



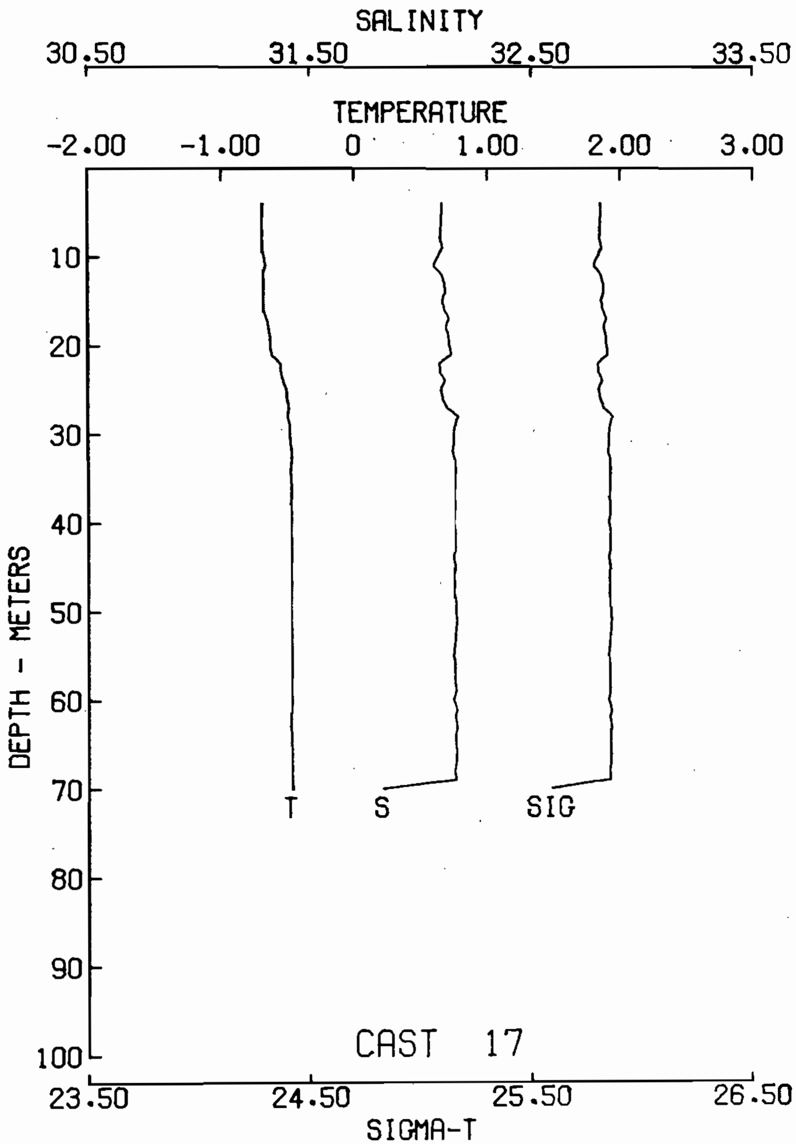
CAST RP4-SU-79A- 15 DATE 6 MAR 79 TIME 805 GMT
LAT 58 38.7N LONG 169 05.2W WEATHER SEA STATE 0
BAROMETER 4 WIND DIR 80 T SPD 3 KT VISIBILITY 6
CLOUD AMOUNT DRY -3.1 WET -4.0 DEPTH M

DEPTH (M)	TEMPERATURE (C)	SALINITY (PPT)	SIGMA-T	DELTA-D (DYN M)
8	-.35	32.07	25.78	
10	-.31	32.09	25.80	.022
15	-.25	32.13	25.83	.033
20	-.07	32.18	25.86	.044
25	.04	32.16	25.84	.055
30	.23	32.19	25.85	.065
35	.23	32.20	25.86	.076
40	.22	32.25	25.90	.087
45	.23	32.25	25.90	.097
50	.22	32.26	25.91	.108
55	.23	32.22	25.88	.119
60	.21	32.23	25.89	.131



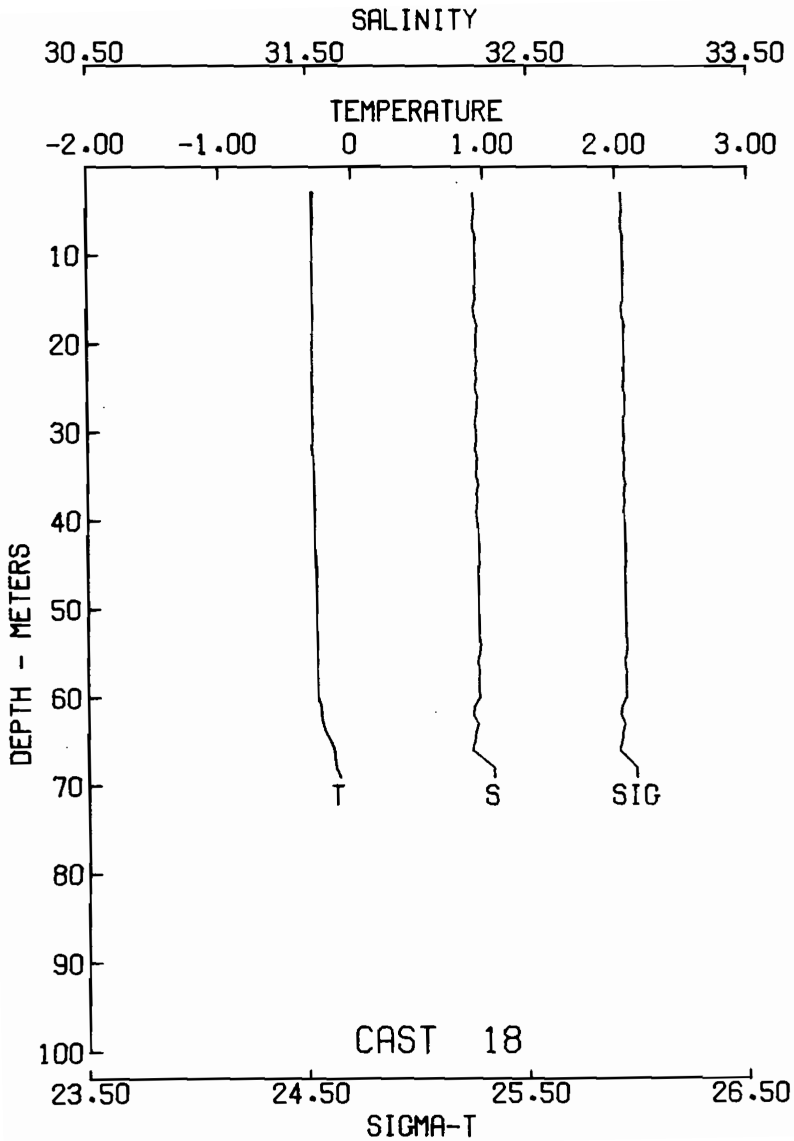
CAST RP4-SU-79A- 16 DATE 8 MAR 79 TIME 1635 GMT
LAT 59 02.2N LONG 170 01.2W WEATHER SEA STATE 0
BAROMETER 2 WIND DIR 15 T SPD 10 KT VISIBILITY 7
CLOUD AMOUNT DRY -5.0 WET -5.5 DEPTH M

DEPTH (M)	TEMPERATURE (C)	SALINITY (PPT)	SIGMA-T	DELTA-D (DYN M)
0	-1.04	32.01	25.76	.000
2	-1.04	32.01	25.76	
5	-1.03	32.03	25.77	.011
10	-.97	32.05	25.79	.022
15	-.66	32.15	25.86	.033
20	-.45	32.16	25.85	.044
25	-.37	32.10	25.80	.055
30	-.35	32.10	25.80	.066
35	-.35	32.10	25.81	.077
40	-.34	32.10	25.81	.088
45	-.35	32.10	25.81	.099
50	-.34	32.11	25.81	.110
55	-.34	32.10	25.81	.121
60	-.34	32.11	25.81	.132
65	-.34	32.10	25.81	.145



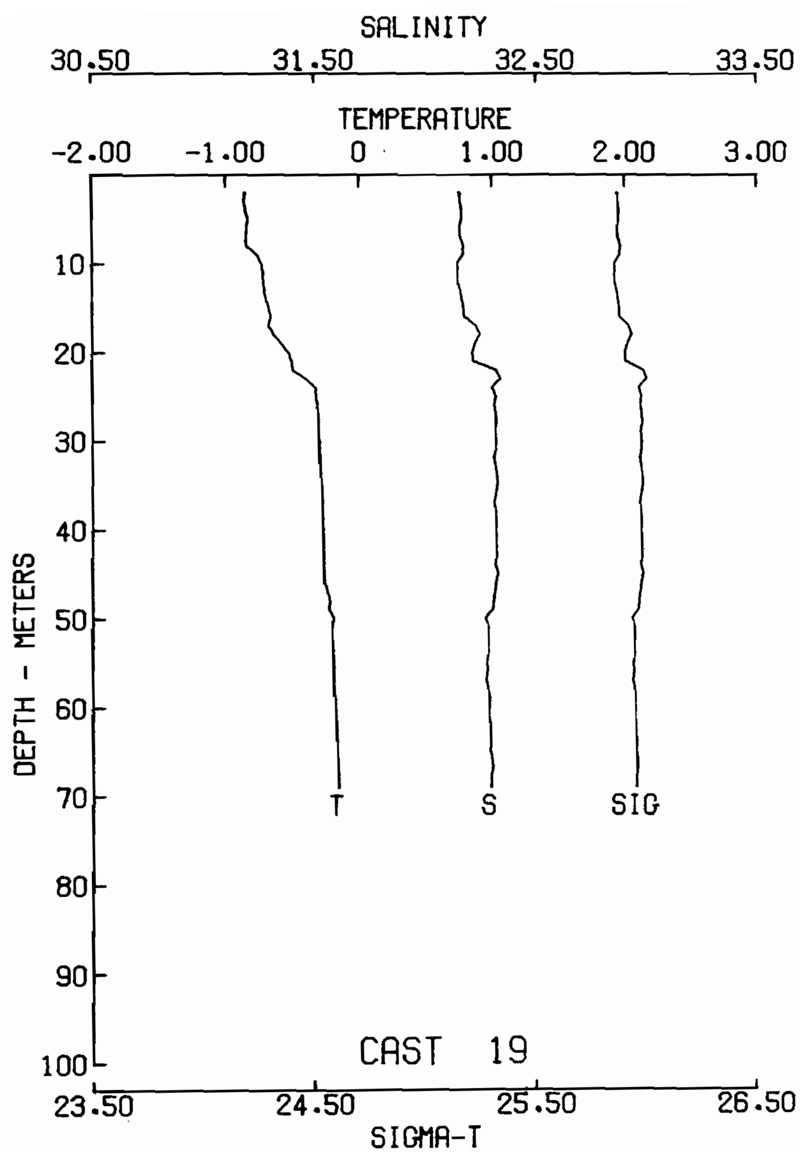
CAST KP4-SU-79A- 17 DATE 9 MAR 79 TIME 340 GMT
LAT 58 58.1N LONG 170 12.0W WEATHER SEA STATE 0
BAROMETER 96 WIND DIR T SPD 20 KT VISIBILITY 5
CLOUD AMOUNT DRY -2.5 WET -3.0 DEPTH M

DEPTH (M)	TEMPERATURE (C)	SALINITY (PPT)	SIGMA-T	DELTA-D (DYN M)
0	-.68	32.10	25.82	.000
4	-.69	32.10	25.81	
5	-.69	32.10	25.81	.011
10	-.68	32.08	25.80	.022
15	-.68	32.10	25.81	.033
20	-.63	32.13	25.84	.044
25	-.51	32.09	25.80	.055
30	-.49	32.15	25.85	.066
35	-.48	32.15	25.85	.076
40	-.46	32.15	25.85	.087
45	-.47	32.16	25.86	.098
50	-.46	32.16	25.86	.109
55	-.47	32.15	25.85	.119
60	-.47	32.15	25.85	.130
65	-.47	32.16	25.86	.141
70	-.47	31.83	25.59	.154



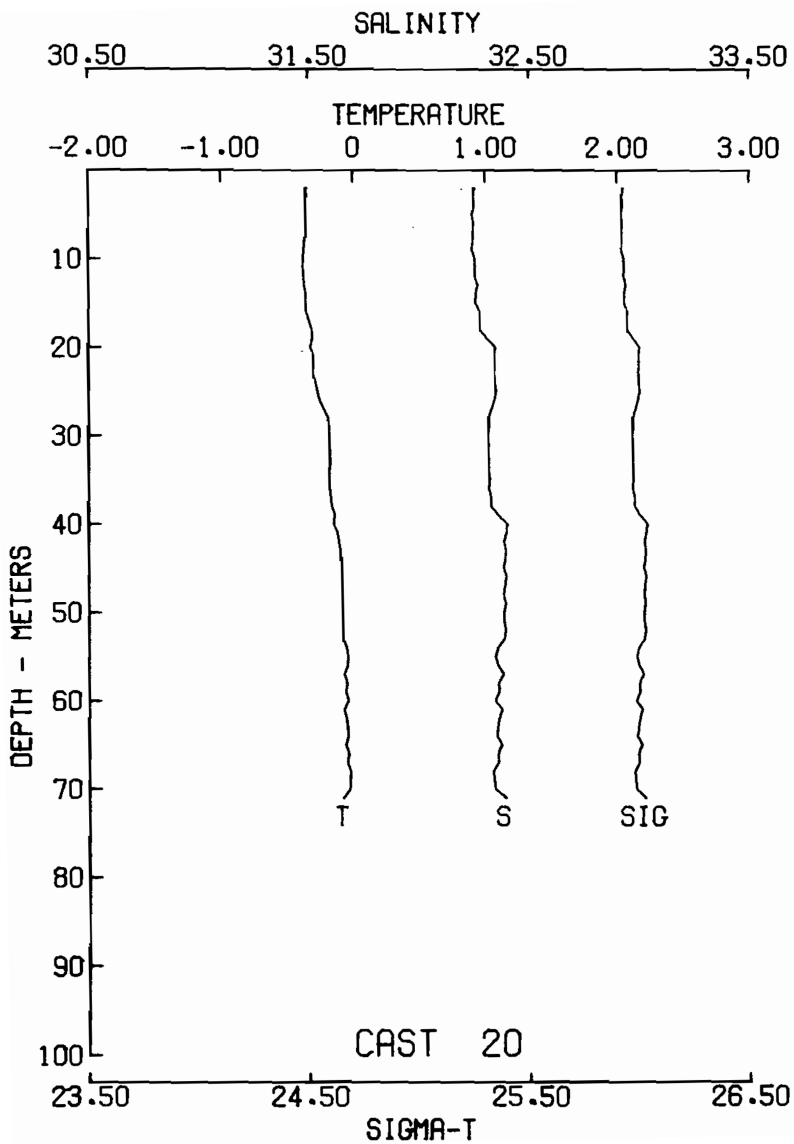
CAST RP4-SU-79A- 18 DATE 9 MAR 79 TIME 804 GMT
LAT 58 57.2N LONG 170 45.6W WEATHER SEA STATE 3
BAROMETER 95 WIND DIR 12 T SPD 20 KT VISIBILITY 6
CLOUD AMOUNT DRY -1.8 WET -2.4 DEPTH 70 M

DEPTH (M)	TEMPERATURE (C)	SALINITY (PPT)	SIGMA-T	DELTA-D (DYN M)
0	-.29	32.26	25.93	.000
3	-.29	32.26	25.93	
5	-.29	32.26	25.93	.010
10	-.29	32.26	25.94	.021
15	-.30	32.26	25.94	.031
20	-.30	32.27	25.94	.042
25	-.29	32.26	25.93	.052
30	-.30	32.26	25.94	.062
35	-.29	32.27	25.94	.073
40	-.28	32.27	25.94	.083
45	-.27	32.28	25.95	.093
50	-.27	32.28	25.94	.104
55	-.26	32.28	25.95	.114
60	-.26	32.28	25.95	.124
65	-.17	32.26	25.92	.135
69	-.10	32.34	25.99	



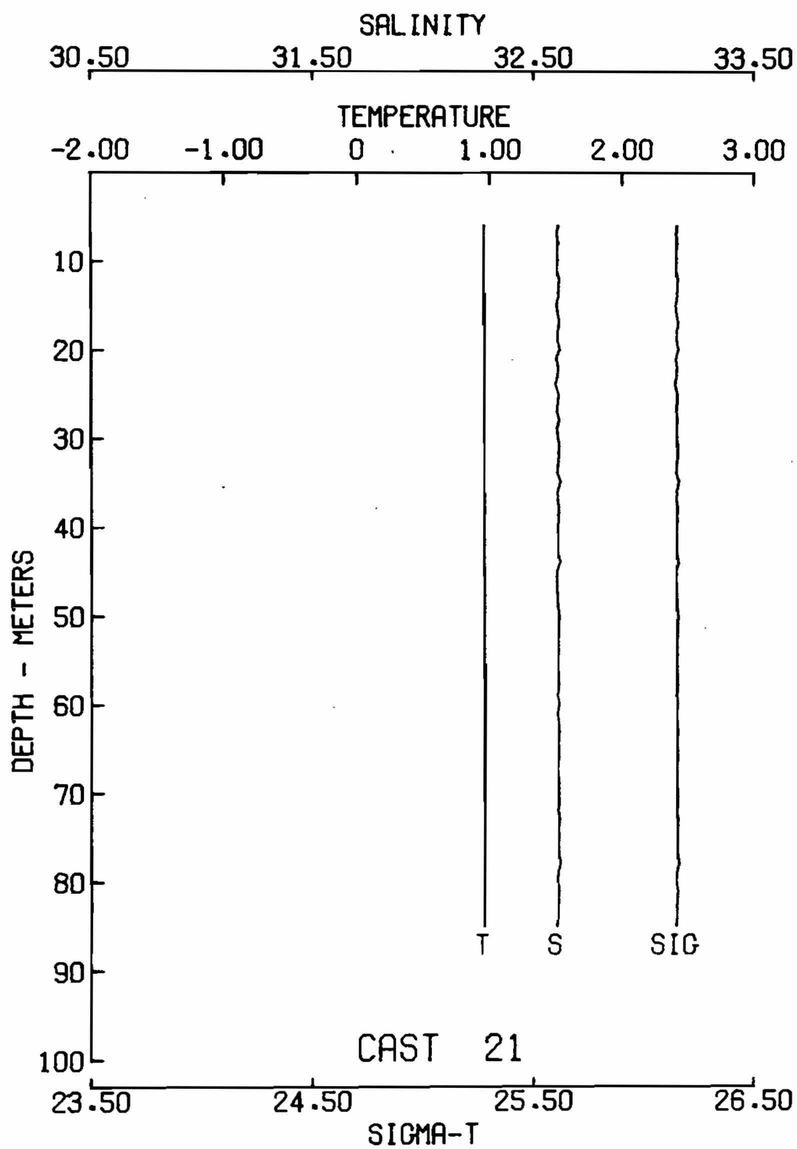
CAST RP4-SU-79A- 19 DATE 9 MAR 79 TIME 1635 GMT
LAT 59 22.2N LONG 170 59.2W WEATHER SEA STATE 0
BAROMETER 93 WIND DIR 350 T SPD 10 KT VISIBILITY 7
CLOUD AMOUNT DRY -4.0 WET -4.2 DEPTH 69 M

DEPTH (M)	TEMPERATURE (C)	SALINITY (PPT)	SIGMA-T	DELTA-D (DYN M)
0	-.86	32.16	25.87	.000
2	-.85	32.15	25.87	
5	-.83	32.16	25.87	.011
10	-.73	32.15	25.86	.021
15	-.68	32.17	25.88	.032
20	-.53	32.21	25.90	.043
25	-.32	32.32	25.98	.053
30	-.30	32.32	25.98	.063
35	-.28	32.33	25.98	.073
40	-.27	32.32	25.98	.083
45	-.26	32.33	25.99	.094
50	-.19	32.27	25.94	.104
55	-.19	32.28	25.94	.114
60	-.17	32.29	25.95	.124
65	-.16	32.29	25.95	.135
69	-.15	32.30	25.96	



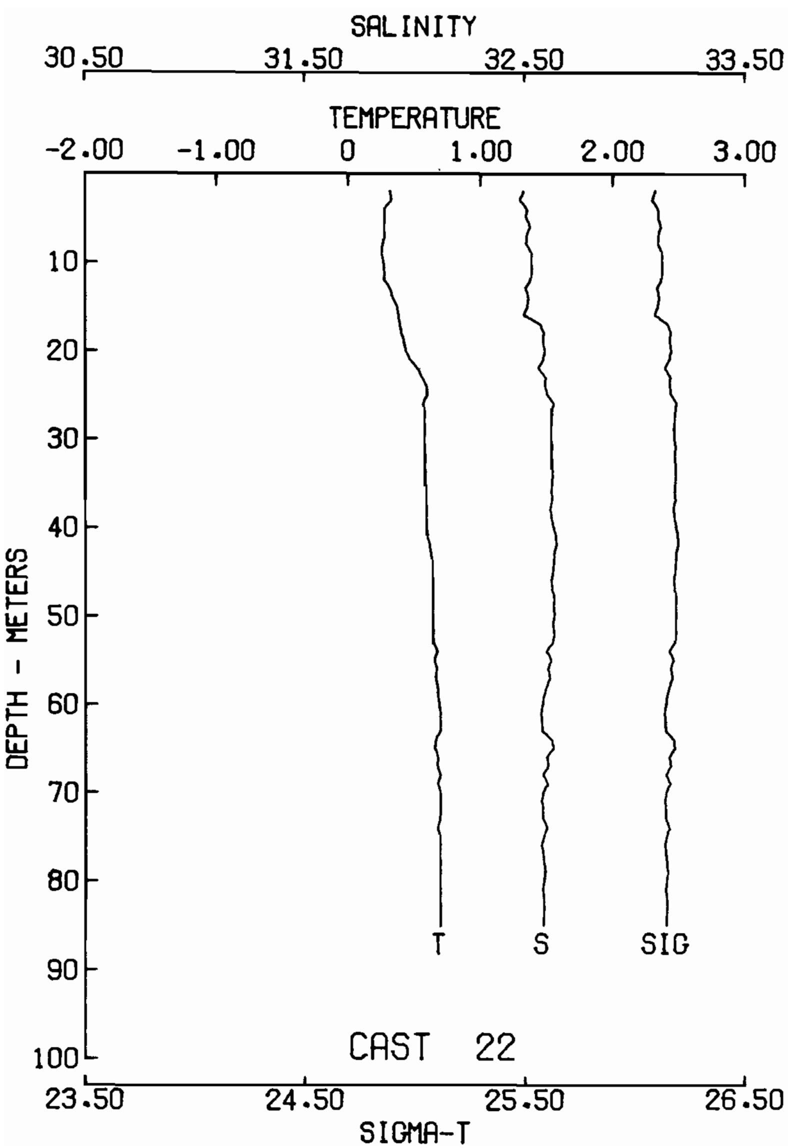
CAST RP4-SU-79A- 20 DATE 10 MAR 79 TIME 212 GMT
LAT 59 16.6N LONG 171 04.5W WEATHER SEA STATE 0
BAROMETER 93 WIND DIR 25 T SPD 10 KT VISIBILITY 7
CLOUD AMOUNT DRY -2.2 WET -3.0 DEPTH M

DEPTH (M)	TEMPERATURE (C)	SALINITY (PPT)	SIGMA-T	DELTA-D (DYN M)
0	-.35	32.25	25.93	.000
2	-.35	32.25	25.93	
5	-.35	32.24	25.92	.010
10	-.37	32.26	25.93	.021
15	-.36	32.26	25.93	.031
20	-.32	32.35	26.00	.042
25	-.27	32.35	26.00	.052
30	-.18	32.31	25.97	.062
35	-.18	32.32	25.98	.072
40	-.14	32.40	26.04	.082
45	-.08	32.38	26.02	.092
50	-.08	32.38	26.02	.102
55	-.04	32.35	25.99	.112
60	-.03	32.34	25.99	.122
65	-.06	32.37	26.01	.132
70	-.03	32.34	25.99	.142
71	-.07	32.39	26.03	



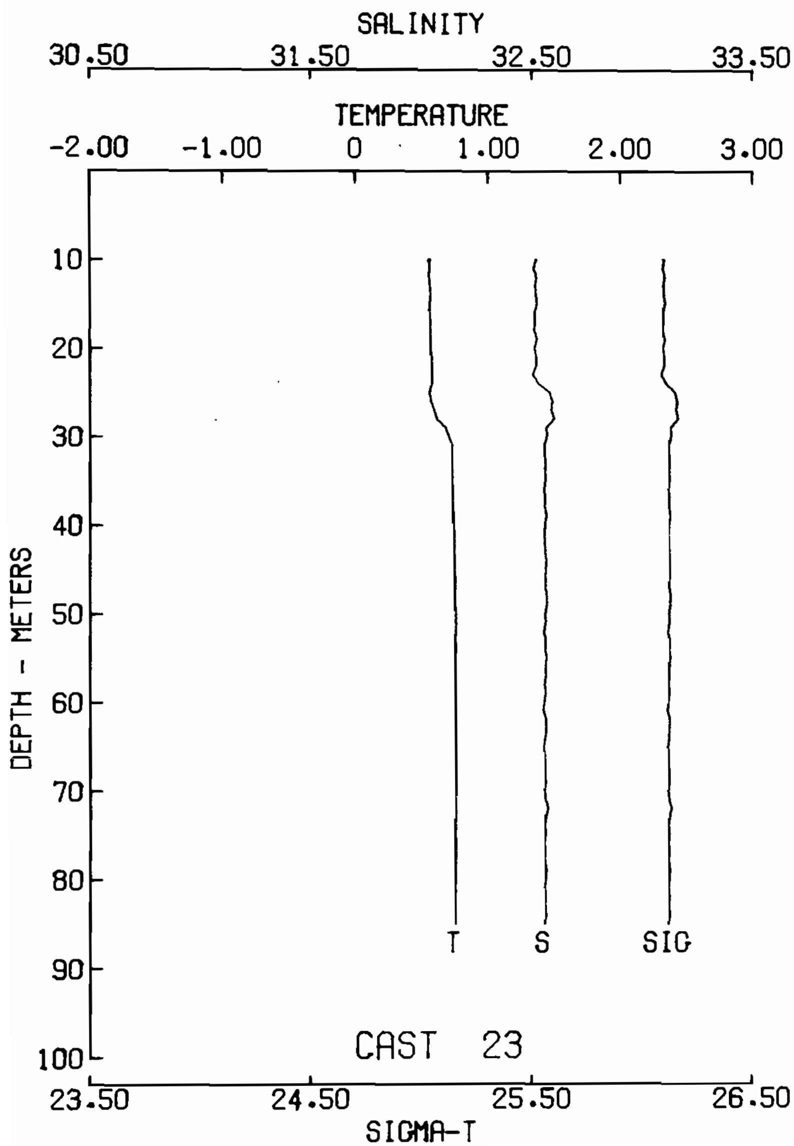
CAST RP4-SU-79A- 21 DATE 10 MAR 79 TIME 807 GMT
LAT 59 11.2N LONG 172 22.0W WEATHER SEA STATE 3
BAROMETER 95 WIND DIR T SPD 17 KT VISIBILITY 6
CLOUD AMOUNT DRY -1.0 WET -2.2 DEPTH M

DEPTH (M)	TEMPERATURE (C)	SALINITY (PPT)	SIGMA-T	DELTA-D (DYN M)
0	.96	32.64	26.17	.000
6	.95	32.61	26.15	
10	.95	32.61	26.15	.019
15	.96	32.60	26.15	.028
20	.96	32.62	26.16	.037
25	.96	32.61	26.15	.047
30	.96	32.61	26.15	.056
35	.96	32.62	26.16	.065
40	.96	32.61	26.15	.075
45	.96	32.61	26.15	.084
50	.96	32.62	26.16	.094
55	.96	32.61	26.15	.103
60	.96	32.61	26.15	.112
65	.96	32.61	26.15	.122
70	.96	32.61	26.15	.131
75	.96	32.61	26.15	.140
80	.96	32.61	26.15	.150
85	.96	32.61	26.15	.161



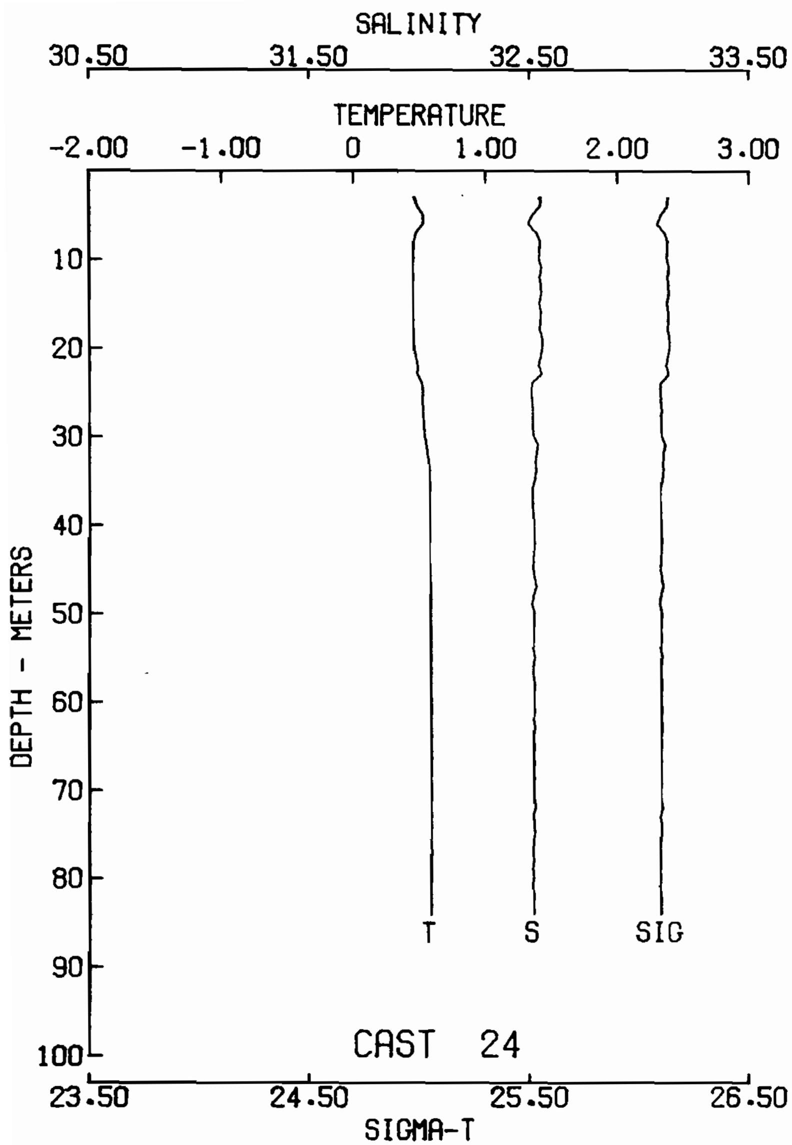
CAST RP4-SU-79A- 22   DATE 10 MAR 79   TIME 1625 GMT
LAT 59 37.1N   LONG 172 40.0W   WEATHER   SEA STATE 0
BAROMETER 96   WIND DIR 15 T SPD 18 KT   VISIBILITY 4
CLOUD   AMOUNT   DRY -2.0   WET -2.5   DEPTH   M

DEPTH (M)	TEMPERATURE (C)	SALINITY (PPT)	SIGMA-T	DELTA-D (DYN M)
0	.34	32.48	26.08	.000
2	.31	32.50	26.09	
5	.27	32.51	26.11	.010
10	.26	32.53	26.12	.019
15	.36	32.51	26.11	.029
20	.43	32.59	26.16	.038
25	.59	32.60	26.16	.047
30	.57	32.62	26.18	.057
35	.58	32.62	26.18	.066
40	.59	32.63	26.19	.075
45	.64	32.63	26.18	.084
50	.64	32.63	26.19	.093
55	.65	32.62	26.13	.103
60	.69	32.58	26.14	.112
65	.65	32.63	26.18	.121
70	.69	32.56	26.15	.131
75	.69	32.59	26.15	.140
80	.69	32.59	26.15	.149
85	.70	32.58	26.15	.161



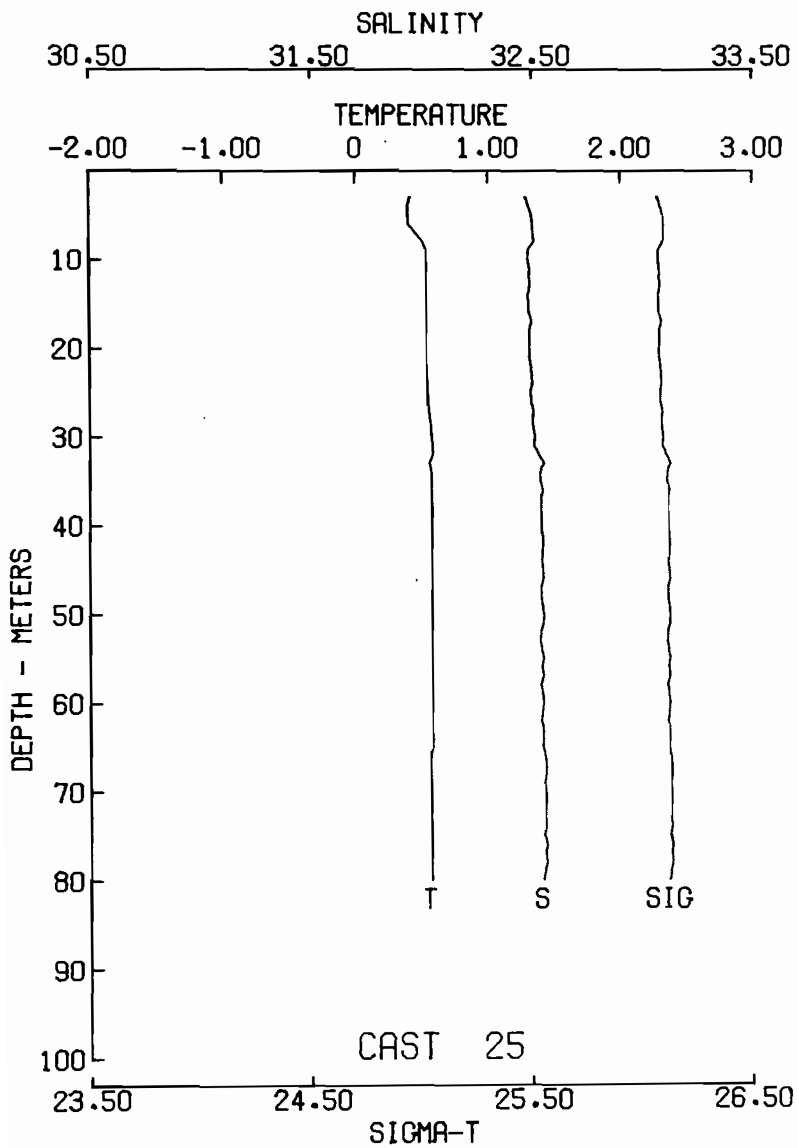
CAST RP4-SU-79A- 23 DATE 10 MAR 79 TIME 2129 GMT
LAT 59 30.8N LONG 172 36.4W WEATHER SEA STATE 2
BAROMETER 97 WIND DIR 10 T SPD 19 KT VISIBILITY 5
CLOUD AMOUNT DRY -2.0 WET -2.5 DEPTH M

DEPTH (M)	TEMPERATURE (C)	SALINITY (PPT)	SIGMA-T	DELTA-D (DYN M)
10	.56	32.52	26.10	
15	.57	32.52	26.10	.029
20	.57	32.51	26.10	.038
25	.56	32.58	26.15	.048
30	.71	32.57	26.13	.057
35	.73	32.56	26.13	.067
40	.75	32.56	26.12	.076
45	.75	32.56	26.13	.086
50	.76	32.56	26.12	.095
55	.76	32.57	26.13	.105
60	.76	32.56	26.12	.114
65	.76	32.56	26.12	.124
70	.76	32.56	26.12	.133
75	.76	32.56	26.13	.143
80	.76	32.56	26.13	.152
85	.76	32.56	26.12	.164



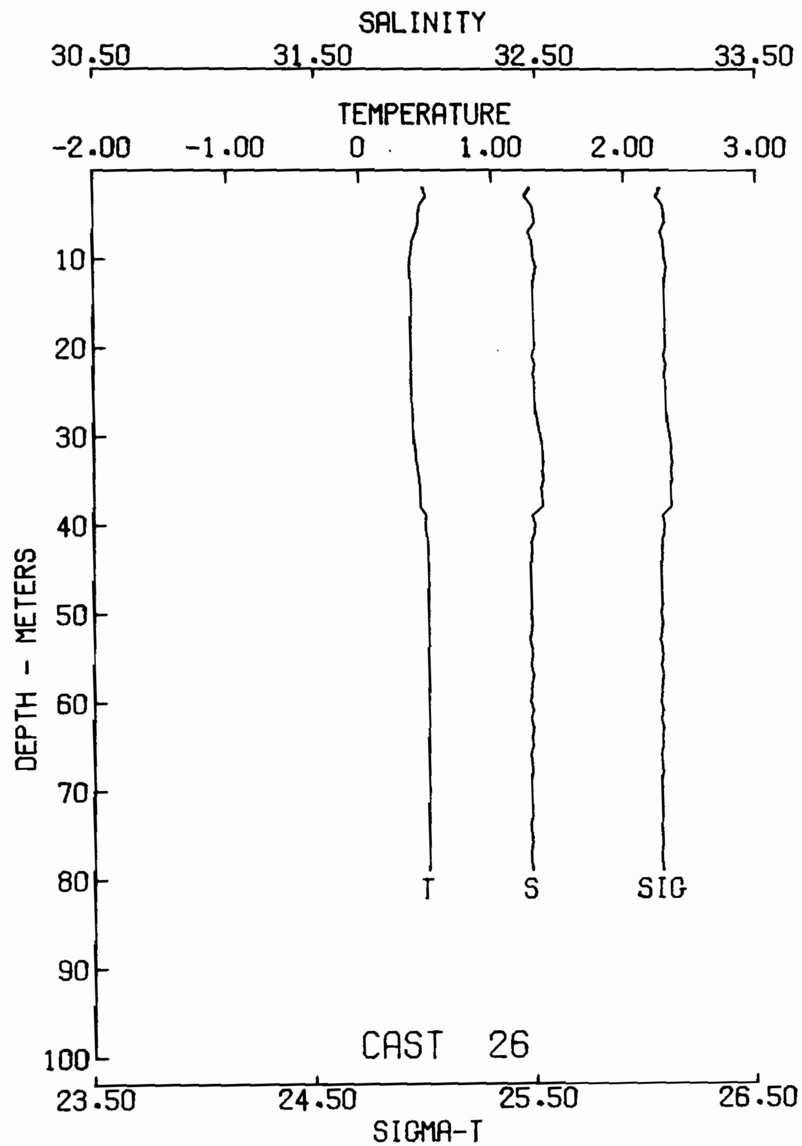
CAST RP4-SU-79A- 24 DATE 11 MAR 79 TIME 0 GMT
LAT 59 22.8N LONG 172 19.7W WEATHER SEA STATE 2
BAROMETER 97 WIND DIR 10 T SPD 18 KT VISIBILITY 5
CLOUD AMOUNT DRY -1.9 WET -2.6 DEPTH M

DEPTH (M)	TEMPERATURE (C)	SALINITY (PPT)	SIGMA-T	DELTA-D (DYN M)
0	.46	32.57	26.15	.000
3	.46	32.55	26.13	
5	.53	32.51	26.10	.009
10	.45	32.54	26.13	.019
15	.45	32.54	26.13	.028
20	.46	32.56	26.14	.038
25	.52	32.51	26.09	.047
30	.54	32.52	26.10	.057
35	.57	32.52	26.10	.067
40	.57	32.52	26.10	.076
45	.58	32.52	26.10	.086
50	.58	32.52	26.10	.095
55	.59	32.52	26.10	.105
60	.59	32.52	26.10	.115
65	.59	32.52	26.10	.124
70	.59	32.52	26.10	.134
75	.59	32.52	26.10	.143
80	.59	32.52	26.10	.153
84	.59	32.52	26.10	



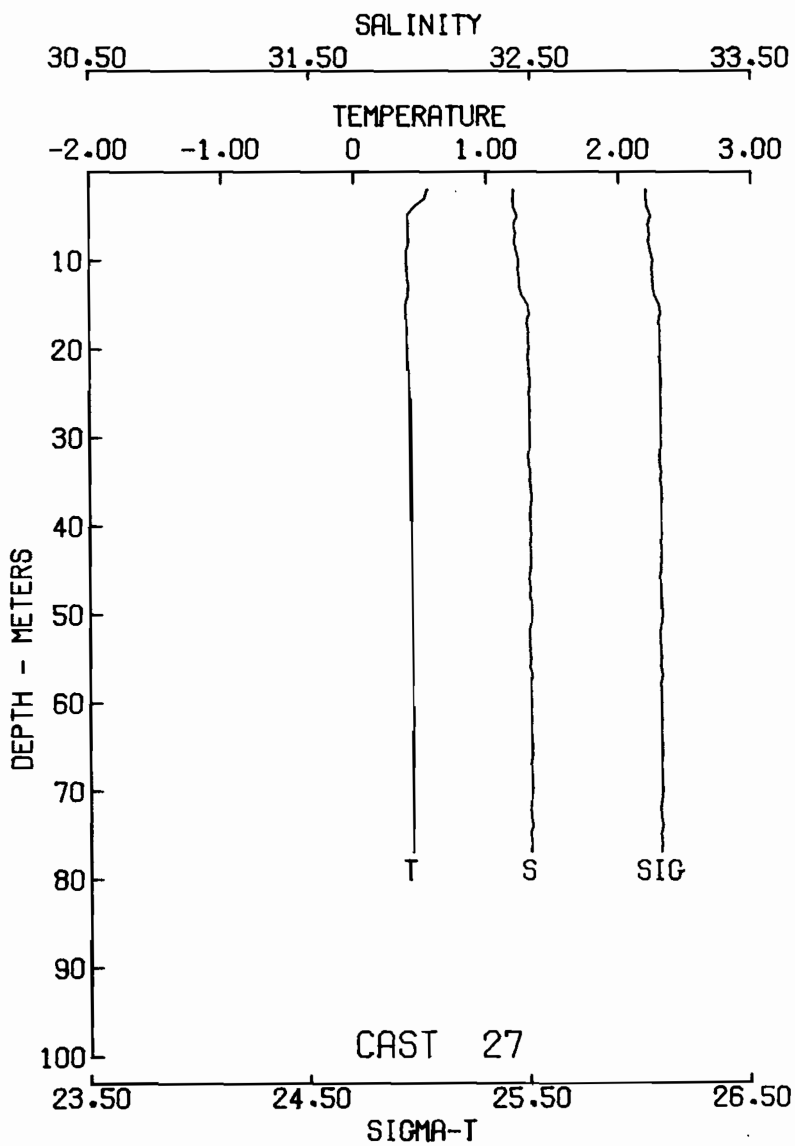
CAST KP4-SU-79A- 25   DATE 11 MAR 79   TIME 136 GMT
LAT 59 17.7N LONG 172 02.4W WEATHER   SEA STATE 2
BAROMETER 97 WIND DIR 40 T SPD 4 KT VISIBILITY 6
CLOUD   AMOUNT   DRY -1.2 WET -2.2   DEPTH   M

DEPTH (M)	TEMPERATURE (C)	SALINITY (PPT)	SIGMA-T	DELTA-D (DYN M)
0	.37	32.45	26.06	.000
3	.41	32.47	26.07	
5	.40	32.50	26.09	.010
10	.53	32.48	26.07	.019
15	.53	32.49	26.08	.029
20	.53	32.49	26.08	.039
25	.55	32.50	26.08	.048
30	.57	32.51	26.09	.058
35	.58	32.54	26.11	.068
40	.56	32.54	26.12	.077
45	.58	32.55	26.12	.087
50	.57	32.55	26.13	.096
55	.56	32.55	26.13	.106
60	.58	32.55	26.13	.115
65	.58	32.55	26.12	.125
70	.57	32.56	26.13	.134
75	.57	32.55	26.13	.144
80	.57	32.55	26.13	.155



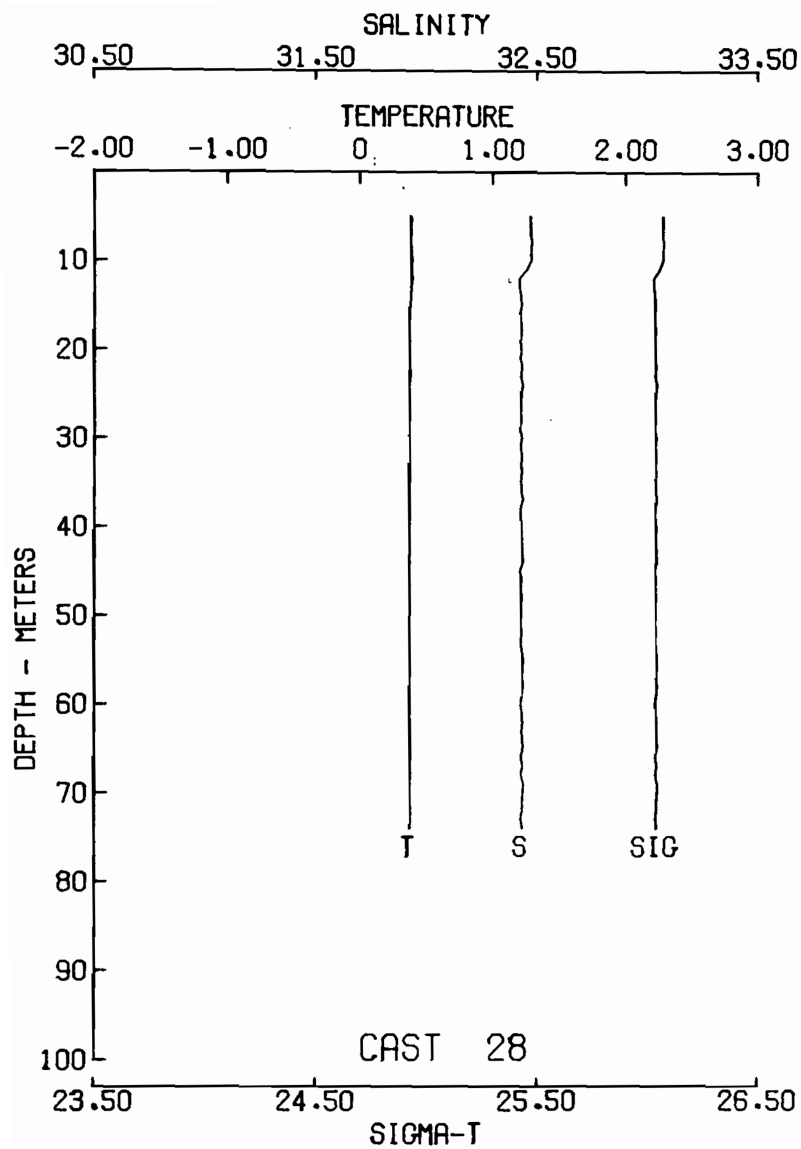
CAST RP4-SU-79A- 26 DATE 11 MAR 79 TIME 316 GMT
LAT 59 13.2N LONG 171 45.3W WEATHER SEA STATE 2
BAROMETER 98 WIND DIR 105 T SPD 6 KT VISIBILITY 6
CLOUD AMOUNT DRY -.2 WET -1.5 DEPTH M

DEPTH (M)	TEMPERATURE (C)	SALINITY (PPT)	SIGMA-T	DELTA-D (DYN M)
0	.52	32.46	26.06	.000
2	.49	32.47	26.07	
5	.45	32.49	26.08	.010
10	.39	32.49	26.09	.019
15	.39	32.49	26.08	.029
20	.39	32.49	26.09	.039
25	.39	32.49	26.09	.048
30	.41	32.52	26.11	.056
35	.45	32.53	26.12	.068
40	.50	32.49	26.08	.077
45	.52	32.48	26.07	.087
50	.52	32.48	26.07	.097
55	.52	32.48	26.07	.106
60	.53	32.48	26.07	.116
65	.53	32.49	26.08	.126
70	.53	32.48	26.07	.136
75	.53	32.48	26.07	.145
79	.52	32.48	26.07	



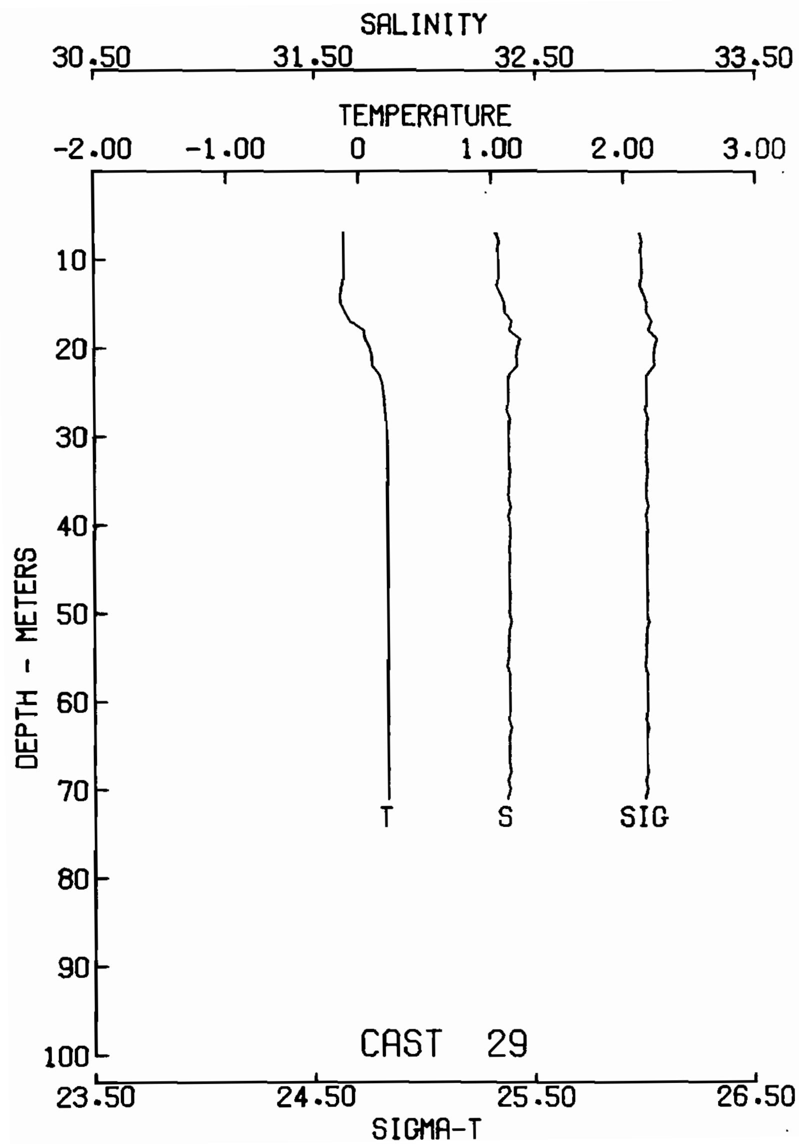
CAST RP4-SU-79A- 27 DATE 11 MAR 79 TIME 440 GMT
LAT 59 7.9N LONG 171 28.5W WEATHER SEA STATE 2
BAROMETER 99 WIND DIR 98 T SPD 7 KT VISIBILITY 6
CLOUD AMOUNT DRY - .5 WET -1.5 DEPTH M

DEPTH (M)	TEMPERATURE (C)	SALINITY (PPT)	SIGMA-T	DELTA-D (DYN M)
0	.61	32.42	26.02	.000
2	.56	32.42	26.02	
5	.40	32.44	26.05	.010
10	.40	32.45	26.05	.020
15	.39	32.49	26.06	.030
20	.40	32.49	26.09	.039
25	.42	32.49	26.09	.049
30	.42	32.50	26.09	.059
35	.43	32.49	26.09	.068
40	.43	32.50	26.09	.078
45	.43	32.50	26.09	.088
50	.44	32.51	26.10	.097
55	.44	32.50	26.09	.107
60	.44	32.50	26.10	.116
65	.44	32.51	26.10	.126
70	.44	32.51	26.10	.136
75	.44	32.50	26.09	.145
77	.44	32.50	26.09	



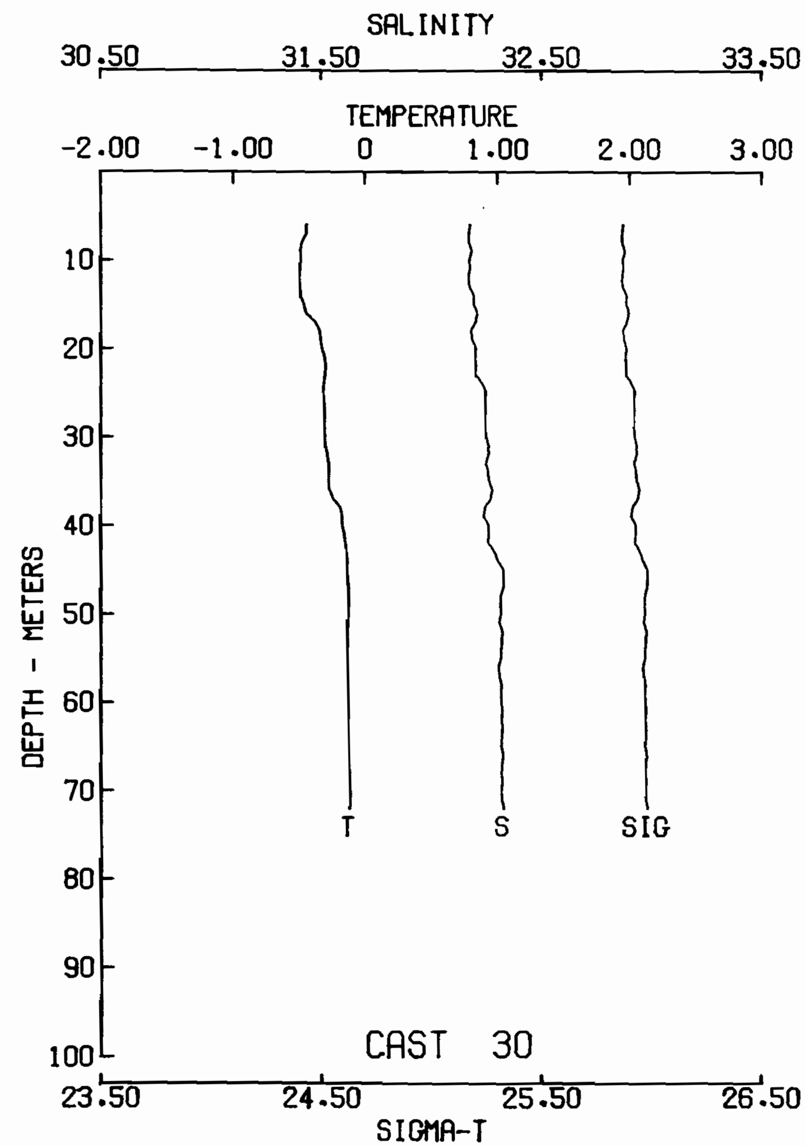
CAST KP4-SU-79A- 28 DATE 11 MAR 79 TIME 614 GMT
LAT 59 02.4N LONG 171 10.8W WEATHER SEA STATE 2
BAROMETER 99 WIND DIR 142 T SPD 8 KT VISIBILITY 7
CLOUD AMOUNT DRY 0 WET -1.4 DEPTH 74 M

DEPTH (M)	TEMPERATURE (C)	SALINITY (PPT)	SIGMA-T	DELTA-D (DYN M)
0	.38	32.47	26.07	.000
5	.38	32.47	26.07	
10	.39	32.47	26.07	.019
15	.38	32.43	26.04	.029
20	.37	32.43	26.04	.039
25	.37	32.43	26.04	.049
30	.37	32.43	26.04	.059
35	.37	32.43	26.04	.069
40	.37	32.43	26.04	.079
45	.37	32.42	26.03	.089
50	.37	32.43	26.04	.099
55	.37	32.44	26.04	.109
60	.38	32.43	26.04	.118
65	.37	32.44	26.04	.128
70	.37	32.44	26.04	.138
74	.37	32.43	26.04	



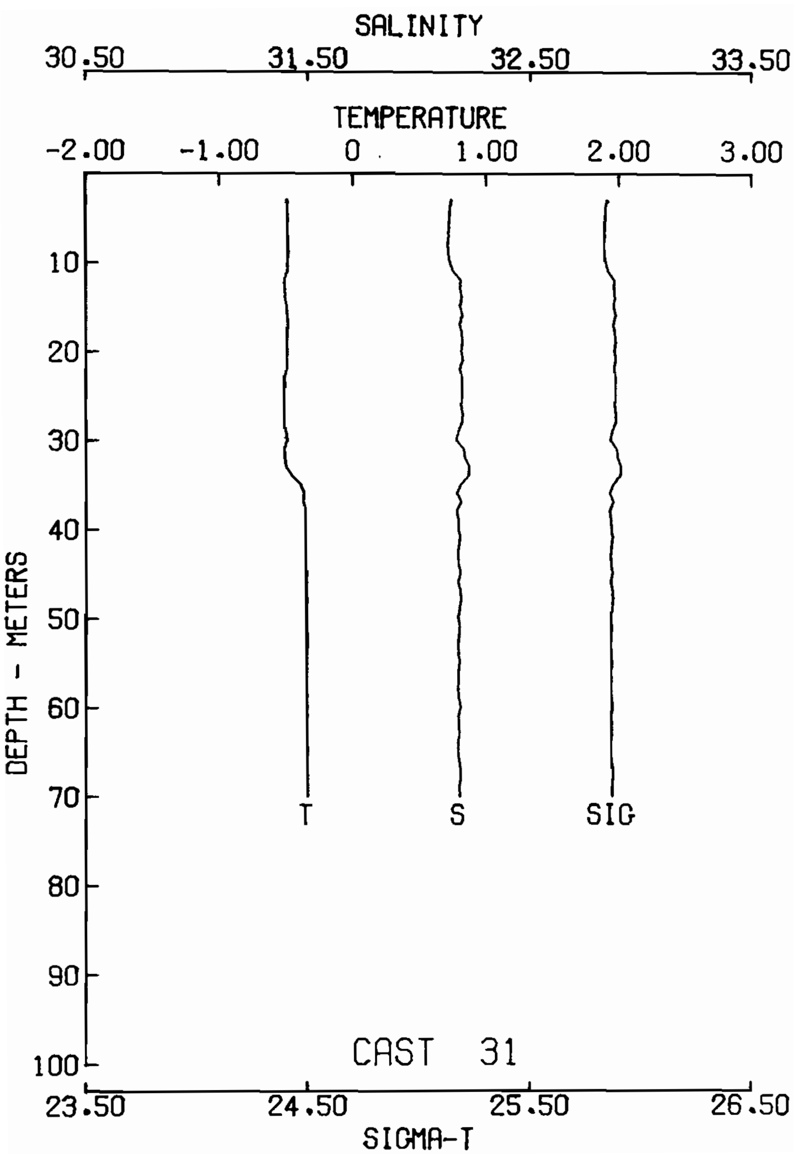
CAST RP4-SU-79A- 29 DATE 11 MAR 79 TIME 736 GMT
LAT 58 58.4N LONG 170 57.6W WEATHER SEA STATE 2
BAROMETER 0 WIND DIR 140 T SPD 8 KT VISIBILITY 7
CLOUD AMOUNT DRY 0 WET -1.4 DEPTH 73 M

DEPTH (M)	TEMPERATURE (C)	SALINITY (PPT)	SIGMA-T	DELTA-D (DYN M)
7	-.11	32.32	25.97	
10	-.11	32.33	25.98	.020
15	-.14	32.36	26.01	.031
20	.08	32.42	26.04	.040
25	.18	32.37	26.00	.050
30	.21	32.37	26.00	.061
35	.22	32.38	26.01	.071
40	.22	32.38	26.01	.081
45	.22	32.38	26.01	.091
50	.22	32.38	26.01	.101
55	.22	32.38	26.00	.111
60	.22	32.38	26.01	.121
65	.22	32.38	26.01	.131
70	.22	32.38	26.01	.141
71	.22	32.37	26.00	



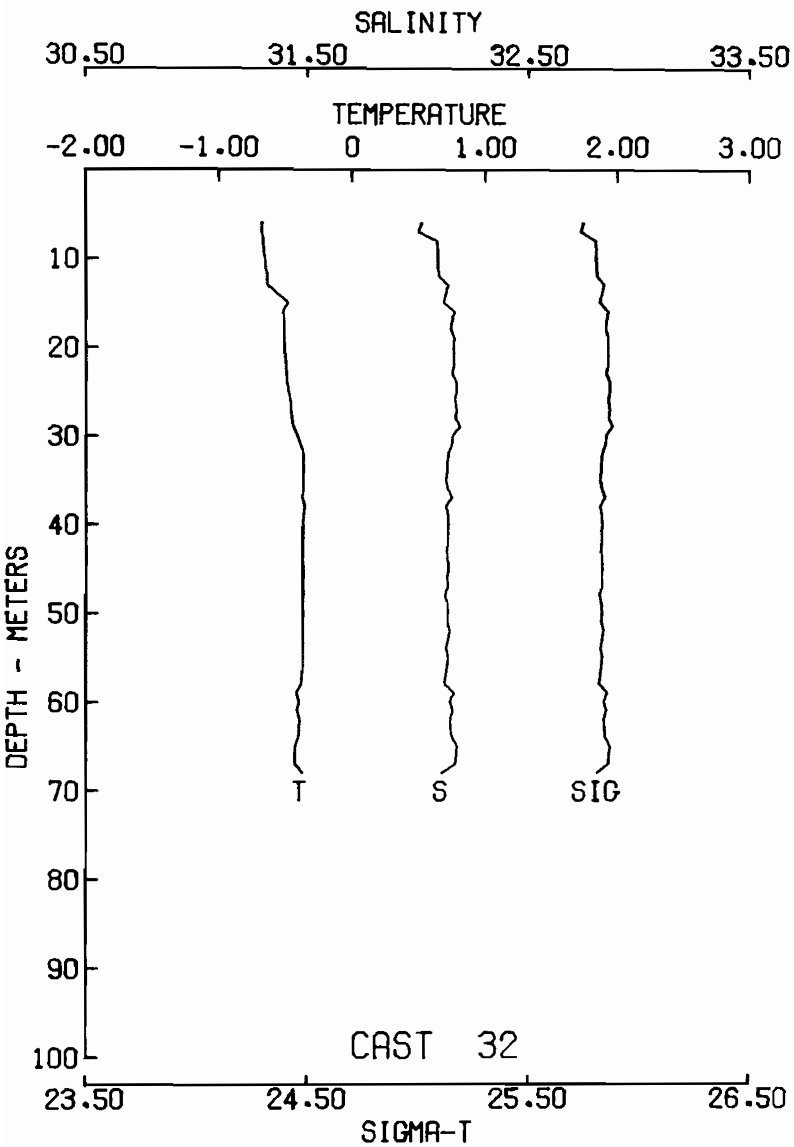
CAST RP4-SU-79A- 30 DATE 11 MAR 79 TIME 928 GMT
LAT 59 53.7N LONG 170 40.8W WEATHER SEA STATE 0
BAROMETER 00 WIND DIR 147 T SPD 12 KT VISIBILITY 7
CLOUD AMOUNT DRY .1 WET -1.0 DEPTH 72 M

DEPTH (M)	TEMPERATURE (C)	SALINITY (PPT)	SIGMA-T	DELTA-D (DYN M)
0	-.45	32.21	25.90	.000
6	-.45	32.18	25.87	
10	-.49	32.17	25.87	.021
15	-.47	32.19	25.89	.032
20	-.33	32.20	25.89	.043
25	-.32	32.25	25.92	.053
30	-.31	32.25	25.92	.064
35	-.28	32.26	25.93	.074
40	-.18	32.26	25.93	.084
45	-.14	32.33	25.98	.095
50	-.13	32.31	25.97	.105
55	-.14	32.32	25.97	.115
60	-.13	32.32	25.97	.125
65	-.13	32.32	25.97	.136
70	-.12	32.32	25.97	.146
72	-.12	32.33	25.98	



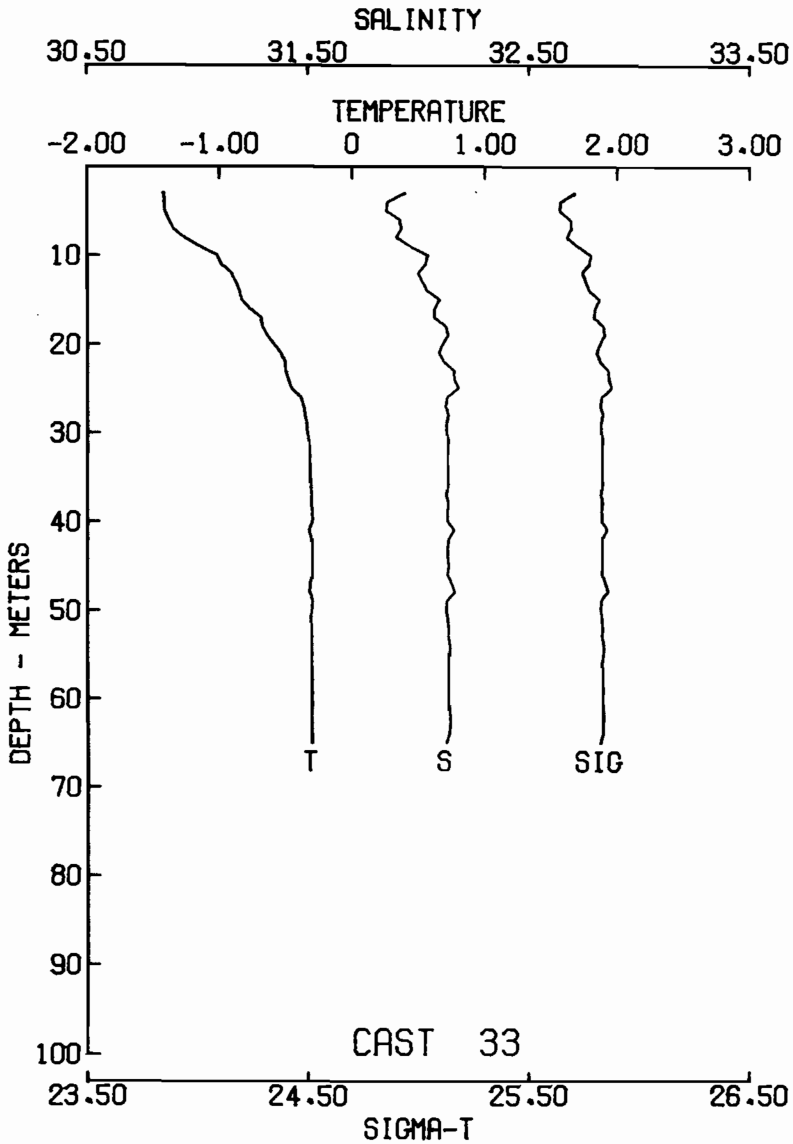
CAST RP4-SU-79A- 31 DATE 11 MAR 79 TIME 1117 GMT
LAT 58 49.2N LONG 170 23.3W WEATHER SEA STATE 0
BAROMETER 2 WIND DIR T SPD 0 KT VISIBILITY 6
CLOUD AMOUNT DRY 1.0 WET - .5 DEPTH M

DEPTH (M)	TEMPERATURE (C)	SALINITY (PPT)	SIGMA-T	DELTA-D (DYN M)
0	-.49	32.15	25.85	.000
3	-.49	32.14	25.85	
5	-.49	32.14	25.84	.011
10	-.49	32.14	25.84	.022
15	-.50	32.18	25.88	.032
20	-.49	32.19	25.88	.043
25	-.52	32.19	25.89	.054
30	-.49	32.16	25.86	.064
35	-.39	32.19	25.88	.075
40	-.35	32.18	25.87	.085
45	-.34	32.19	25.87	.096
50	-.34	32.18	25.87	.107
55	-.34	32.18	25.87	.118
60	-.34	32.19	25.88	.128
65	-.34	32.18	25.87	.139
70	-.34	32.19	25.87	.152



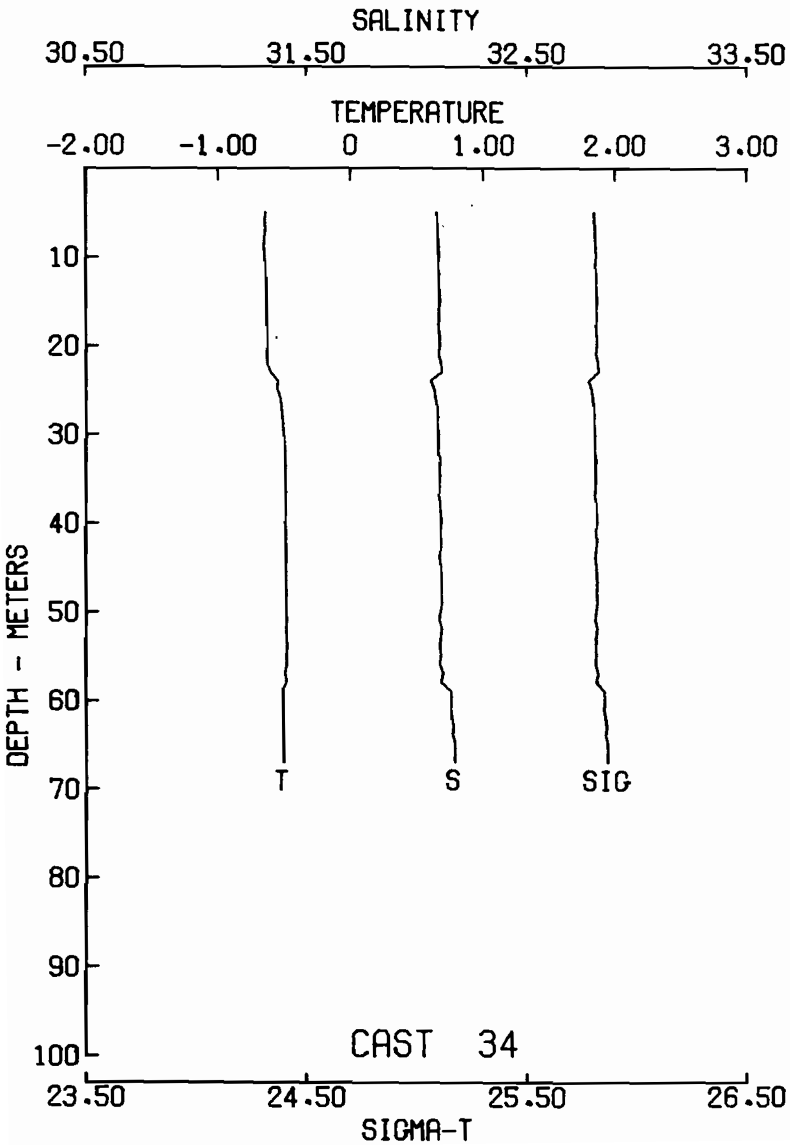
CAST RP4-SU-79A- 32 DATE 11 MAR 79 TIME 1316 GMT
LAT 58 44.2N LONG 170 07.2W WEATHER SEA STATE 0
BAROMETER 2 WIND DIR 85 T SPD 8 KT VISIBILITY 6
CLOUD AMOUNT DRY 0 WET 0 DEPTH M

DEPTH (M)	TEMPERATURE (C)	SALINITY (PPT)	SIGMA-T	DELTA-D (DYN M)
0	-.67	32.10	25.81	.000
5	-.68	32.01	25.75	
10	-.65	32.09	25.81	.022
15	-.48	32.11	25.82	.033
20	-.50	32.16	25.86	.044
25	-.47	32.17	25.87	.055
30	-.41	32.15	25.85	.065
35	-.37	32.12	25.83	.076
40	-.36	32.14	25.83	.087
45	-.36	32.14	25.84	.098
50	-.37	32.13	25.83	.109
55	-.37	32.14	25.83	.120
60	-.40	32.14	25.84	.131
65	-.42	32.18	25.87	.141
68	-.37	32.11	25.81	



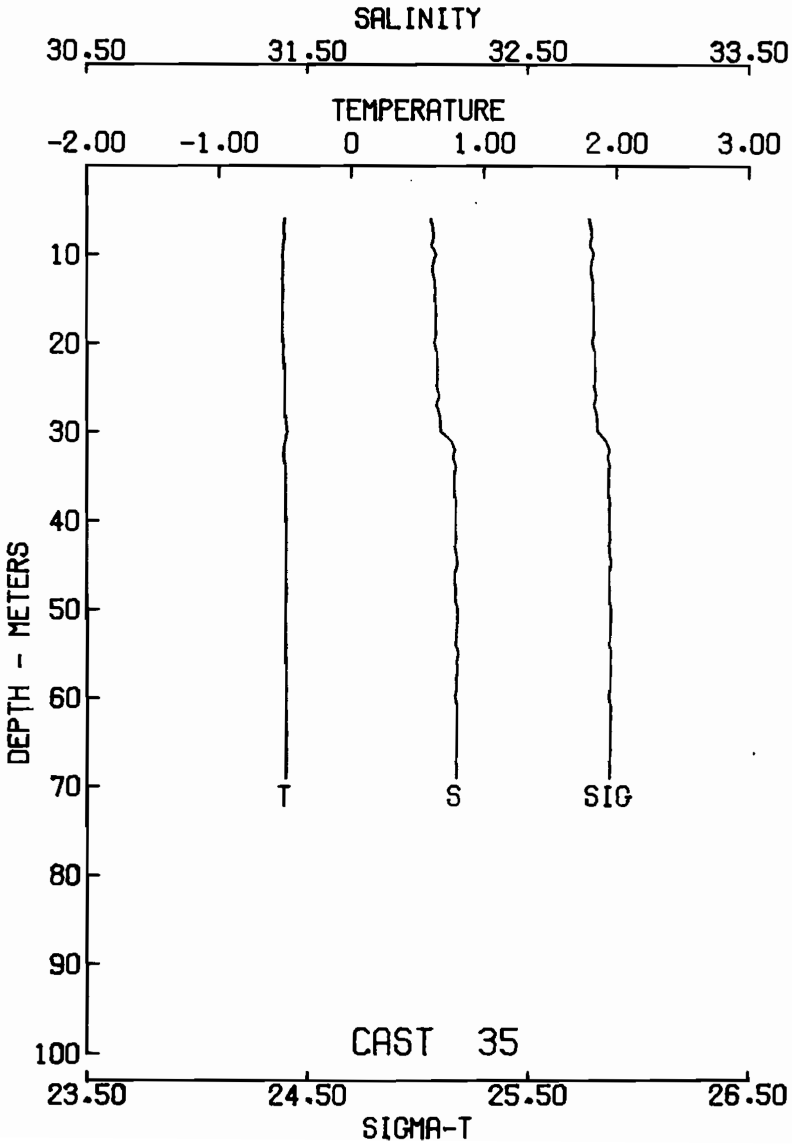
CAST RP4-SU-79A- 33   DATE 11 MAR 79   TIME 1639 GMT
LAT 58 56.5N   LONG 170 60.8W   WEATHER   SEA STATE 0
BAROMETER 3   WIND DIR 70 T   SPD 8 KT   VISIBILITY 6
CLOUD   AMOUNT   DRY 0   WET -1.3   DEPTH M

DEPTH (M)	TEMPERATURE (C)	SALINITY (PPT)	SIGMA-T	DELTA-D (DYN M)
0	-1.49	31.88	25.67	.000
3	-1.42	31.94	25.71	
5	-1.41	31.85	25.64	.012
10	-1.02	32.04	25.78	.023
15	-.83	32.10	25.82	.034
20	-.59	32.11	25.82	.045
25	-.46	32.18	25.97	.056
30	-.34	32.13	25.83	.067
35	-.32	32.13	25.83	.078
40	-.30	32.13	25.83	.089
45	-.31	32.14	25.83	.100
50	-.31	32.13	25.83	.110
55	-.31	32.14	25.84	.121
60	-.31	32.14	25.83	.132
65	-.30	32.13	25.83	.145



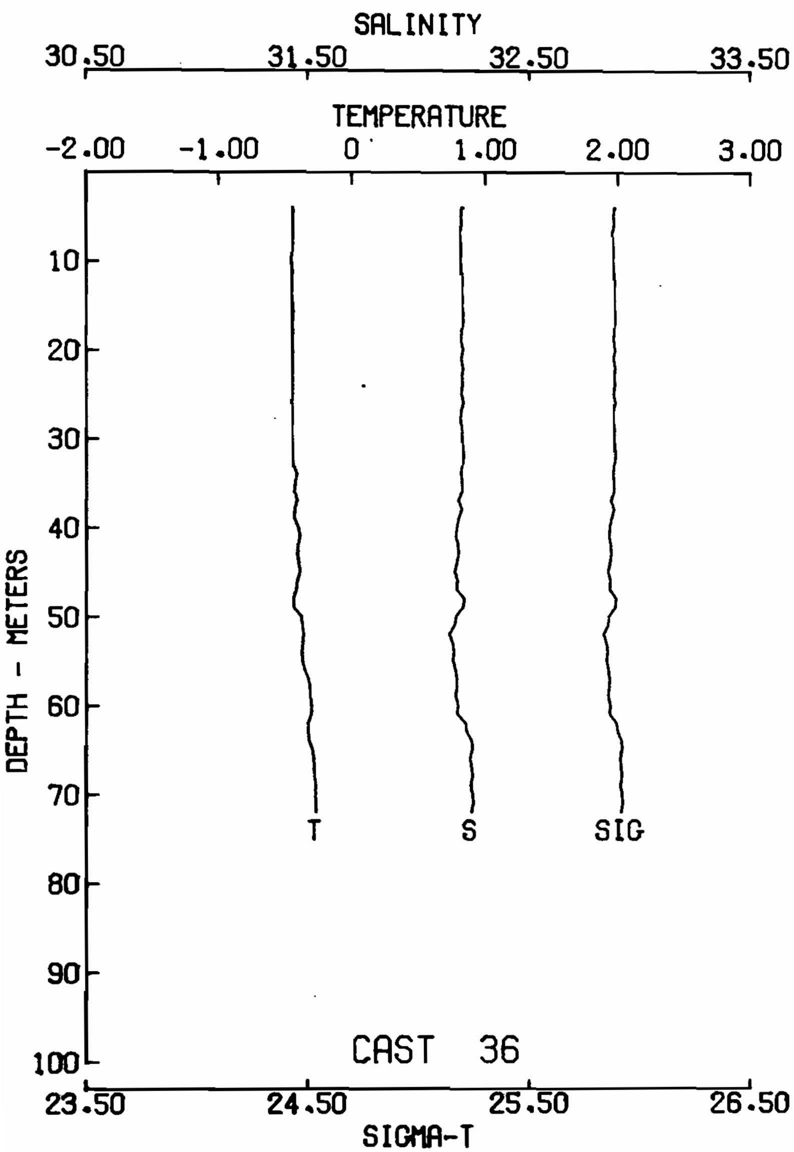
CAST RP4-SU-79A- 34 DATE 12 MAR 79 TIME 439 GMT
LAT 58 53.8N LONG 170 13.9W WEATHER SEA STATE 0
BAROMETER 7 WIND DIR 328 T SPD 22 KT VISIBILITY 7
CLOUD AMOUNT DRY -3.2 WET -3.6 DEPTH M

DEPTH (M)	TEMPERATURE (C)	SALINITY (PPT)	SIGMA-T	DELTA-D (DYN M)
0	-.64	32.07	25.79	.000
5	-.64	32.09	25.81	
10	-.65	32.10	25.82	.022
15	-.64	32.10	25.82	.033
20	-.63	32.10	25.82	.044
25	-.55	32.08	25.79	.055
30	-.51	32.10	25.81	.066
35	-.49	32.10	25.81	.077
40	-.49	32.11	25.82	.088
45	-.49	32.11	25.82	.099
50	-.49	32.11	25.82	.110
55	-.48	32.11	25.82	.121
60	-.51	32.15	25.86	.131
65	-.51	32.17	25.87	.142
67	-.51	32.17	25.87	



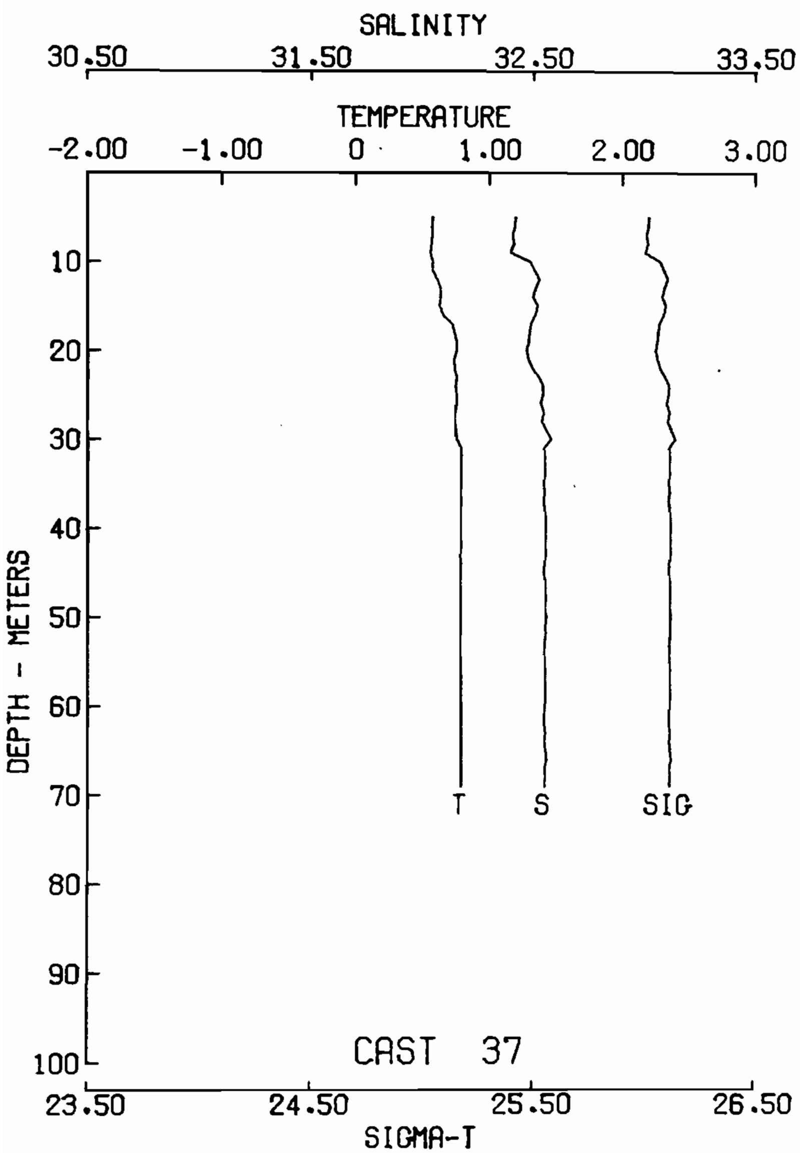
CAST RP4-SU-79A- 35 DATE 12 MAR 79 TIME 822 GMT
LAT 58 52.6N LONG 170 17.9W WEATHER SEA STATE 3
BAROMETER 8 WIND DIR 7 T SPD 23 KT VISIBILITY 6
CLOUD AMOUNT DRY -3.0 WET -3.7 DEPTH M

DEPTH (M)	TEMPERATURE (C)	SALINITY (PPT)	SIGMA-T	DELTA-D (DYN M)
0	-.49	31.99	25.73	.000
6	-.51	32.06	25.78	
10	-.53	32.08	25.80	.022
15	-.53	32.08	25.79	.033
20	-.52	32.07	25.79	.045
25	-.51	32.08	25.80	.056
30	-.49	32.10	25.81	.067
35	-.50	32.17	25.86	.077
40	-.50	32.17	25.87	.088
45	-.50	32.18	25.88	.099
50	-.50	32.18	25.88	.109
55	-.50	32.18	25.88	.120
60	-.50	32.17	25.87	.131
65	-.50	32.17	25.87	.141
69	-.50	32.17	25.87	



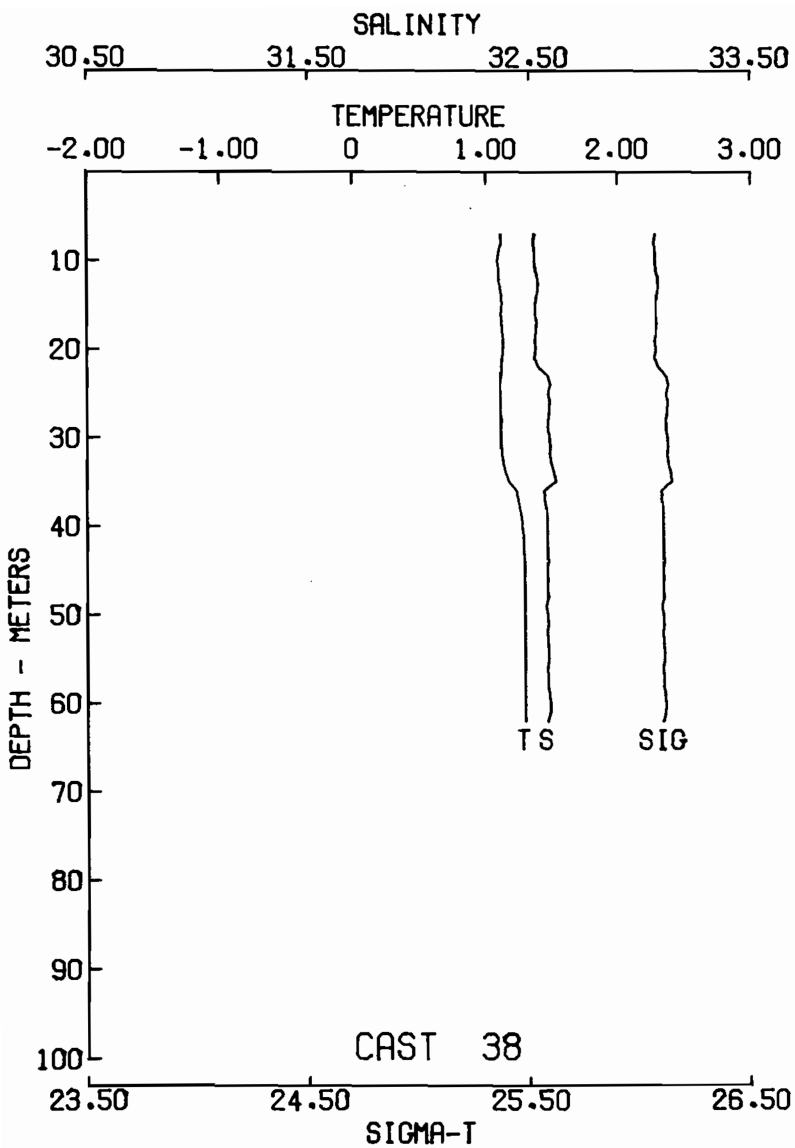
CAST RP4-SU-79A- 36 DATE 12 MAR 79 TIME 1636 GMT
LAT 58 46.9N LONG 170 25.3W WEATHER SEA STATE 0
BAROMETER 12 WIND DIR 10 T SPD 18 KT VISIBILITY 7
CLOUD AMOUNT DRY -4.9 WET -5.2 DEPTH M

DEPTH (M)	TEMPERATURE (C)	SALINITY (PPT)	SIGMA-T	DELTA-D (DYN M)
0	-.45	32.21	25.90	.000
4	-.45	32.19	25.89	
5	-.45	32.19	25.88	.011
10	-.46	32.19	25.88	.021
15	-.45	32.20	25.89	.032
20	-.45	32.20	25.89	.042
25	-.45	32.19	25.88	.053
30	-.45	32.20	25.89	.064
35	-.43	32.19	25.88	.074
40	-.41	32.17	25.87	.085
45	-.39	32.16	25.86	.096
50	-.39	32.17	25.86	.106
55	-.37	32.15	25.85	.117
60	-.31	32.18	25.87	.128
65	-.30	32.24	25.92	.138
70	-.28	32.24	25.92	.149
72	-.27	32.24	25.92	



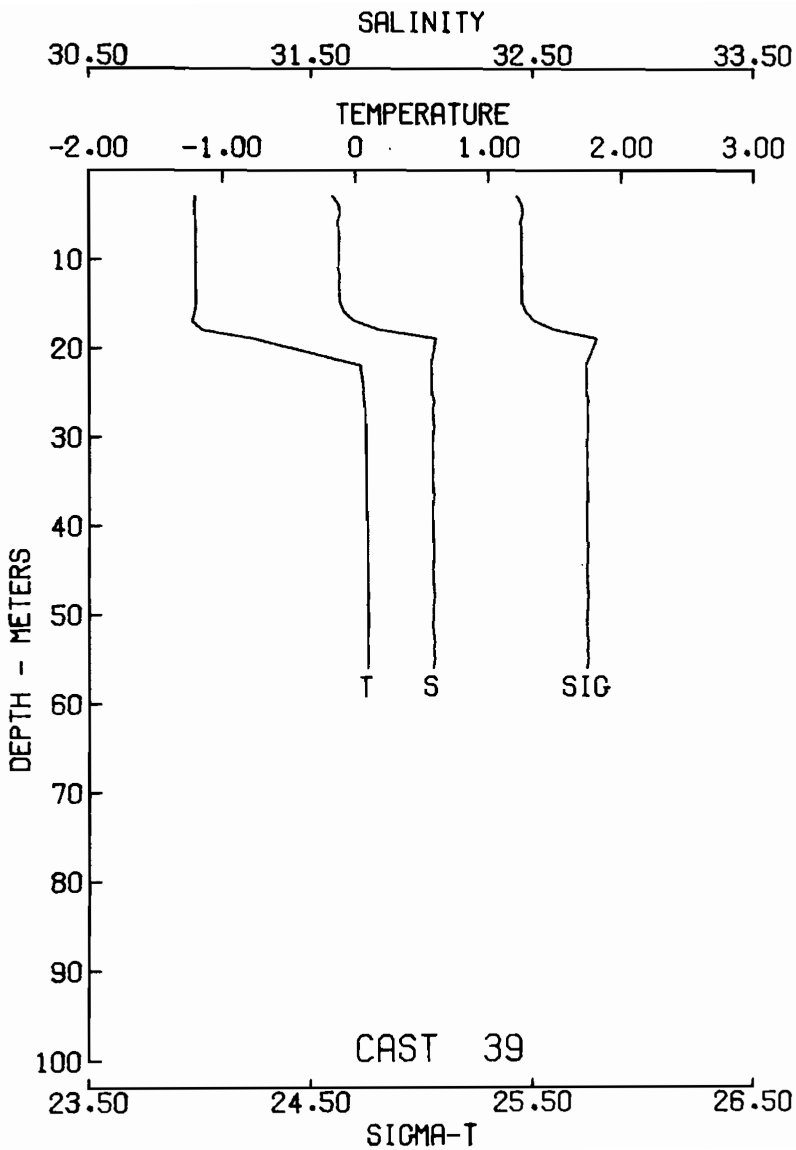
CAST RP4-SU-79A- 37 DATE 13 MAR 79 TIME 438 GMT
LAT 57 58.5N LONG 168 21.1W WEATHER SEA STATE 2
BAROMETER 11 WIND DIR 358 T SPD 21 KT VISIBILITY 7
CLOUD AMOUNT DRY -4.0 WET -4.7 DEPTH M

DEPTH (M)	TEMPERATURE (C)	SALINITY (PPT)	SIGMA-T	DELTA-D (DYN M)
0	.58	32.45	26.05	.000
5	.57	32.42	26.02	
10	.57	32.48	26.07	.020
15	.63	32.52	26.10	.030
20	.76	32.47	26.05	.039
25	.75	32.54	26.11	.049
30	.76	32.56	26.14	.059
35	.79	32.55	26.11	.068
40	.79	32.56	26.12	.078
45	.79	32.55	26.11	.087
50	.79	32.56	26.12	.097
55	.79	32.55	26.11	.106
60	.80	32.55	26.12	.116
65	.80	32.56	26.12	.125
69	.80	32.55	26.12	



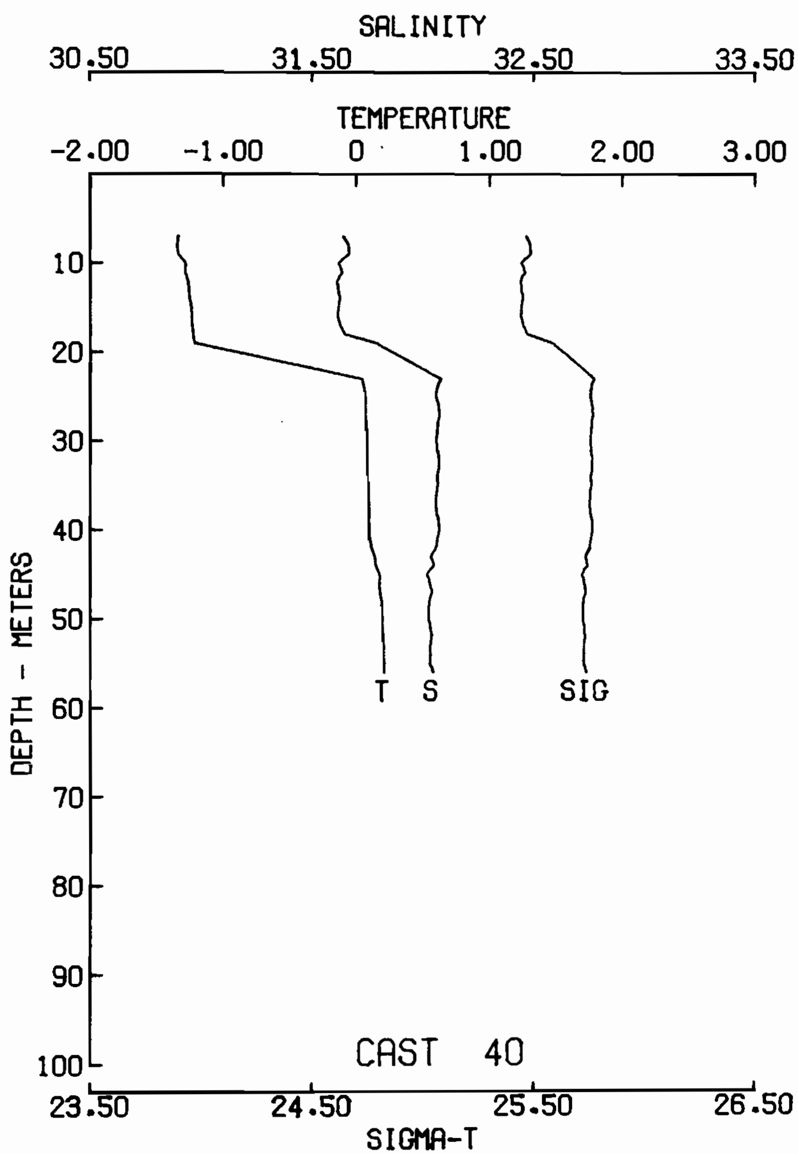
CAST RP4-SU-79A- 38 DATE 13 MAR 79 TIME 812 GMT
LAT 57 45.2N LONG 167 37.7W WEATHER SEA STATE 3
BAROMETER 10 WIND DIR 352 T SPD 15 KT VISIBILITY 6
CLOUD AMOUNT DRY -4.0 WET -5.0 DEPTH 62 M

DEPTH (M)	TEMPERATURE (C)	SALINITY (PPT)	SIGMA-T	DELTA-D (DYN M)
7	1.11	32.52	26.07	
10	1.09	32.52	26.07	.019
15	1.12	32.53	26.07	.029
20	1.13	32.53	26.07	.039
25	1.11	32.58	26.12	.048
30	1.12	32.59	26.13	.058
35	1.18	32.62	26.15	.067
40	1.28	32.58	26.11	.077
45	1.30	32.58	26.11	.087
50	1.30	32.56	26.11	.096
55	1.30	32.59	26.11	.106
60	1.30	32.60	26.12	.115
62	1.31	32.59	26.11	



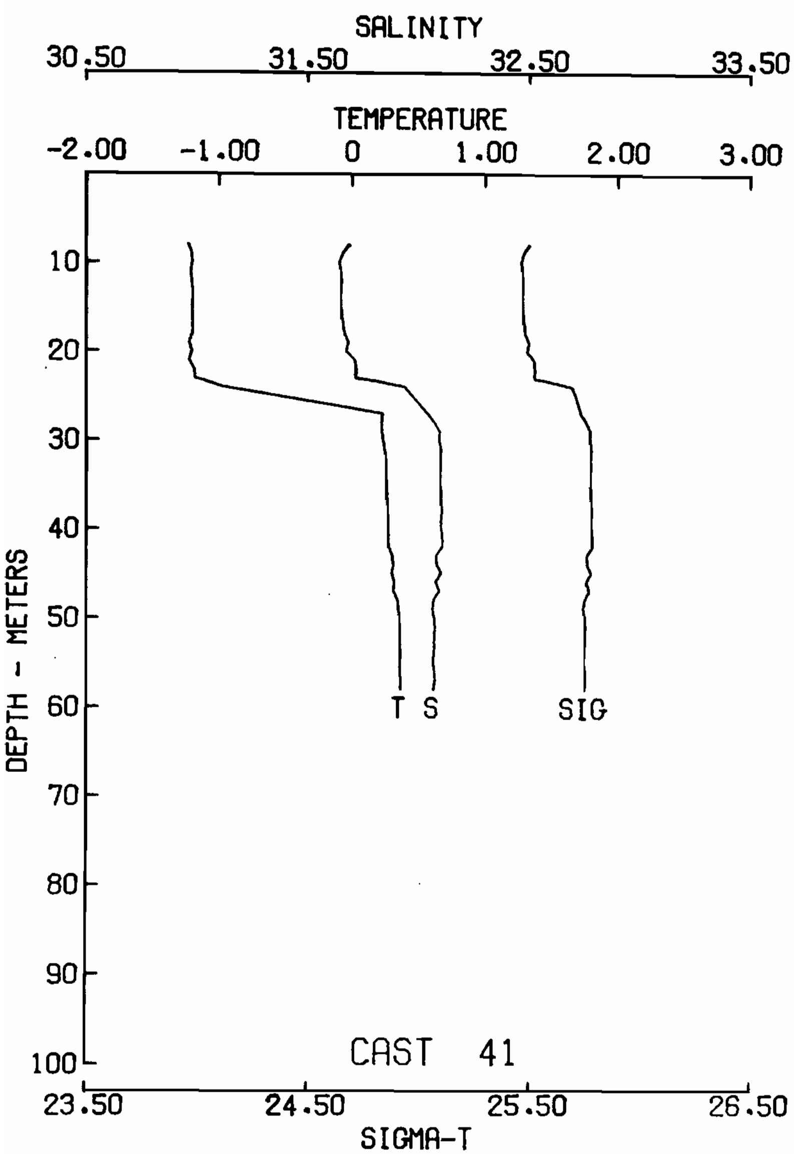
CAST RP4-SU-79A- 39 DATE 14 MAR 79 TIME 436 GMT
LAT 58 01.6N LONG 166 14.9W WEATHER SEA STATE 0
BAROMETER 9 WIND DIR 45 T SPD 4 KT VISIBILITY 7
CLOUD AMOUNT DRY -6.5 WET -7.5 DEPTH M

DEPTH (M)	TEMPERATURE (C)	SALINITY (PPT)	SIGMA-T	DELTA-D (DYN M)
0	-1.21	31.60	25.43	.000
3	-1.21	31.60	25.43	
5	-1.21	31.63	25.45	.013
10	-1.20	31.62	25.45	.025
15	-1.20	31.63	25.45	.038
20	-.50	32.05	25.77	.050
25	.06	32.04	25.74	.061
30	.08	32.05	25.75	.073
35	.08	32.05	25.75	.084
40	.09	32.05	25.75	.095
45	.10	32.05	25.75	.107
50	.10	32.05	25.75	.118
55	.10	32.06	25.75	.129
56	.09	32.05	25.75	



CAST RP4-SU-79A- 40 DATE 14 MAR 79 TIME 809 GMT
LAT 58 00.5N LONG 166 14.7W WEATHER SEA STATE 0
BAROMETER 8 WIND DIR 37 T SPD 8 KT VISIBILITY 7
CLOUD AMOUNT DRY -5.5 WET -7.1 DEPTH M

DEPTH (M)	TEMPERATURE (C)	SALINITY (PPT)	SIGMA-T	DELTA-D (DYN M)
7	-1.34	31.04	25.47	
10	-1.29	31.62	25.45	.025
15	-1.24	31.62	25.44	.036
20	-.90	31.86	25.63	.050
25	.07	32.06	25.75	.062
30	.08	32.06	25.75	.073
35	.09	32.07	25.76	.084
40	.10	32.07	25.77	.095
45	.18	32.02	25.72	.107
50	.20	32.03	25.72	.118
55	.21	32.03	25.73	.129
56	.21	32.05	25.74	

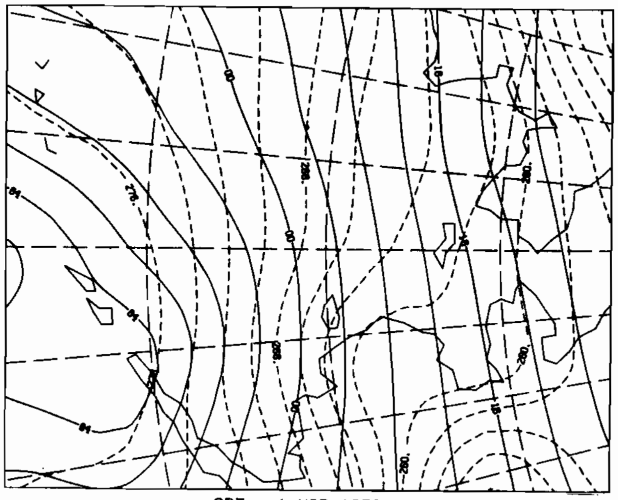


CAST RP4-SU-79A- 41 DATE 14 MAR 79 TIME 1632 GMT
LAT 58 00.2N LONG 166 14.4W WEATHER SEA STATE 0
BAROMETER 3 WIND DIR 60 T SPD 15 KT VISIBILITY 7
CLOUD AMOUNT DRY -6.8 WET -7.2 DEPTH M

DEPTH (M)	TEMPERATURE (C)	SALINITY (PPT)	SIGMA-T	DELTA-D (DYN M)
8	-1.23	31.69	25.50	
10	-1.20	31.64	25.46	.025
15	-1.20	31.65	25.47	.038
20	-1.21	31.67	25.49	.050
25	-.57	31.97	25.71	.062
30	.23	32.09	25.77	.073
35	.26	32.10	25.78	.085
40	.27	32.10	25.78	.096
45	.30	32.10	25.78	.107
50	.36	32.07	25.75	.118
55	.36	32.07	25.75	.129
58	.37	32.07	25.75	

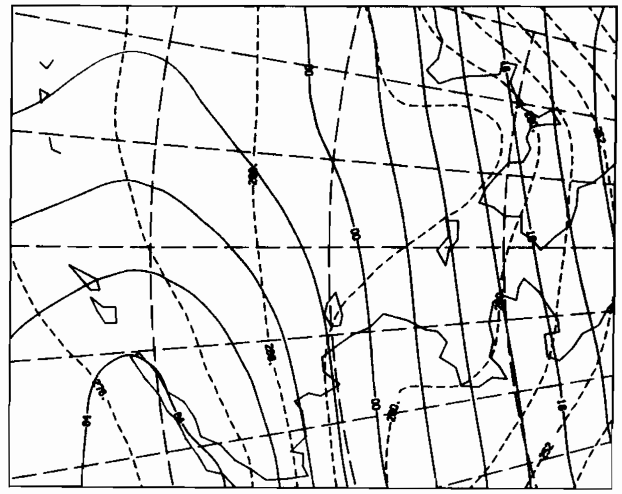
APPENDIX B: SURFACE AIR ISOTHERMS AT 00Z AND 12Z, FROM THE WSFO SURFACE ANALYSES. TEMPERATURES ARE DEGREES KELVIN.

SLP AND TEMP



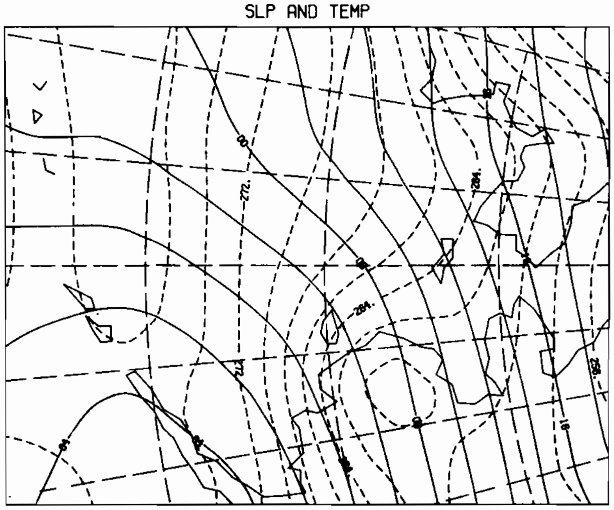
00Z 1 MAR 1979

SLP AND TEMP



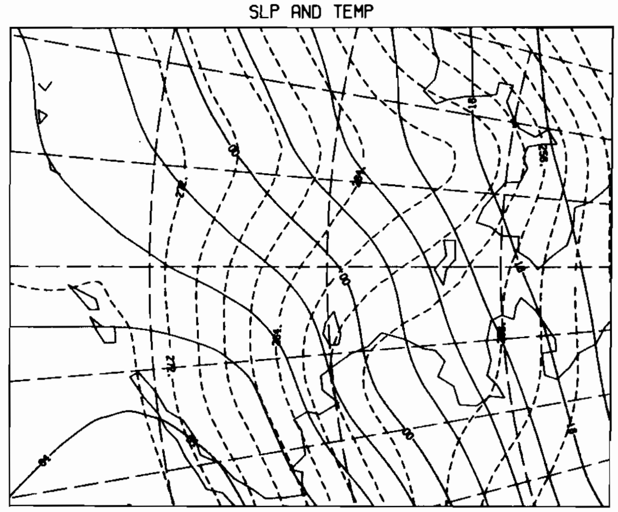
12Z 1 MAR 1979

SLP AND TEMP



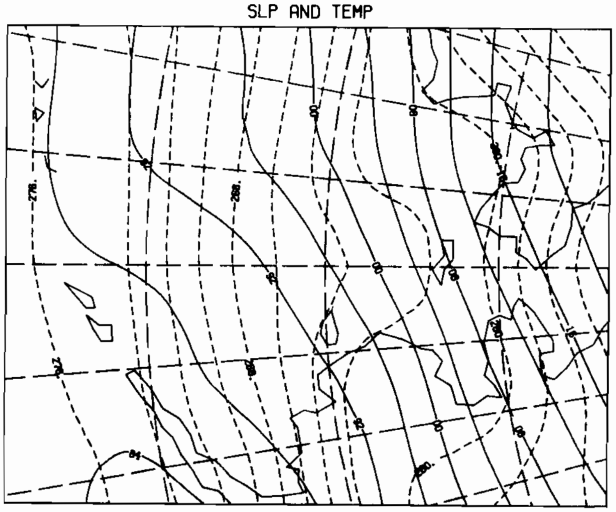
00Z 2 MAR 1979

SLP AND TEMP



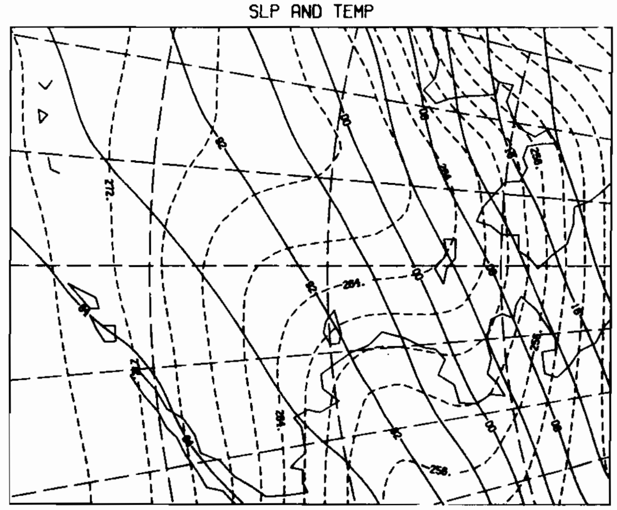
12Z 2 MAR 1979

SLP AND TEMP



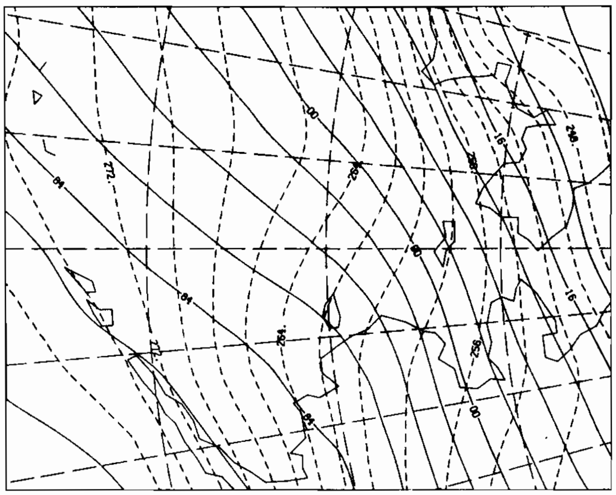
00Z 3 MAR 1979

SLP AND TEMP



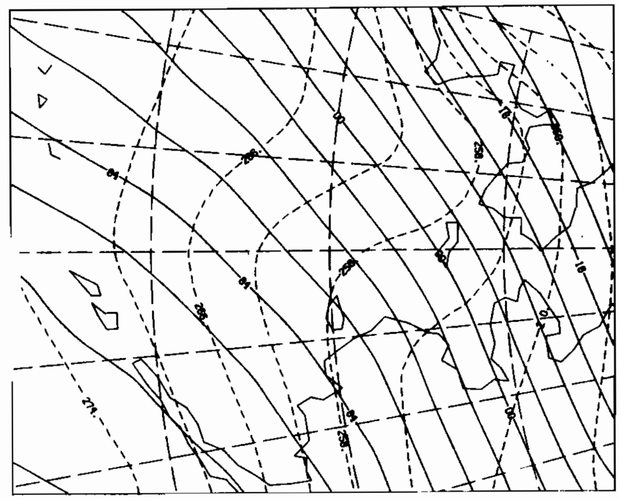
12Z 3 MAR 1979

SLP AND TEMP



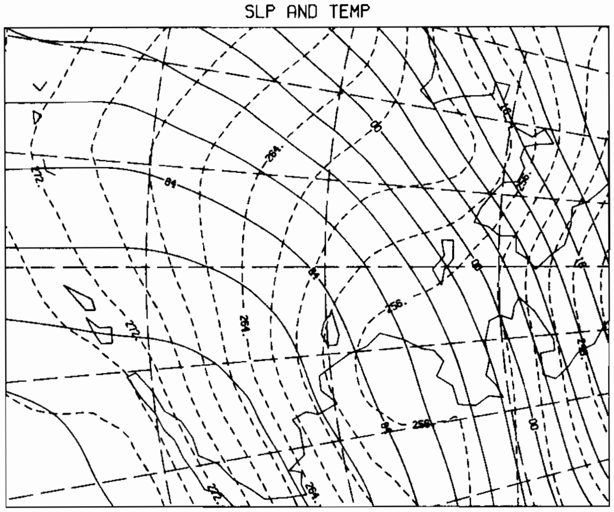
00Z 4 MAR 1979

SLP AND TEMP



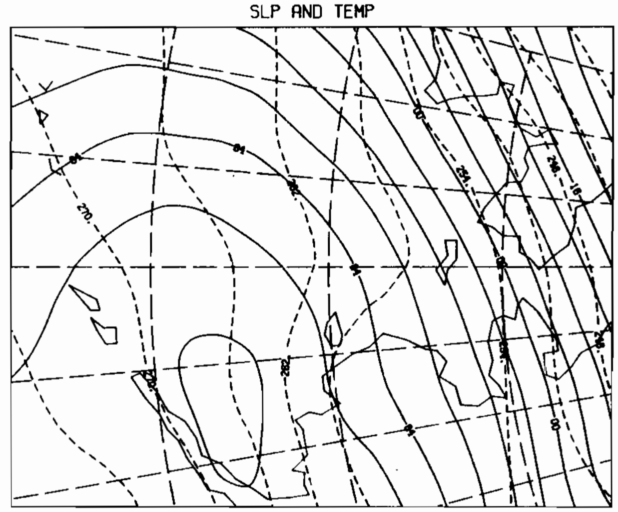
12Z 4 MAR 1979

SLP AND TEMP



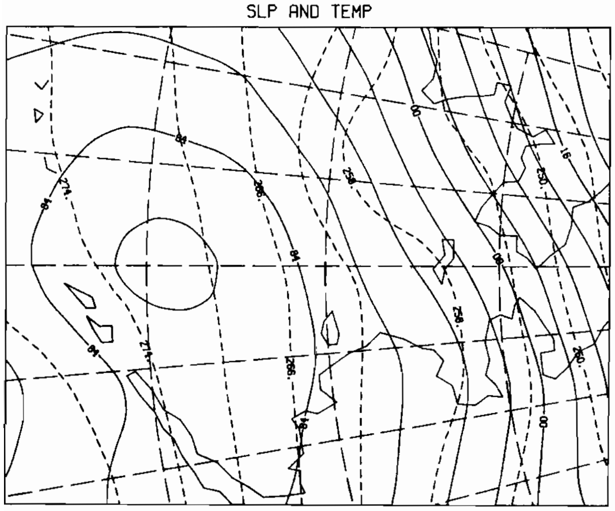
00Z 5 MAR 1979

SLP AND TEMP



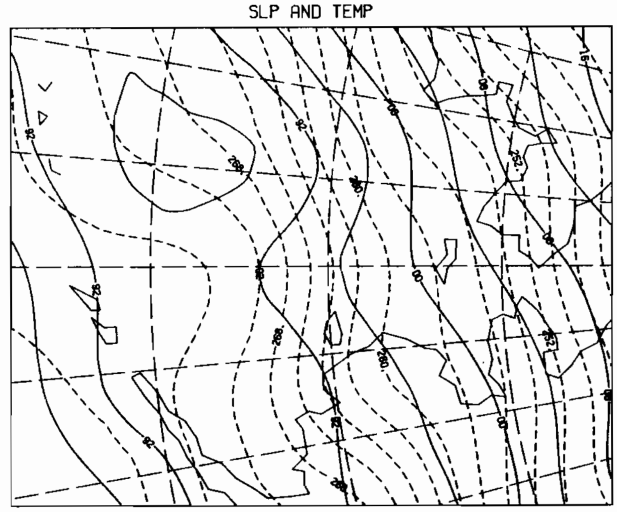
12Z 5 MAR 1979

SLP AND TEMP



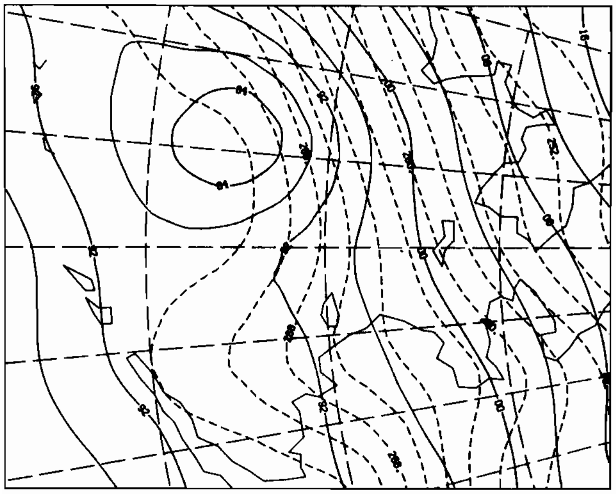
00Z 6 MAR 1979

SLP AND TEMP



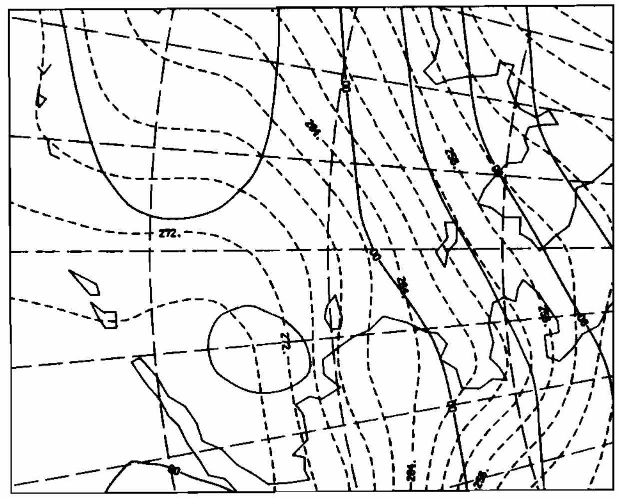
12Z 6 MAR 1979

SLP AND TEMP



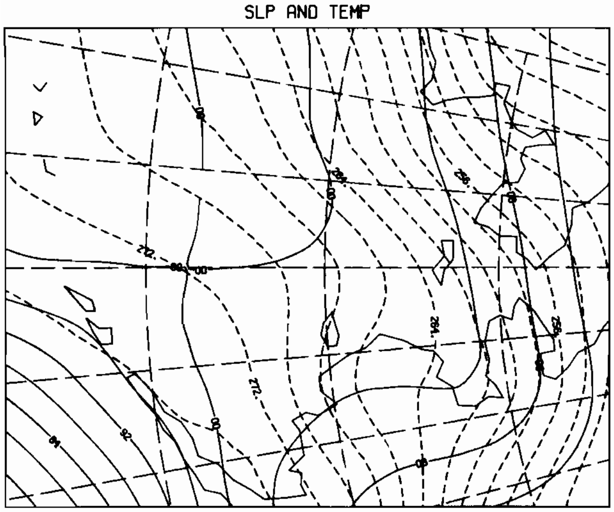
00Z 7 MAR 1979

SLP AND TEMP



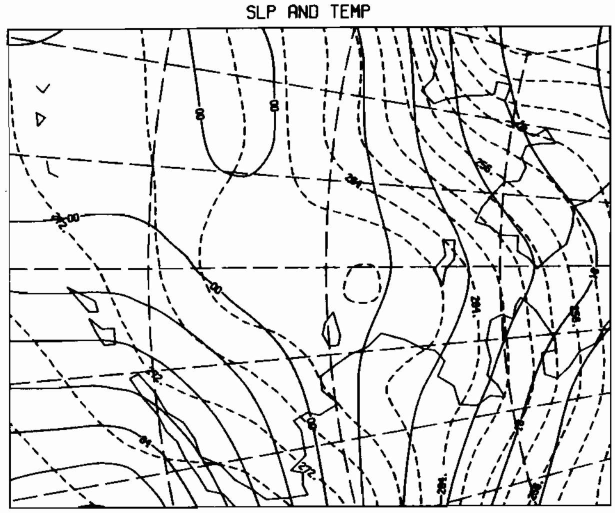
12Z 7 MAR 1979

SLP AND TEMP



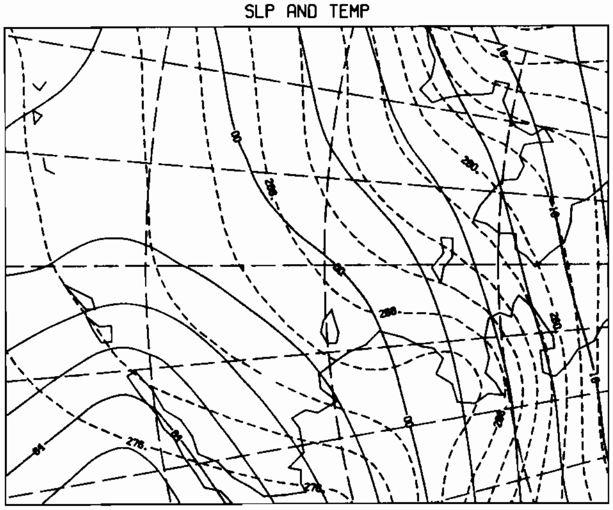
00Z 8 MAR 1979

SLP AND TEMP



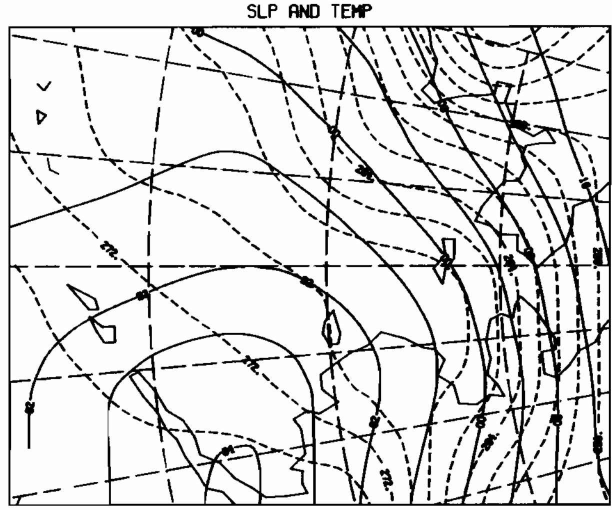
12Z 8 MAR 1979

SLP AND TEMP



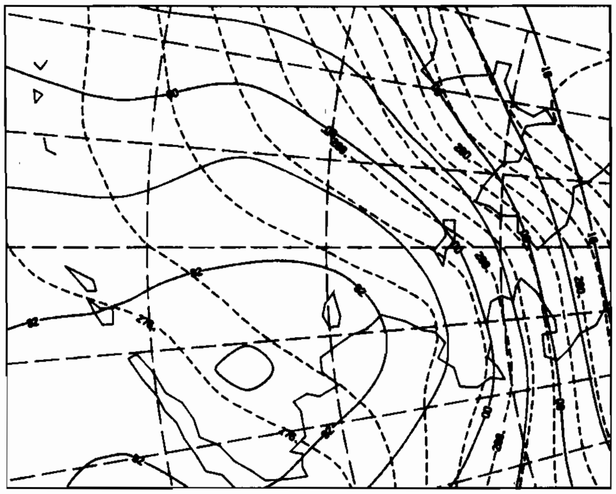
00Z 9 MAR 1979

SLP AND TEMP



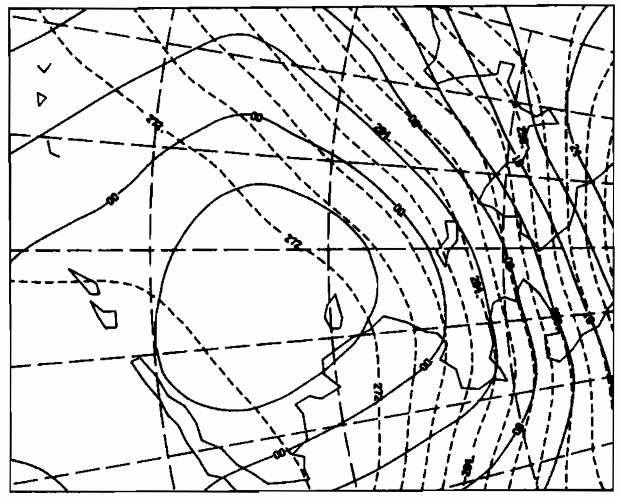
12Z 9 MAR 1979

SLP AND TEMP



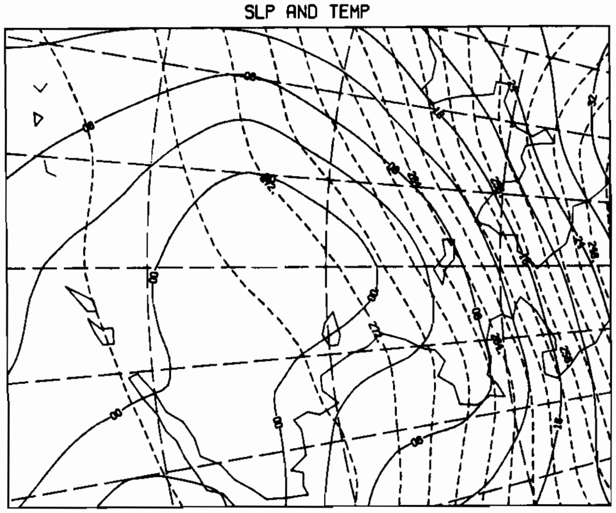
00Z 10 MAR 1979

SLP AND TEMP



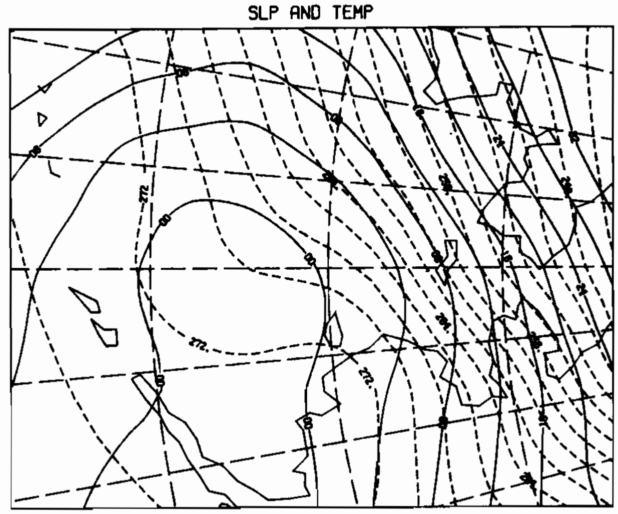
12Z 10 MAR 1979

SLP AND TEMP



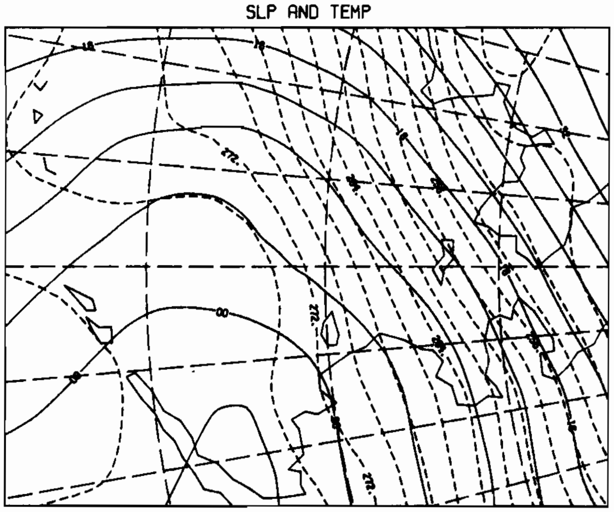
00Z 11 MAR 1979

SLP AND TEMP



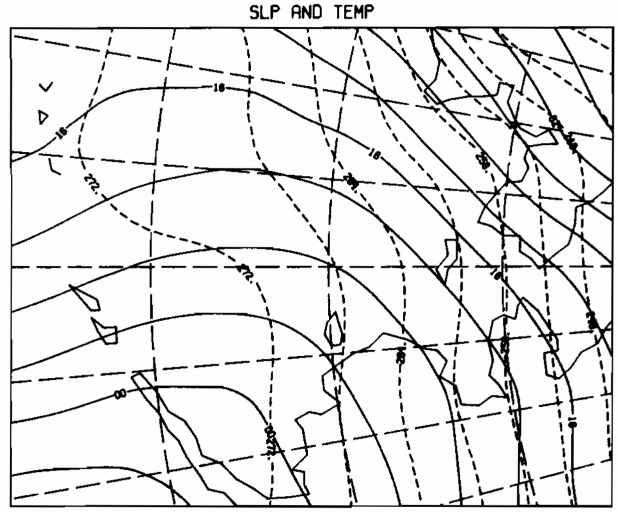
12Z 11 MAR 1979

SLP AND TEMP



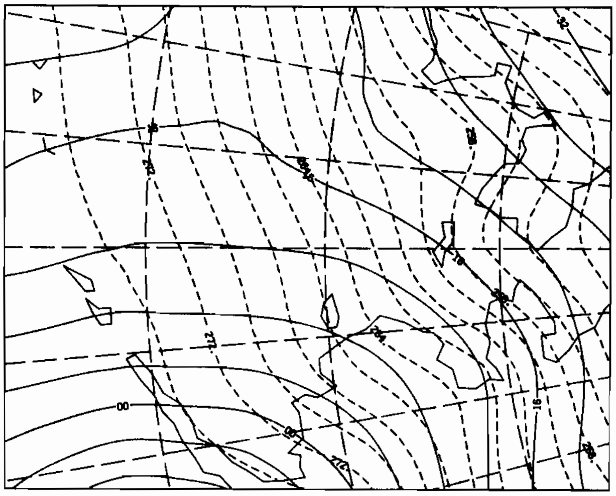
00Z 12 MAR 1979

SLP AND TEMP



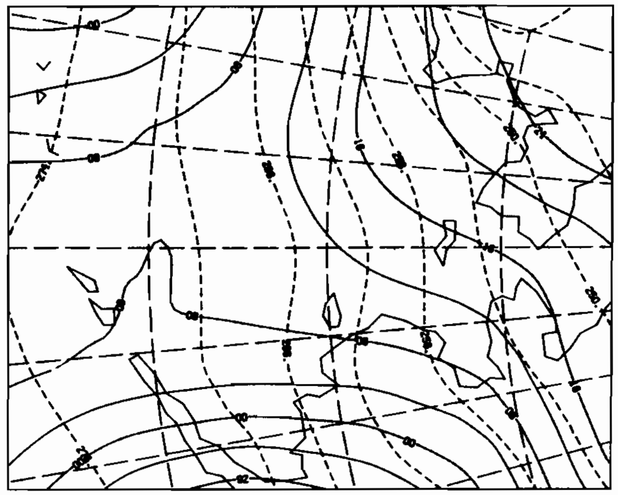
12Z 12 MAR 1979

SLP AND TEMP



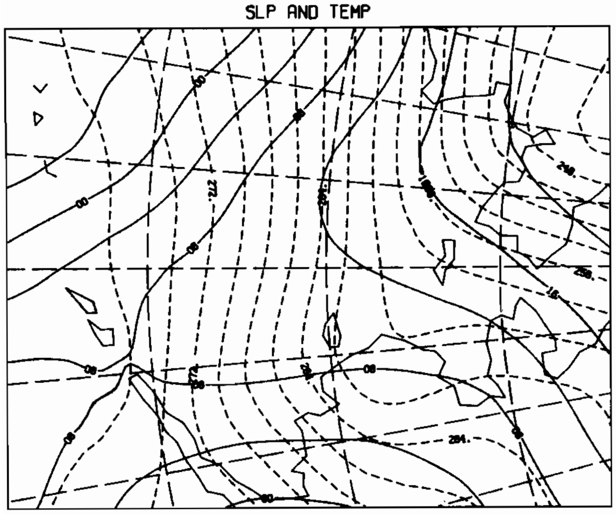
00Z 13 MAR 1979

SLP AND TEMP



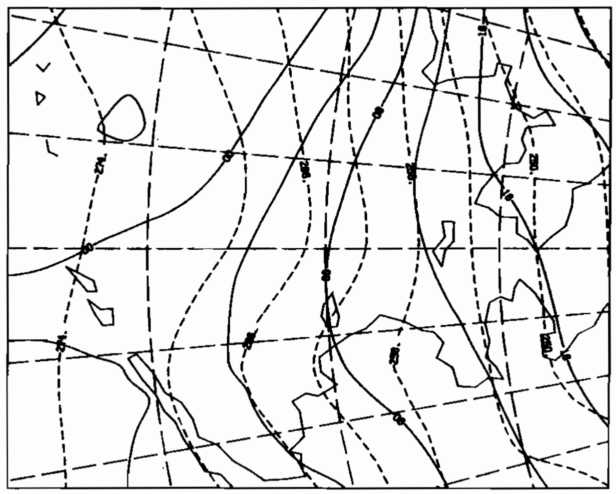
12Z 13 MAR 1979

SLP AND TEMP



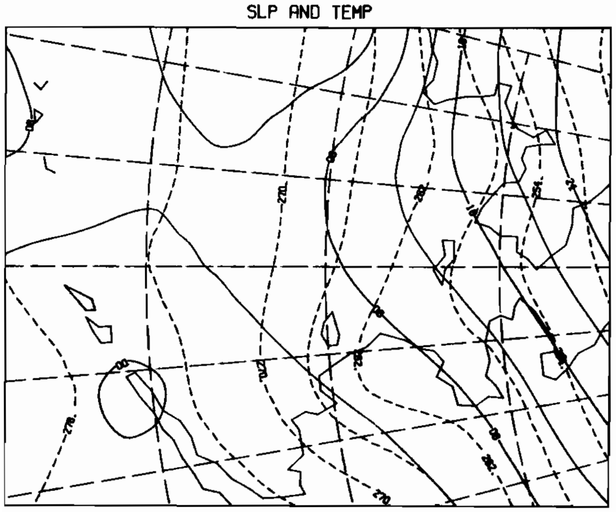
00Z 14 MAR 1979

SLP AND TEMP



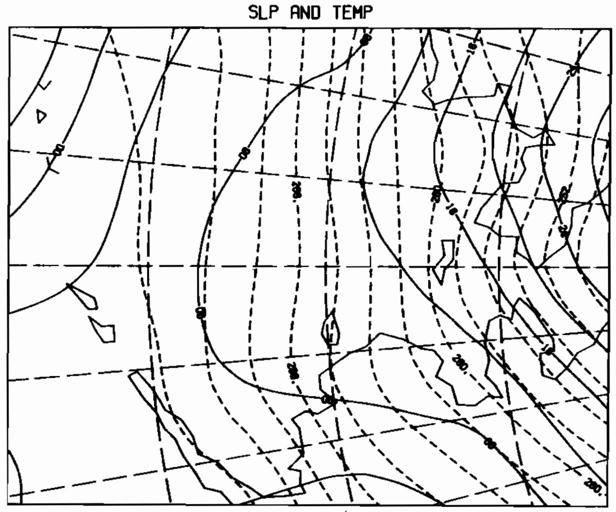
12Z 14 MAR 1979

SLP AND TEMP



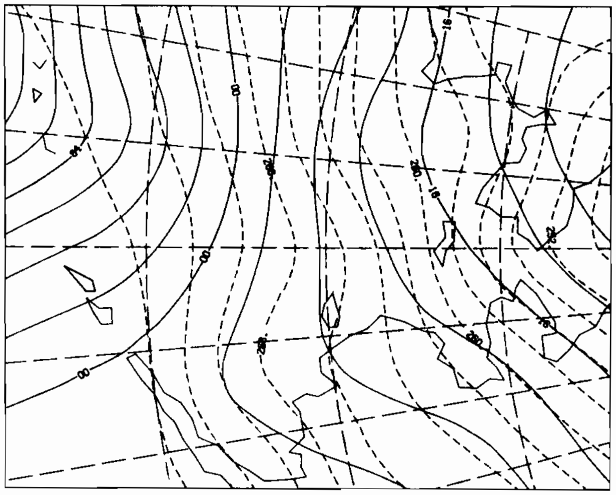
00Z 15 MAR 1979

SLP AND TEMP



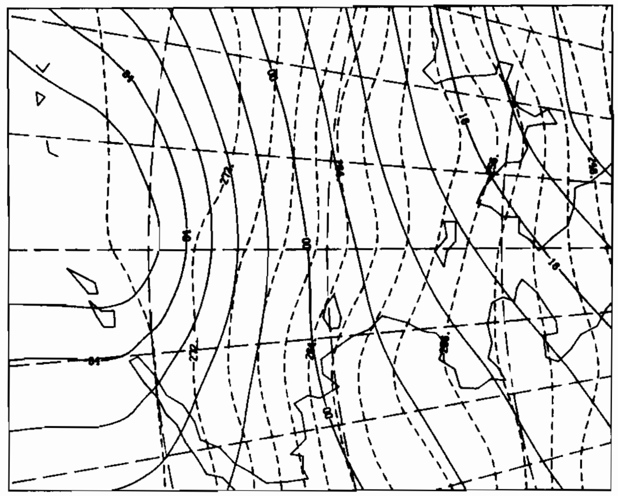
12Z 15 MAR 1979

SLP AND TEMP



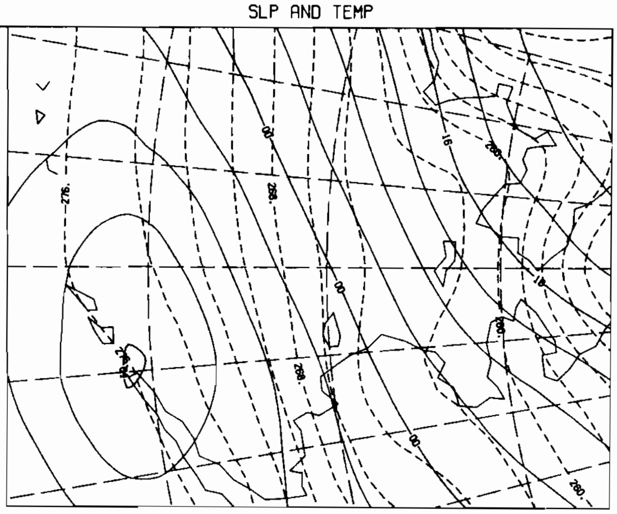
00Z 16 MAR 1979

SLP AND TEMP



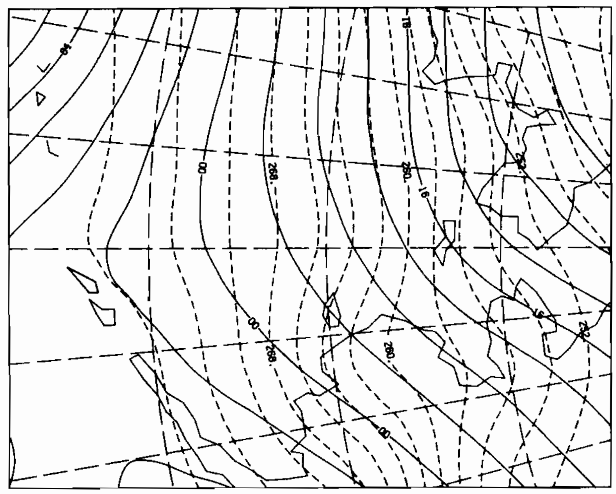
12Z 16 MAR 1979

SLP AND TEMP



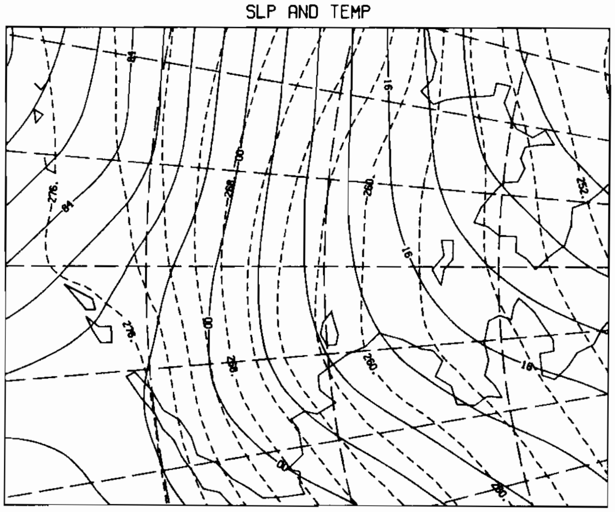
00Z 17 MAR 1979

SLP AND TEMP



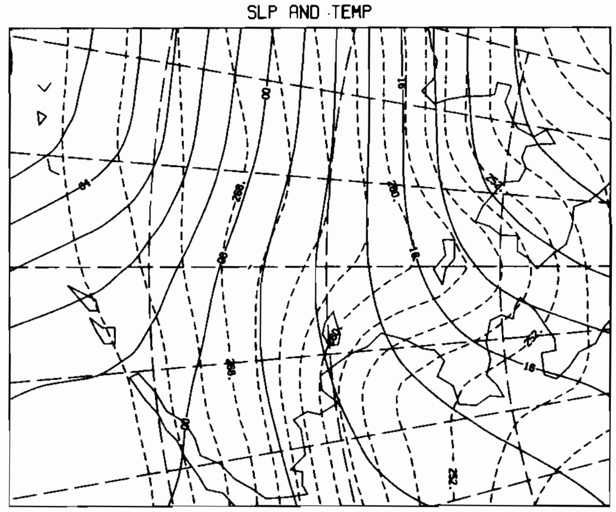
12Z 17 MAR 1979

SLP AND TEMP



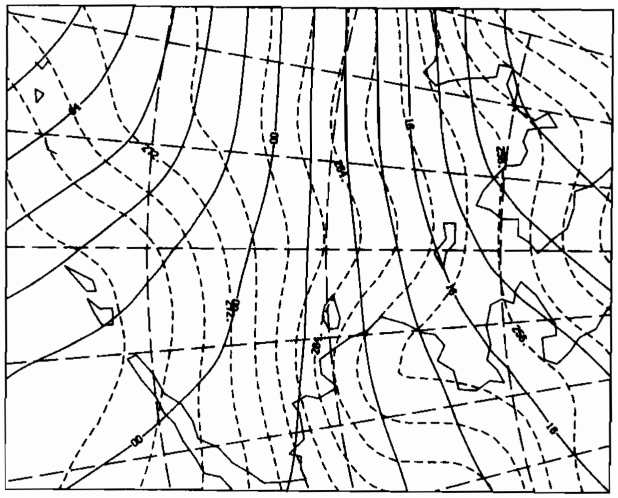
00Z 18 MAR 1979

SLP AND TEMP



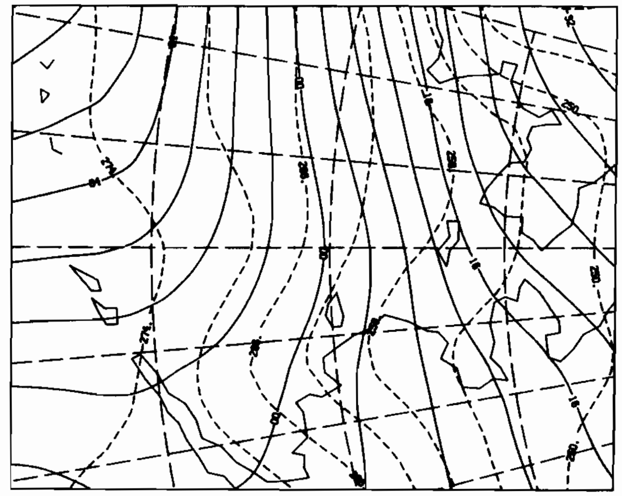
12Z 18 MAR 1979

SLP AND TEMP



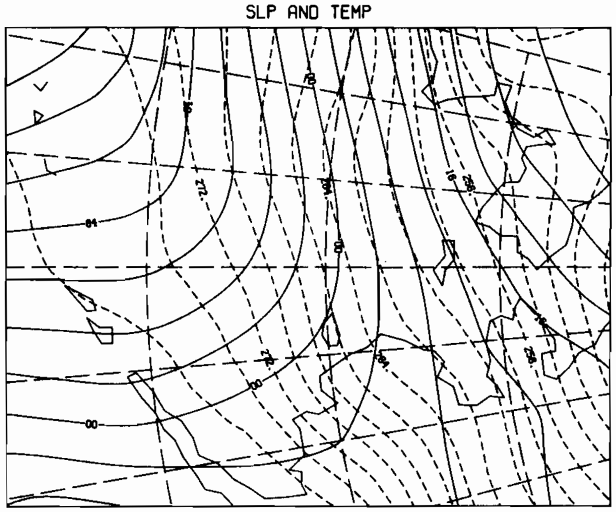
00Z 19 MAR 1979

SLP AND TEMP



12Z 19 MAR 1979

SLP AND TEMP



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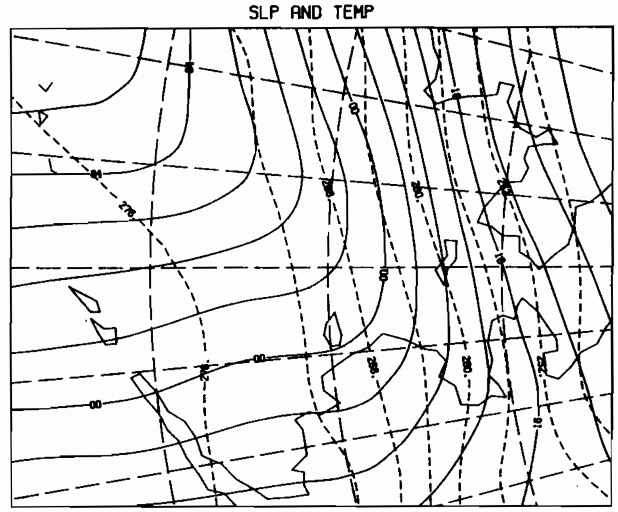
SLP AND TEMP



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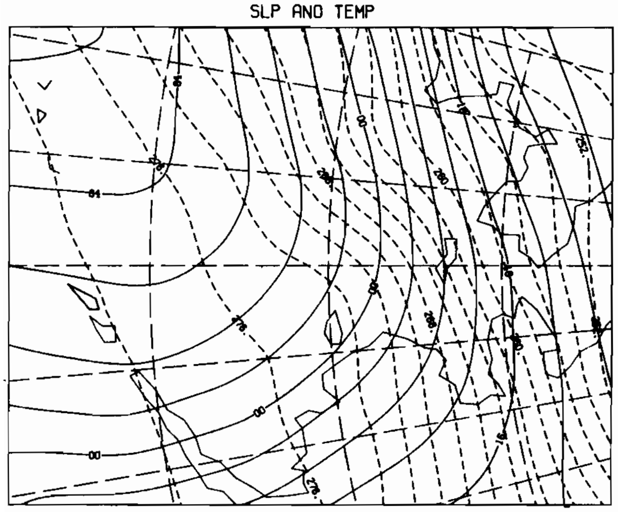
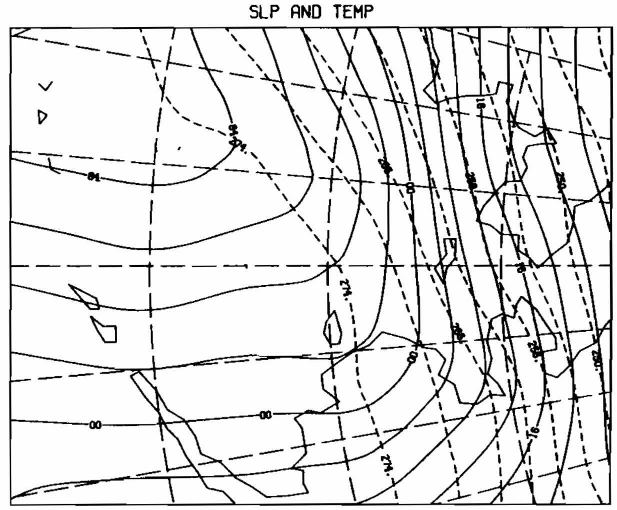
SLP AND TEMP



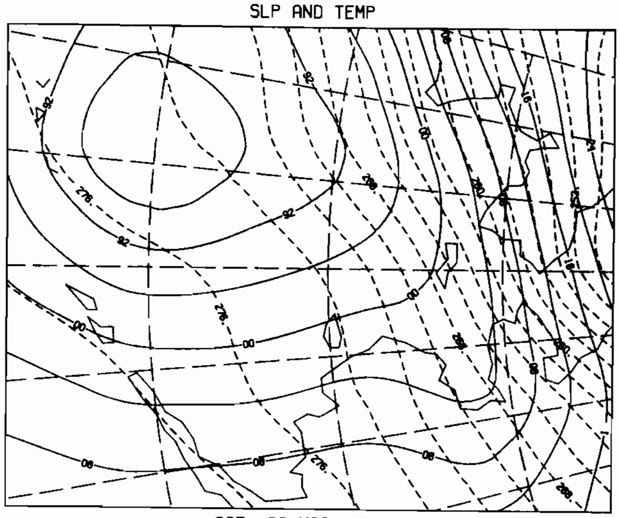
00Z 21 MAR 1979

SLP AND TEMP



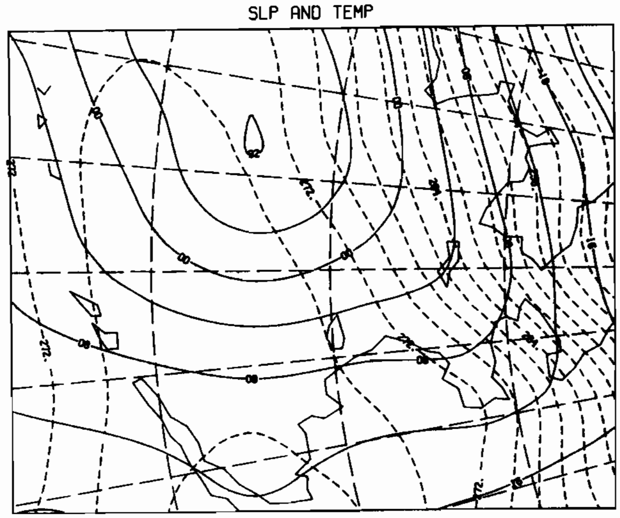
12Z 21 MAR 1979

SLP AND TEMP



00Z 22 MAR 1979

SLP AND TEMP



12Z 22 MAR 1979

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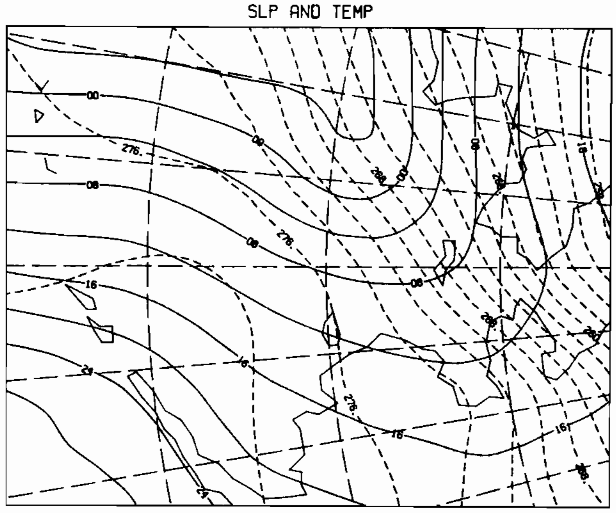
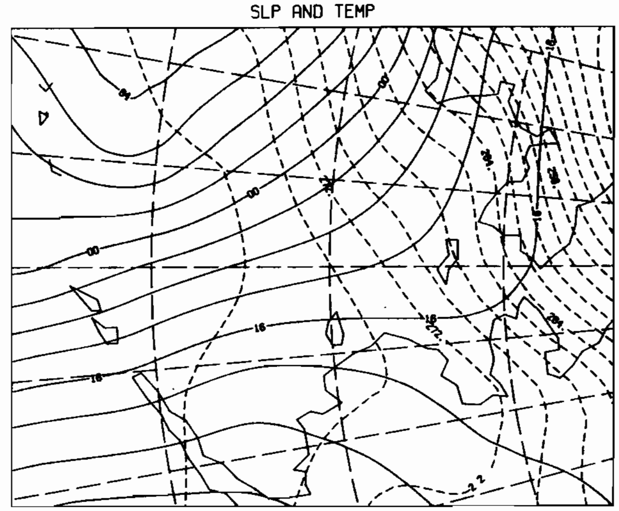


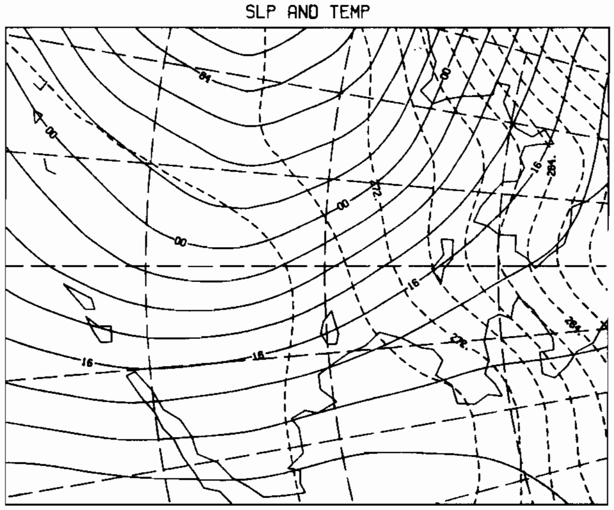
00Z 23 MAR 1979

SLP AND TEMP



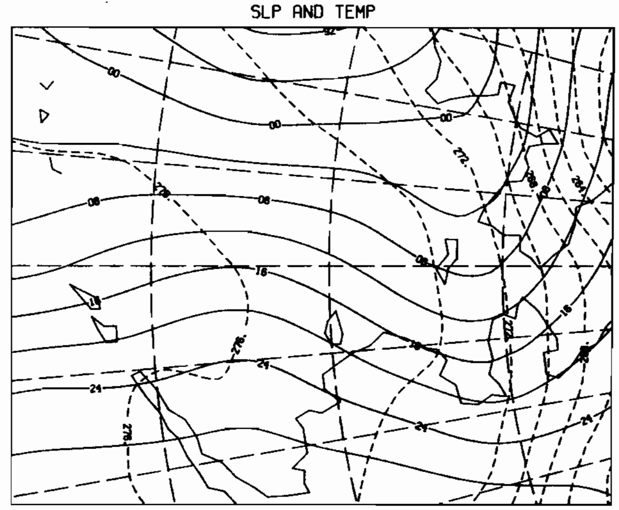
12Z 23 MAR 1979

SLP AND TEMP



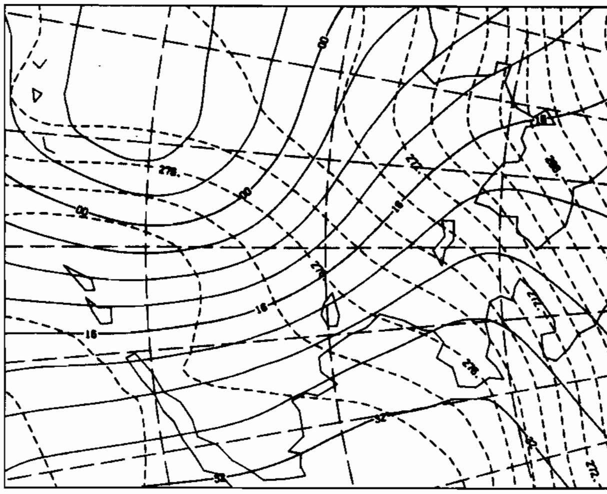
00Z 24 MAR 1979

SLP AND TEMP



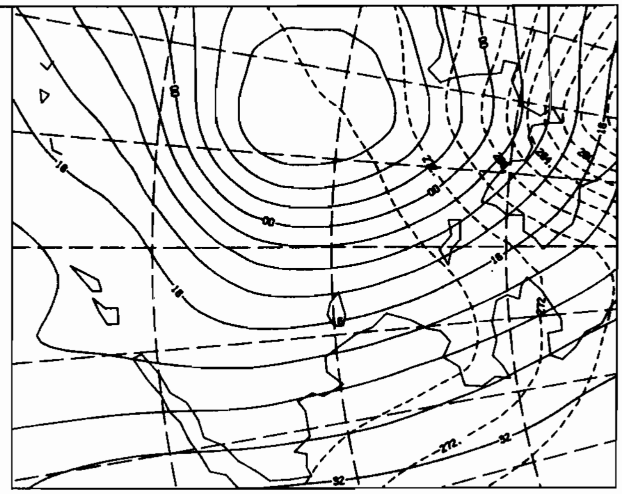
12Z 24 MAR 1979

SLP AND TEMP



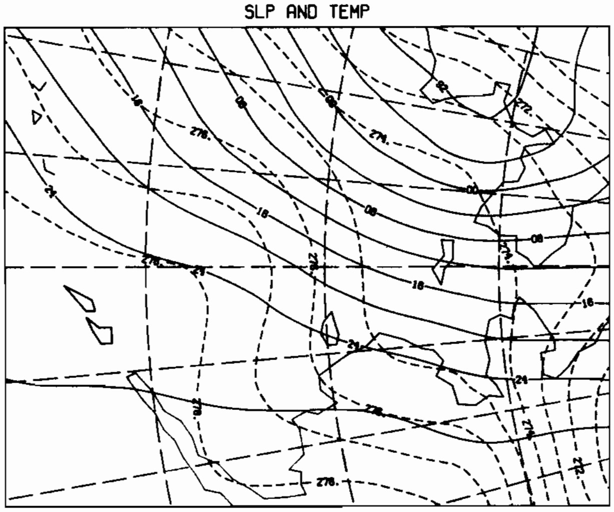
00Z 25 MAR .979

SLP AND TEMP



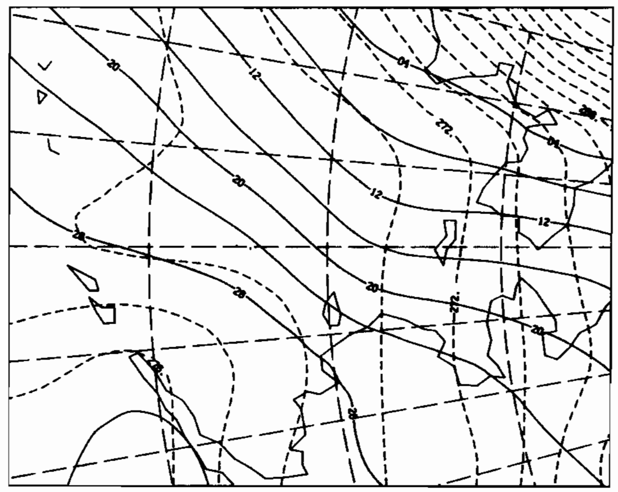
12Z 25 MAR 1979

SLP AND TEMP



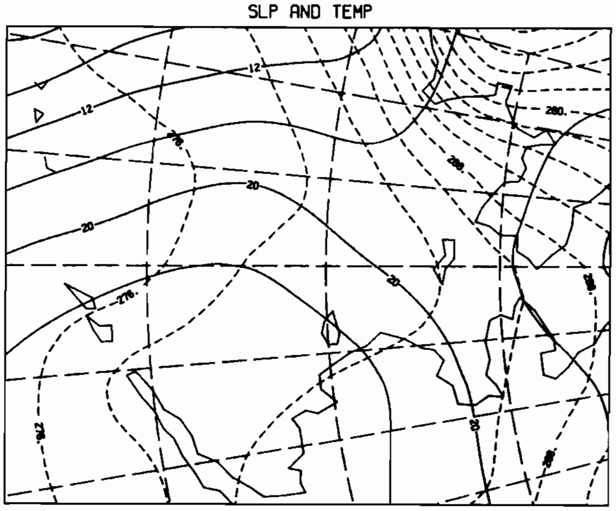
00Z 26 MAR 1979

SLP AND TEMP



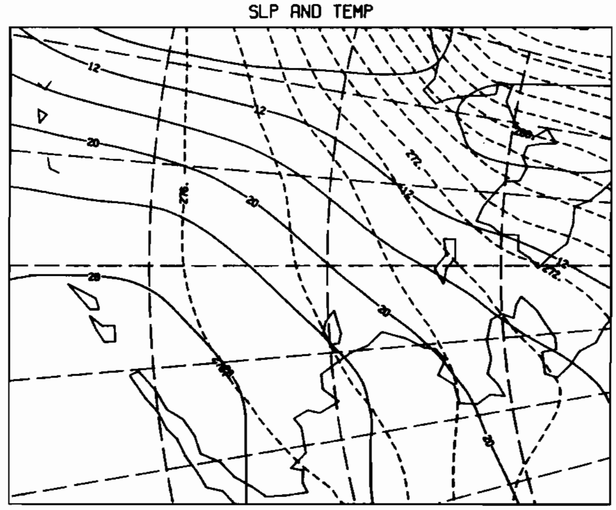
12Z 26 MAR 1979

SLP AND TEMP



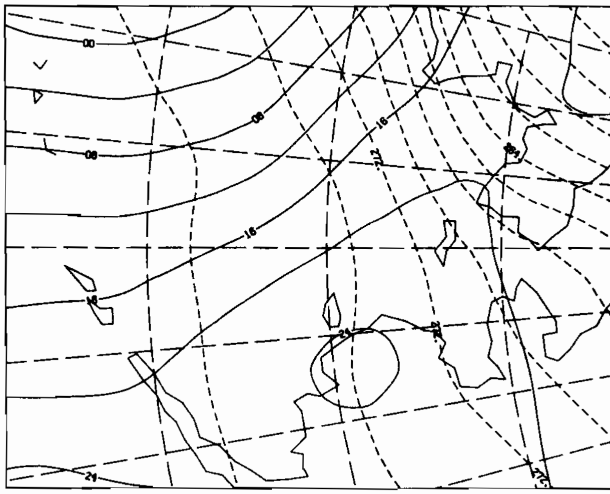
12Z 27 MAR 1979

SLP AND TEMP



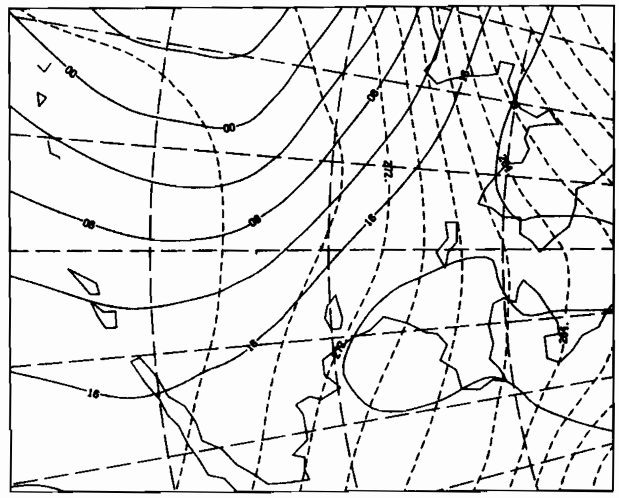
00Z 27 MAR 1979

SLP AND TEMP



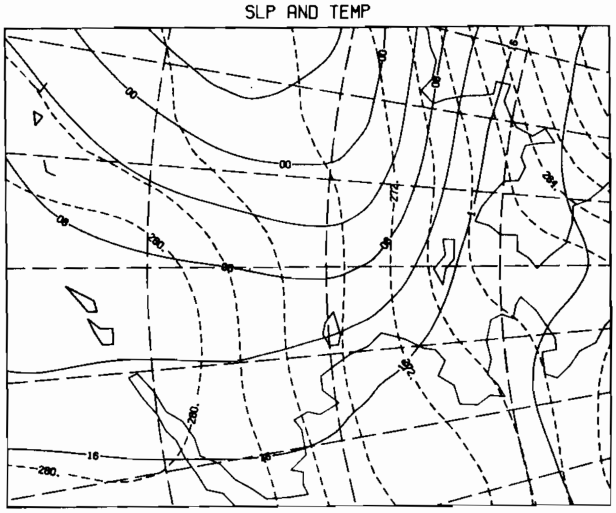
00Z 28 MAR 1979

SLP AND TEMP



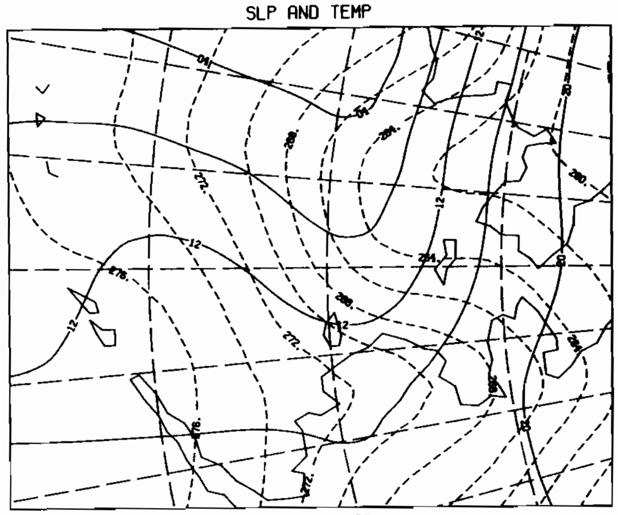
12Z 28 MAR 1979

SLP AND TEMP



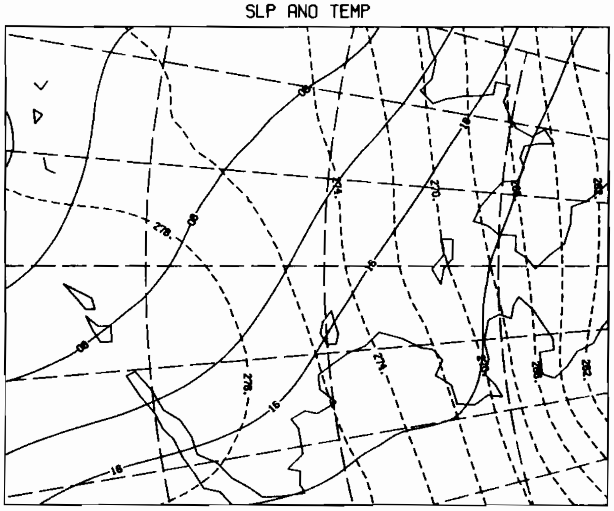
00Z 29 MAR 1979

SLP AND TEMP



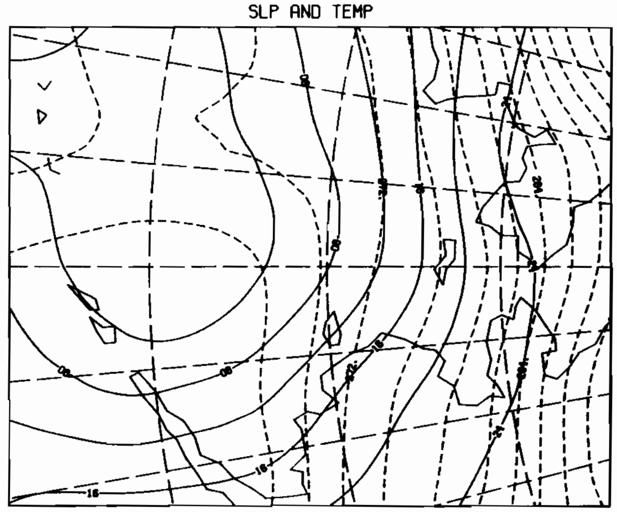
12Z 29 MAR 1979

SLP AND TEMP

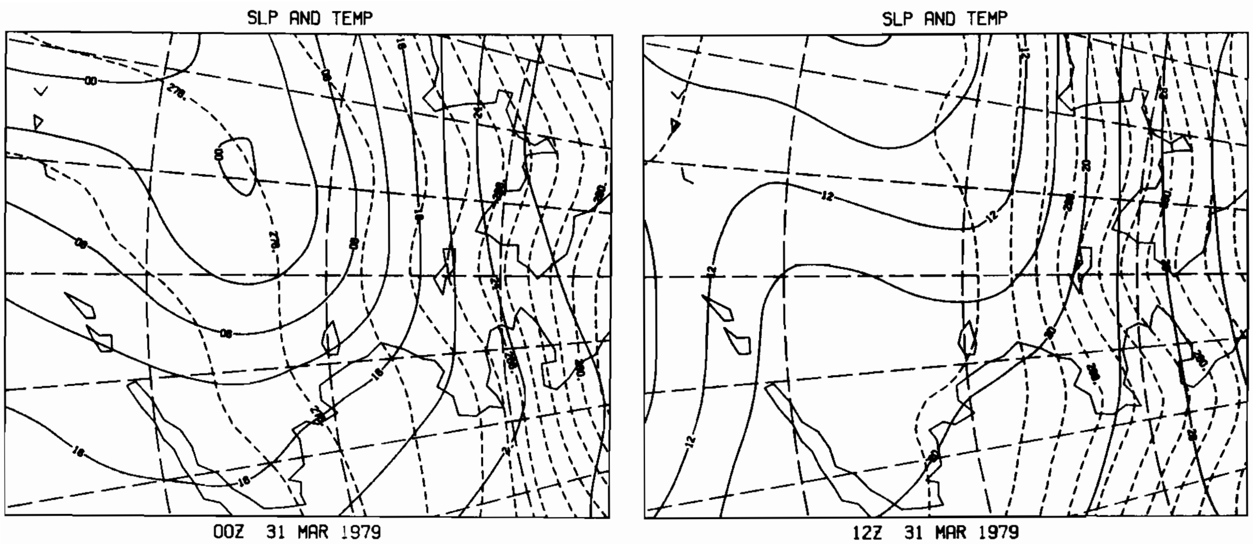


00Z 30 MAR 1979

SLP AND TEMP

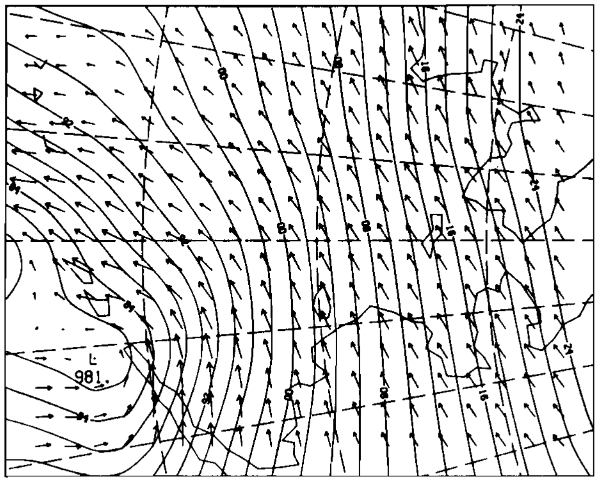


12Z 30 MAR 1979


SLP AND TEMP
00Z 31 MAR 1979
SLP AND TEMP
12Z 31 MAR 1979

APPENDIX C: SURFACE WINDS DERIVED FROM THE WSFO SURFACE ANALYSES.

ØBSERVED SLP AND WINDS 4



00Z 1 MAR 1979

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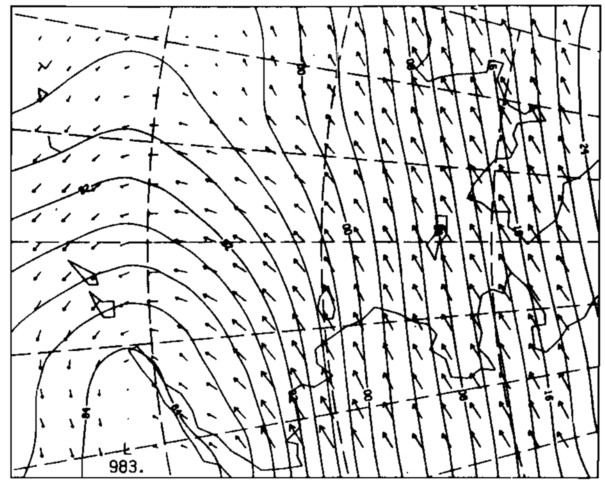

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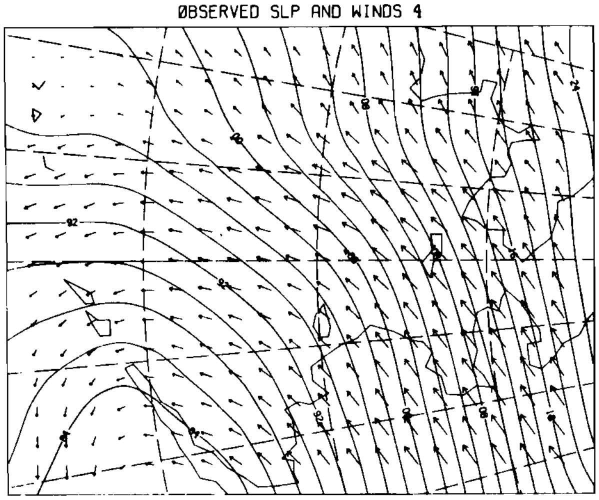

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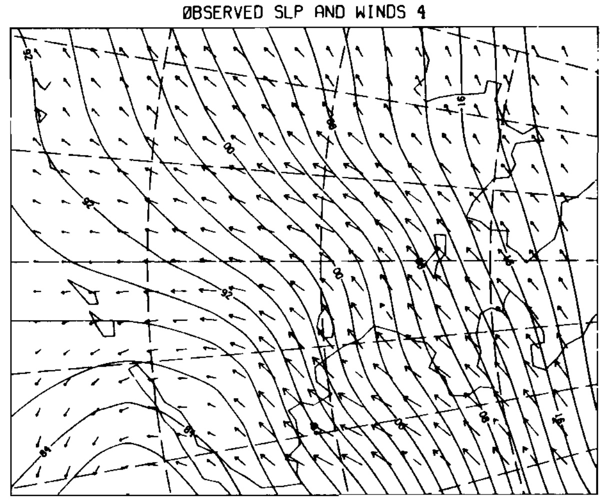

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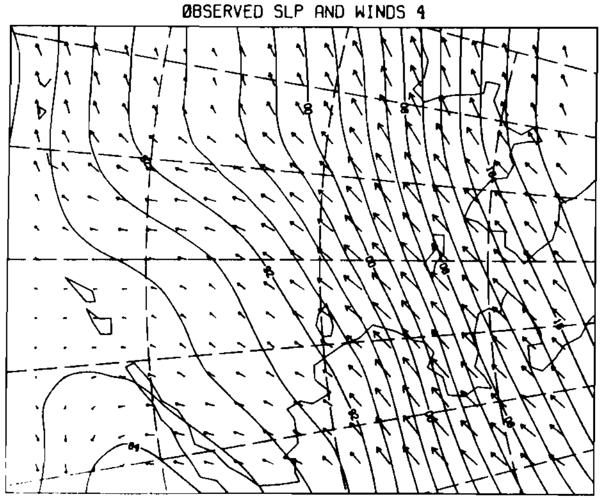

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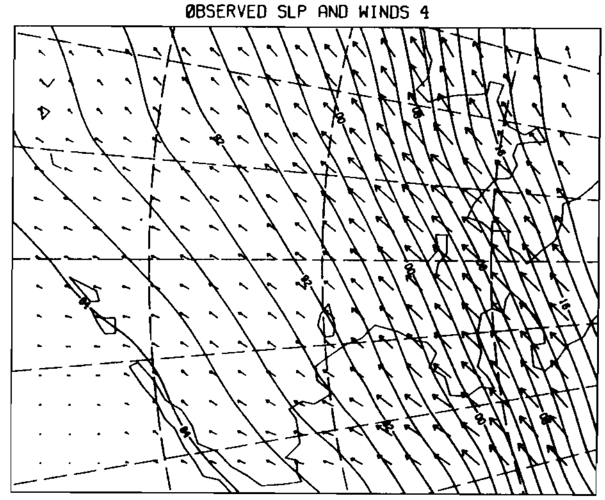

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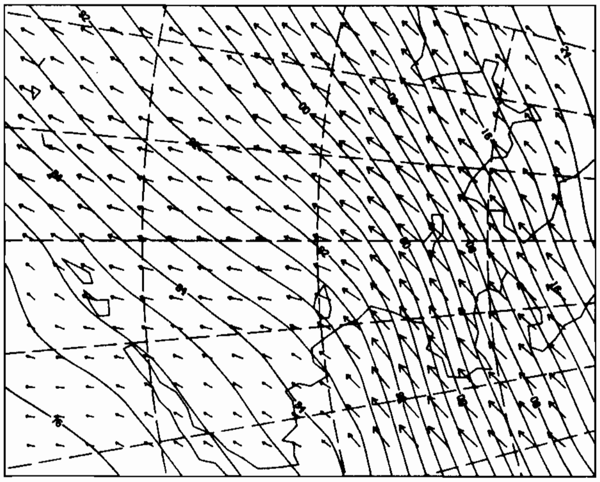

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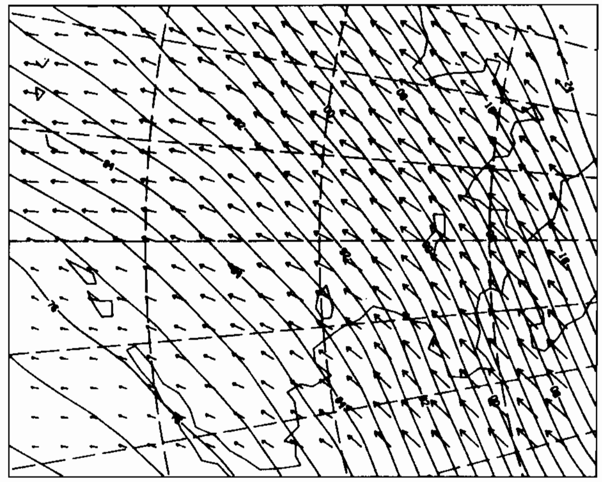

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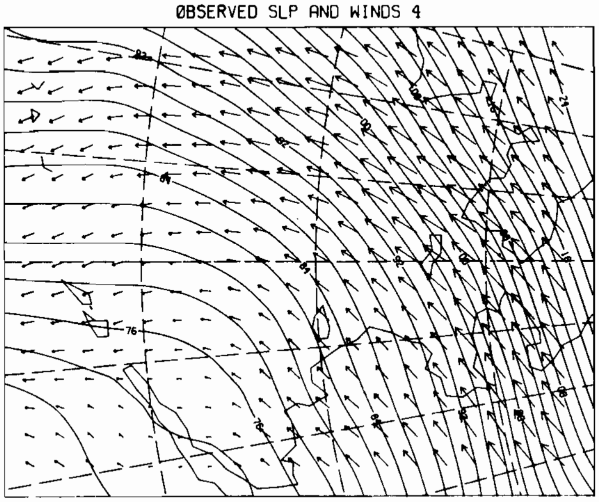

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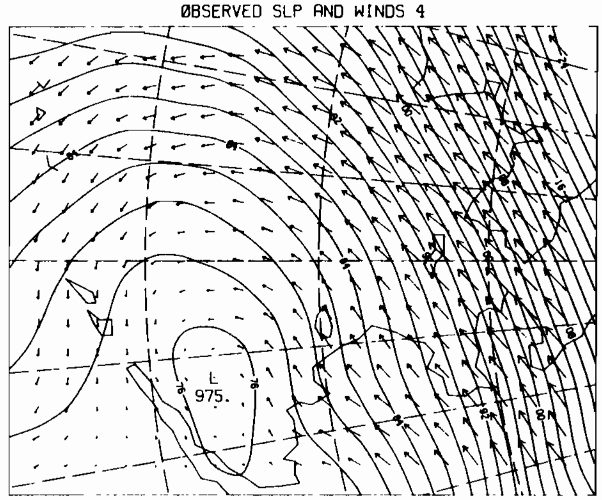

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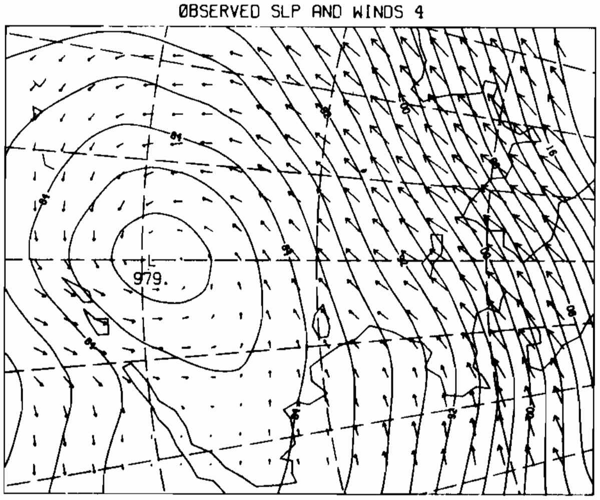

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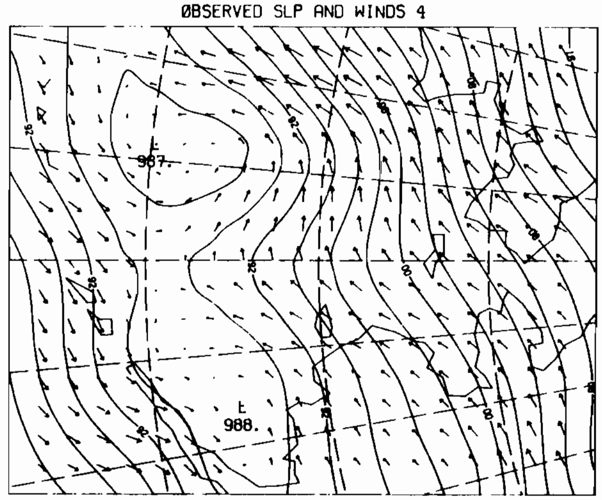

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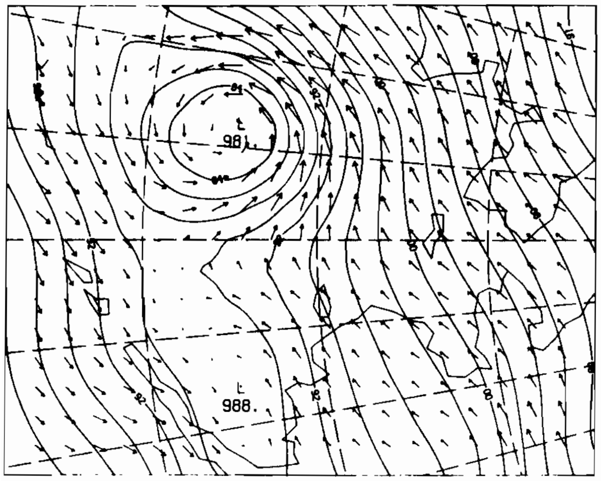

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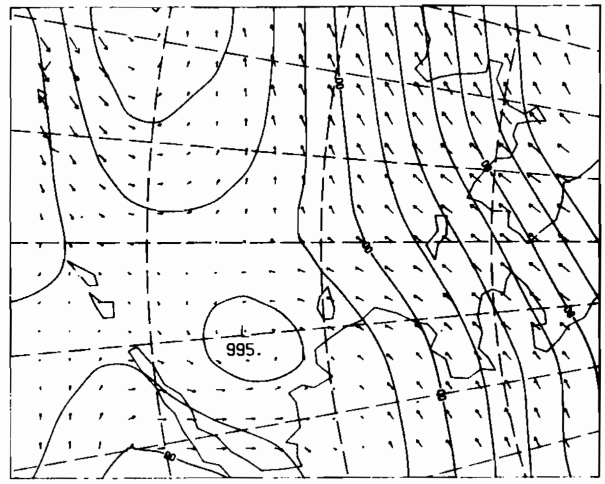

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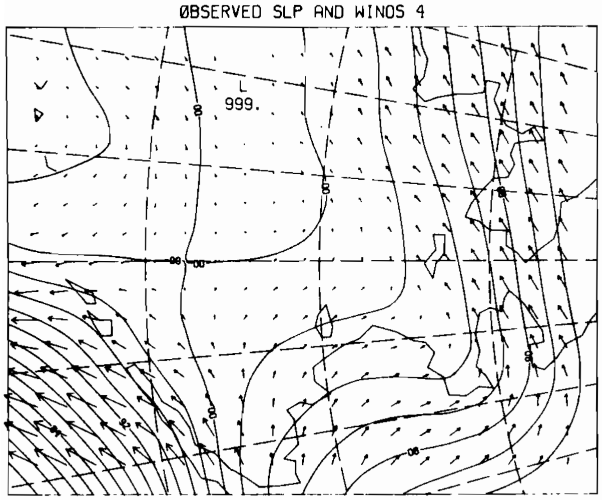

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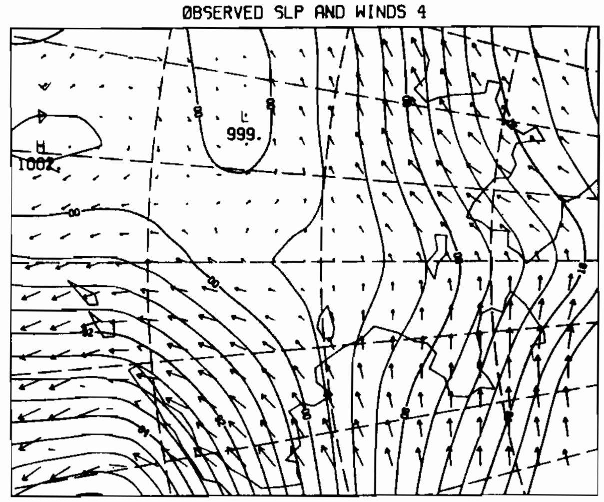

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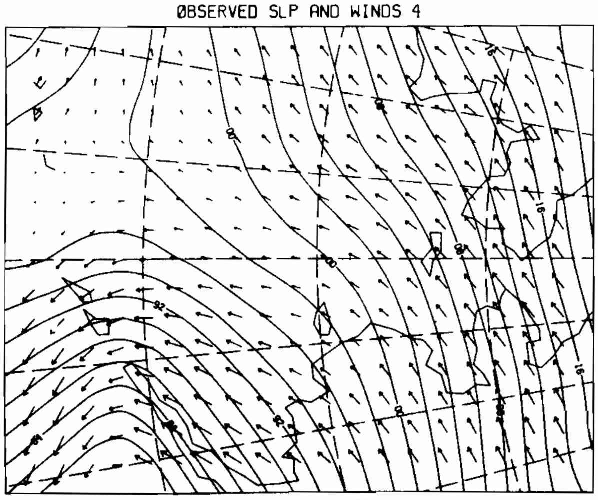

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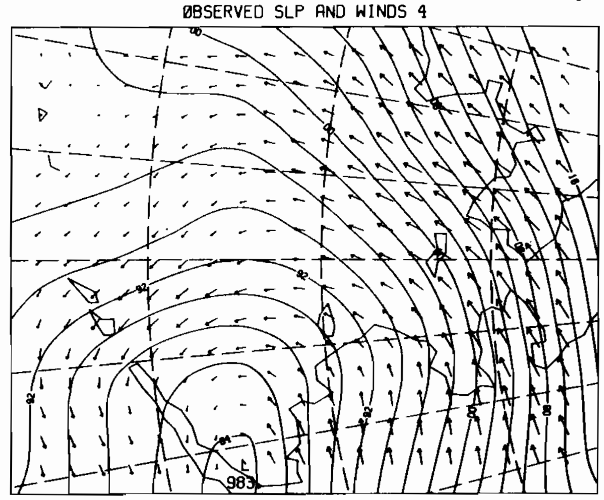

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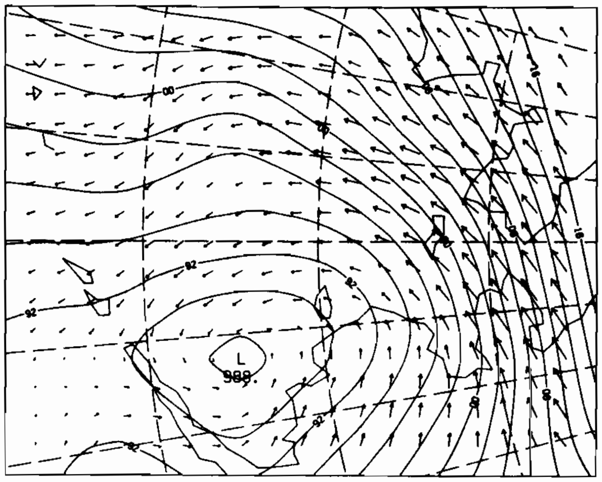

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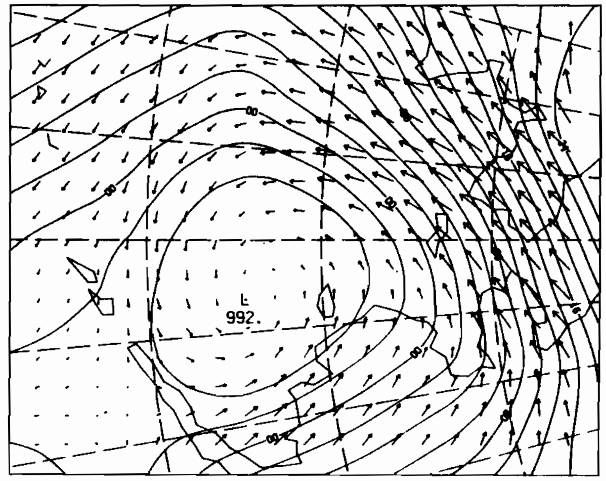

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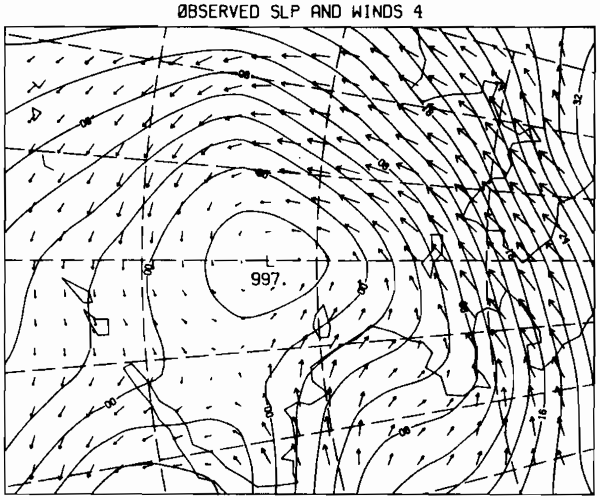

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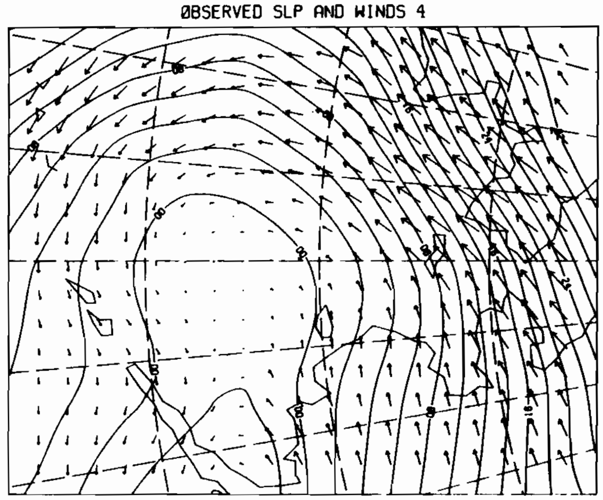

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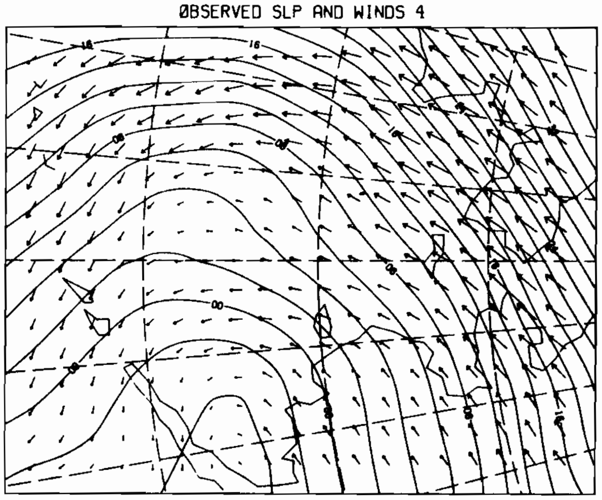

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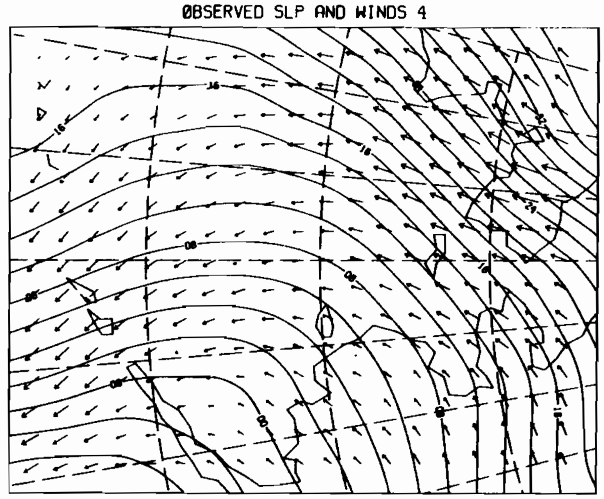

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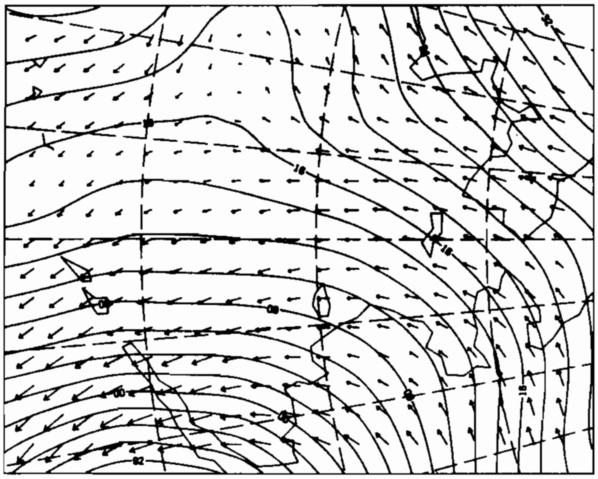

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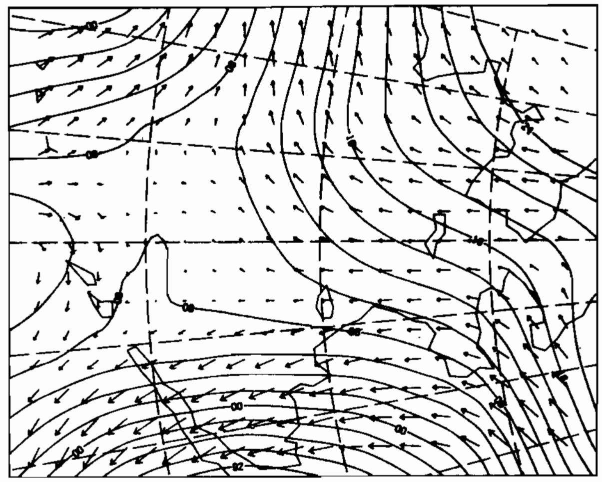

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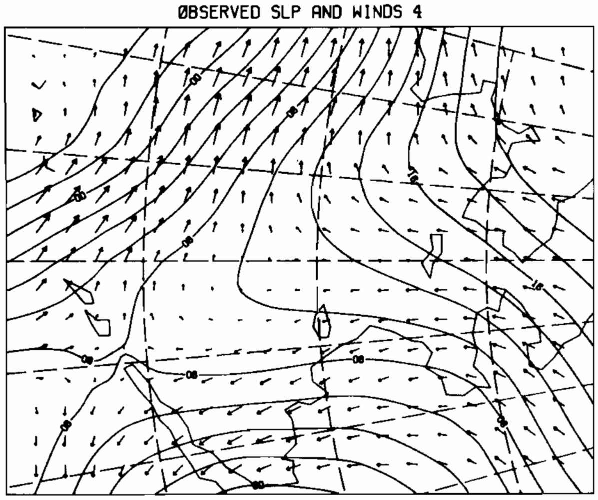

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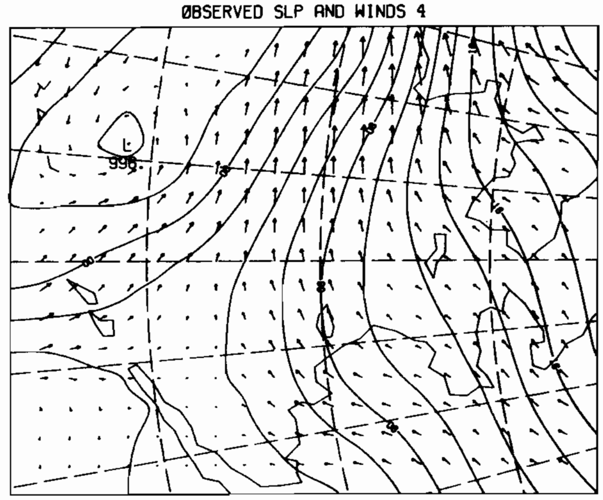

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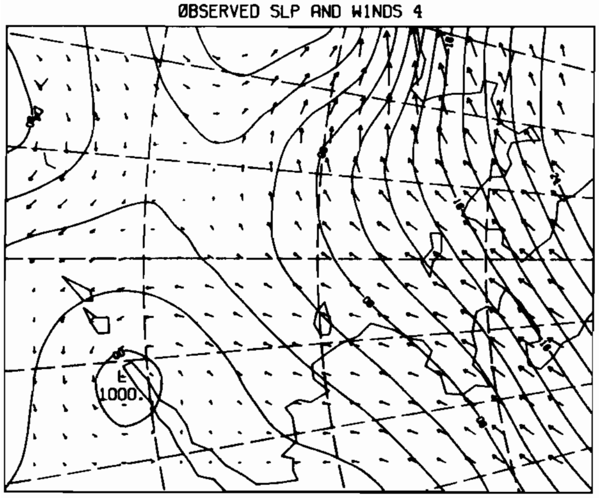

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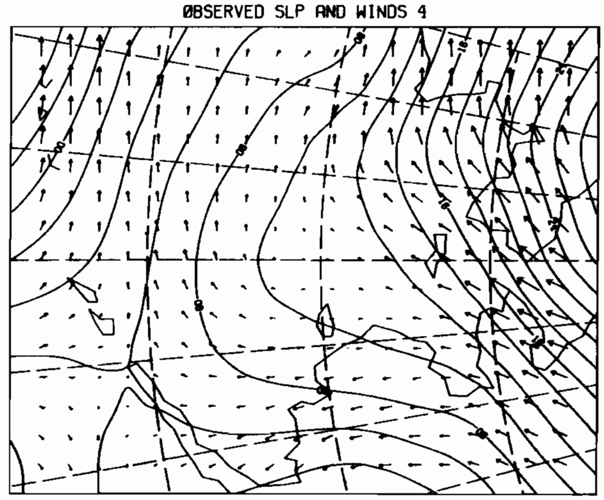

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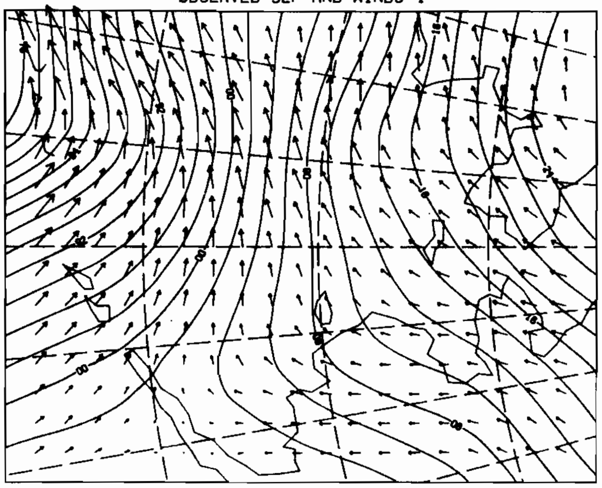

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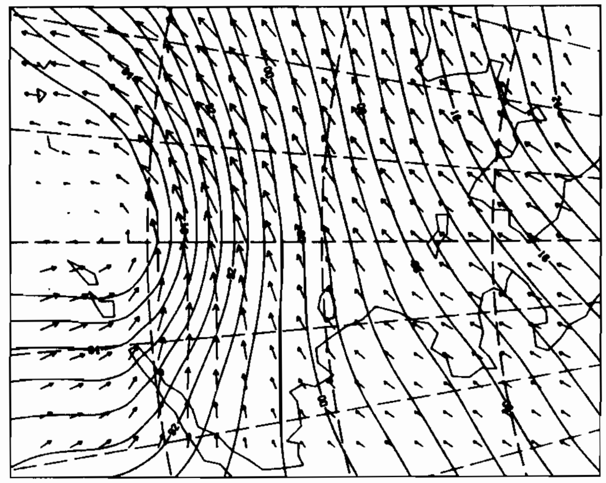

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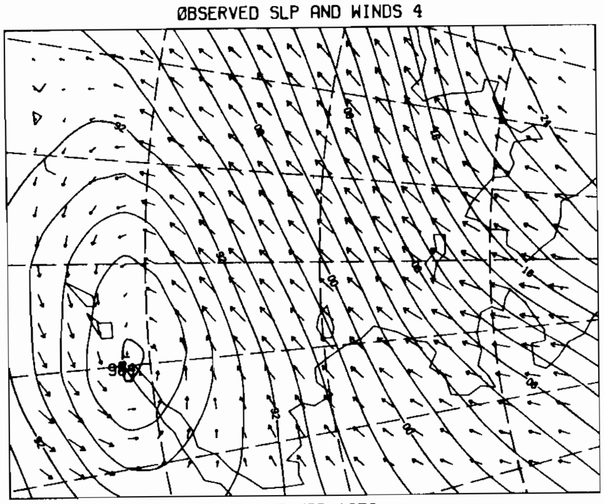

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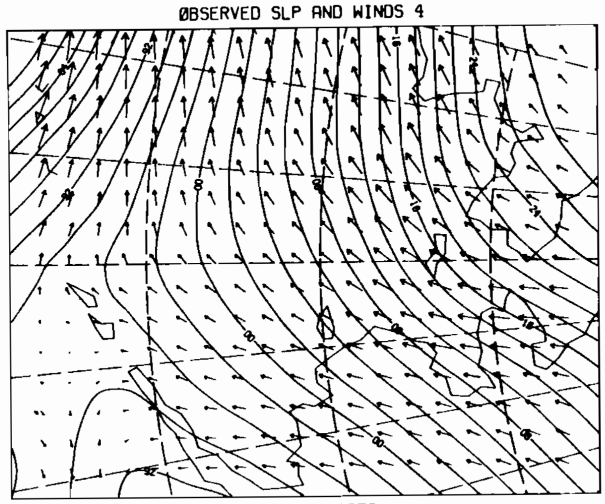

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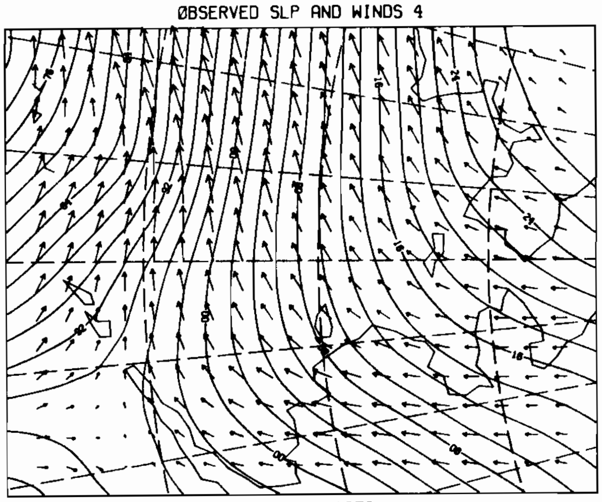

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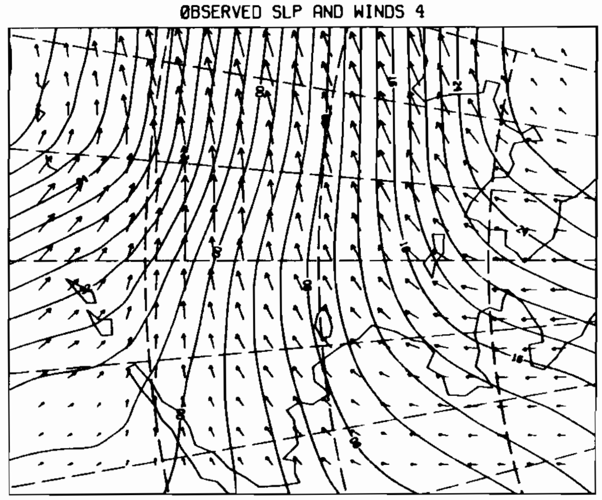

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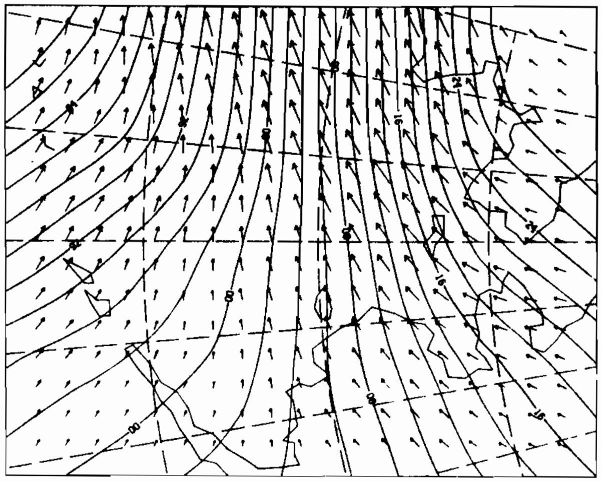

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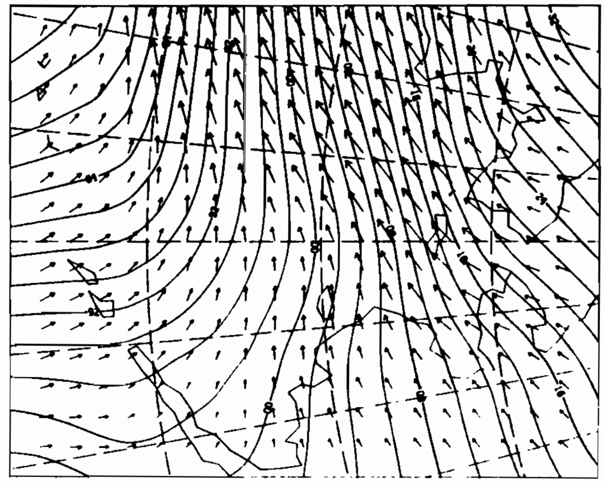

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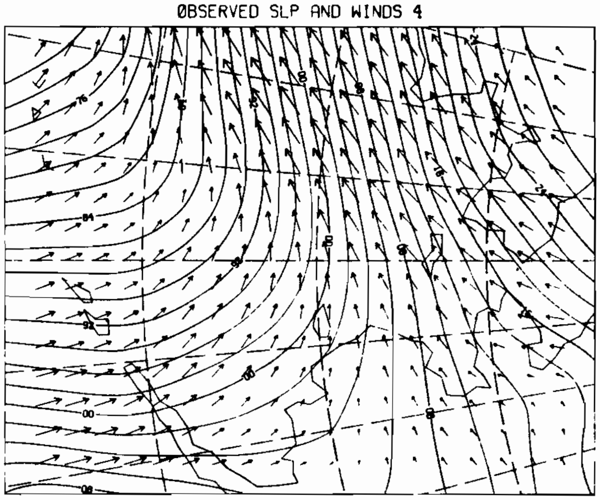

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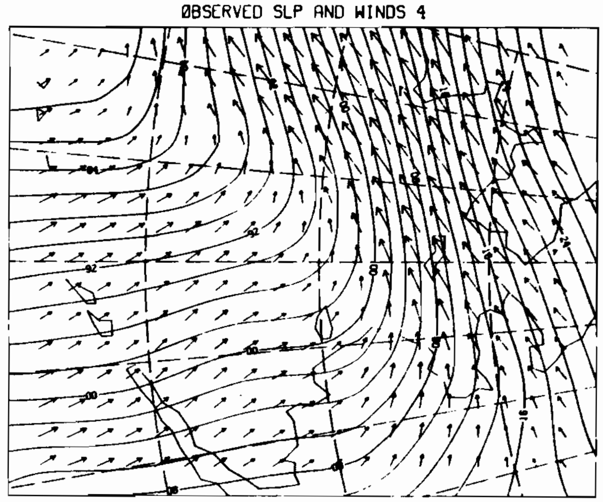

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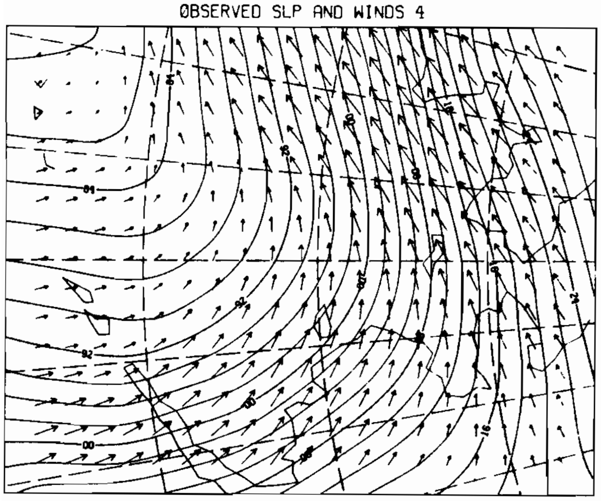

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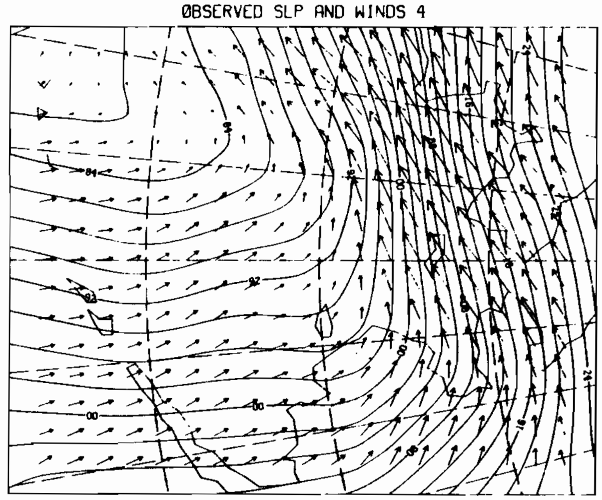

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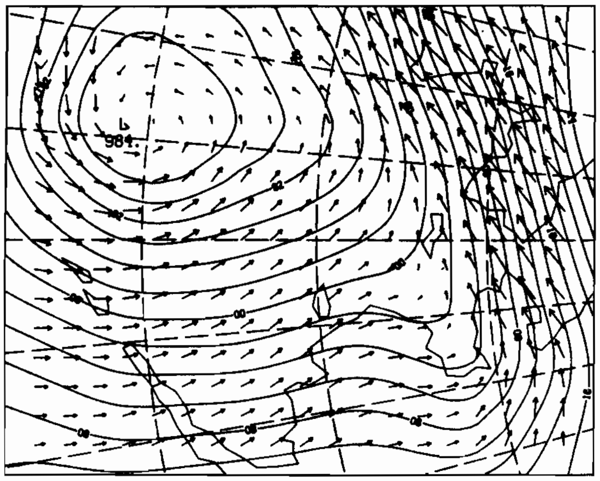

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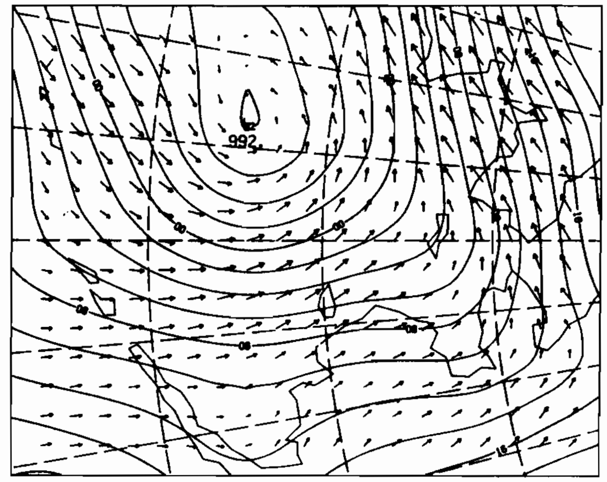

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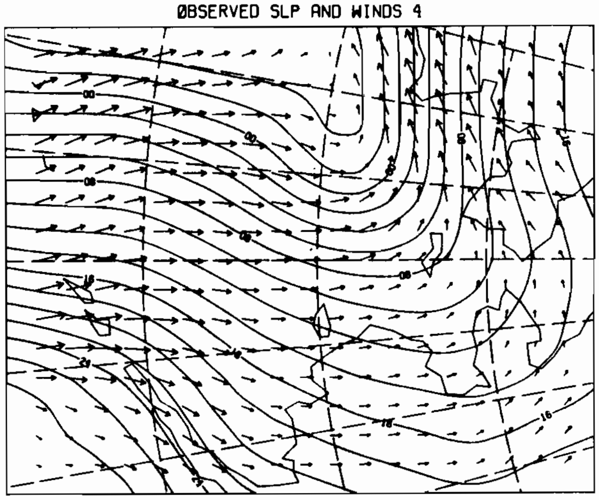

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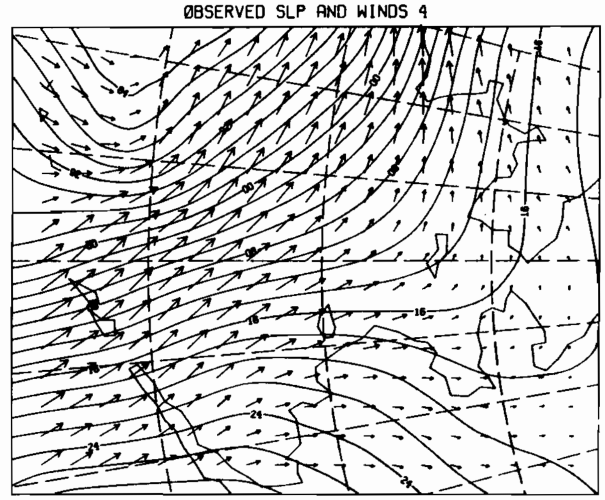

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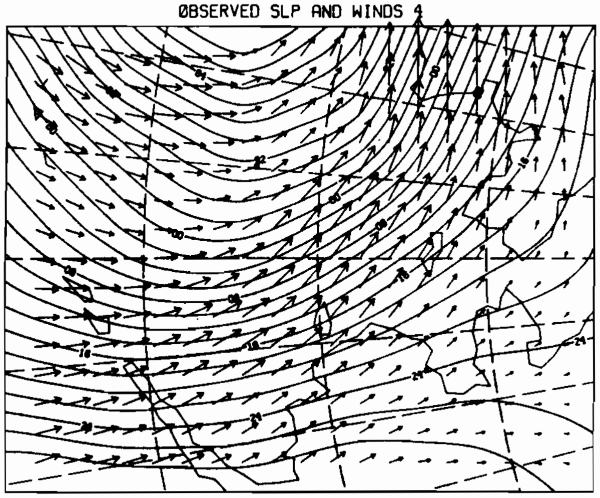

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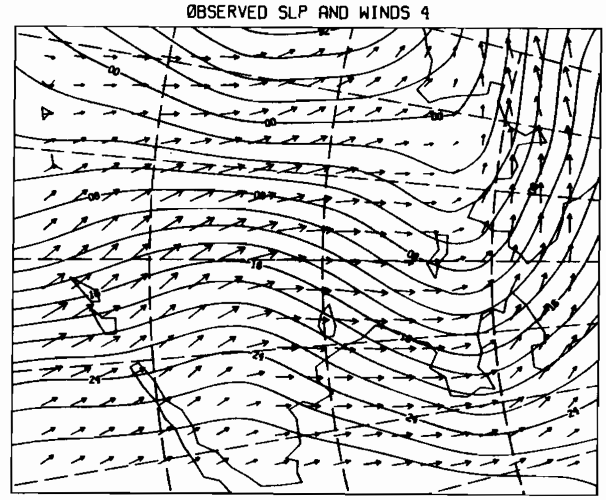

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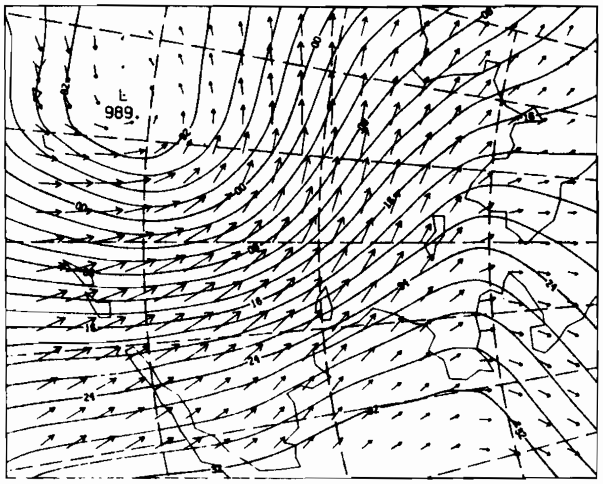

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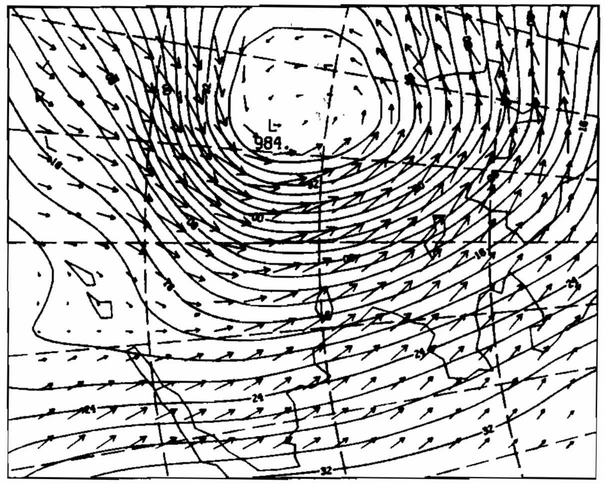

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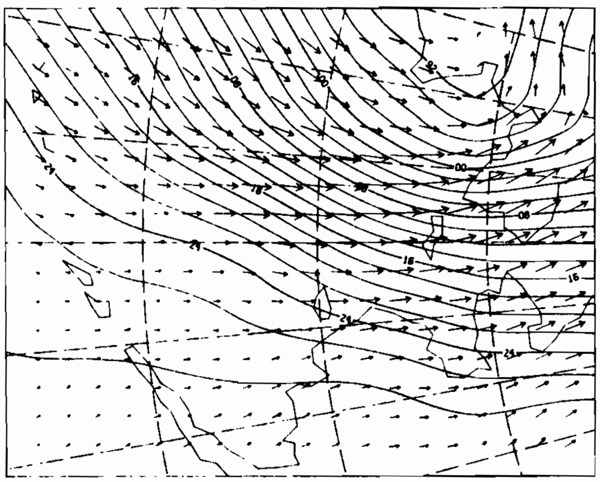

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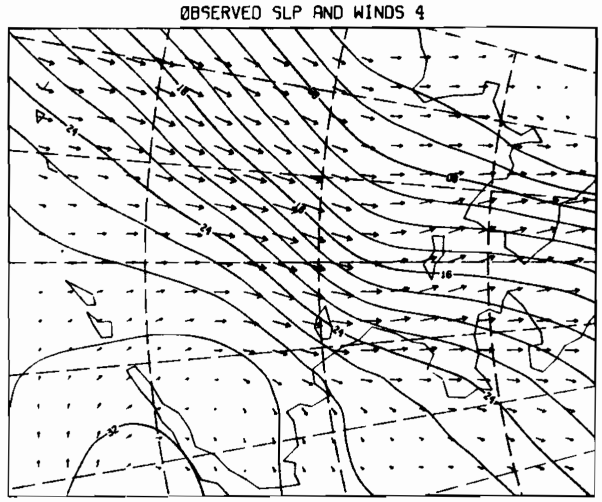

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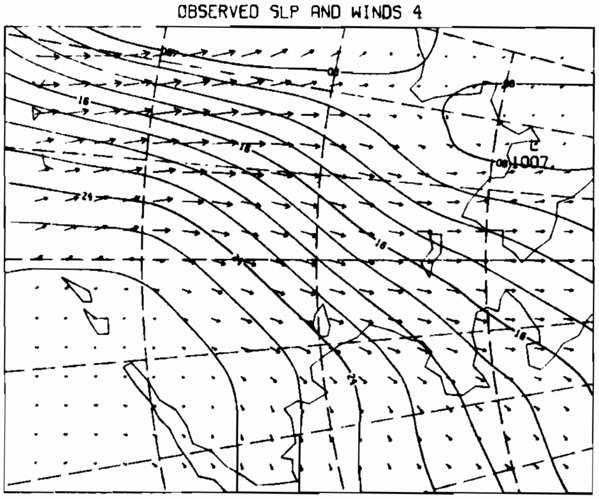

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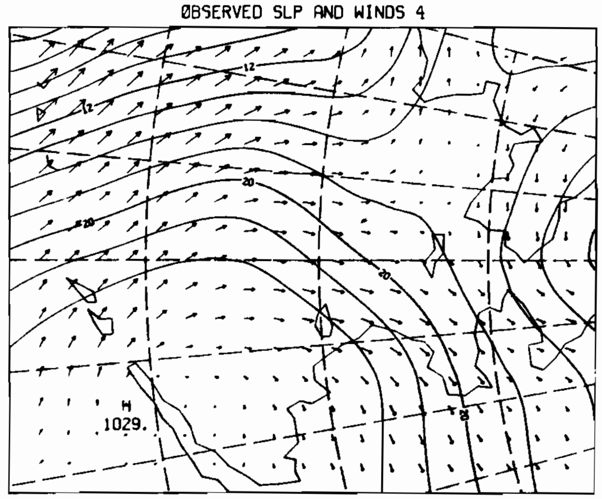

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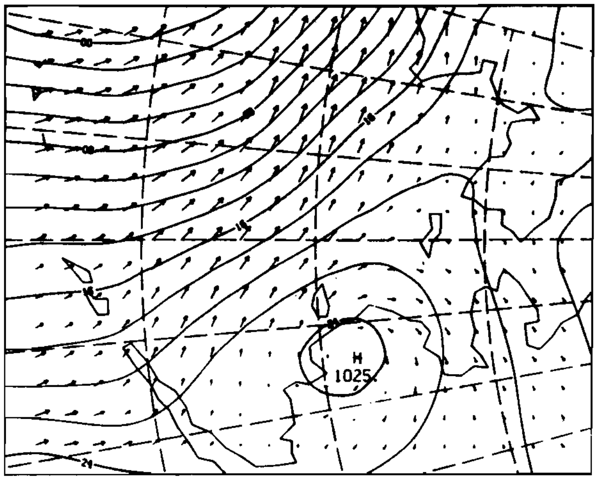

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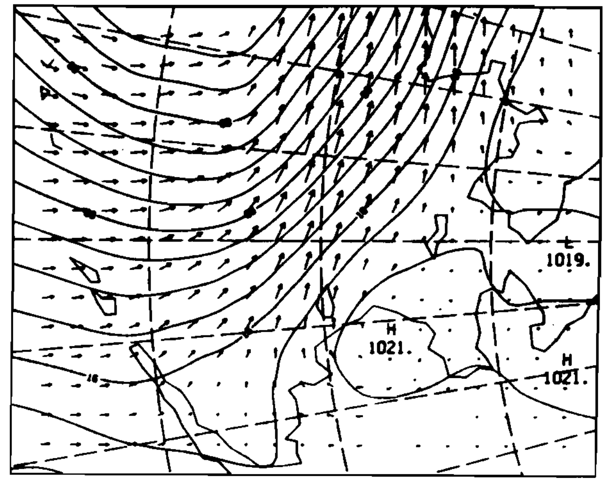

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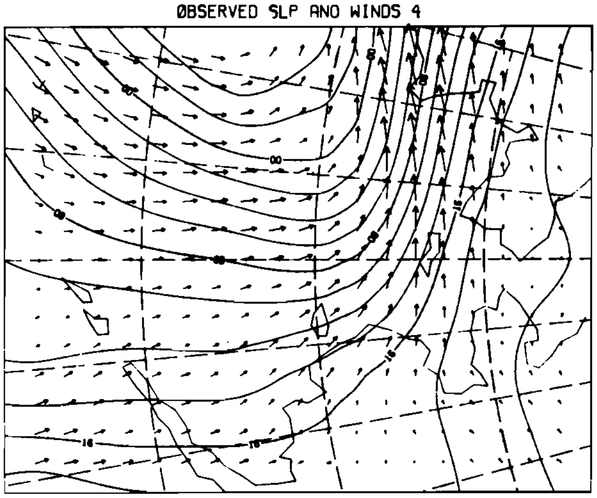

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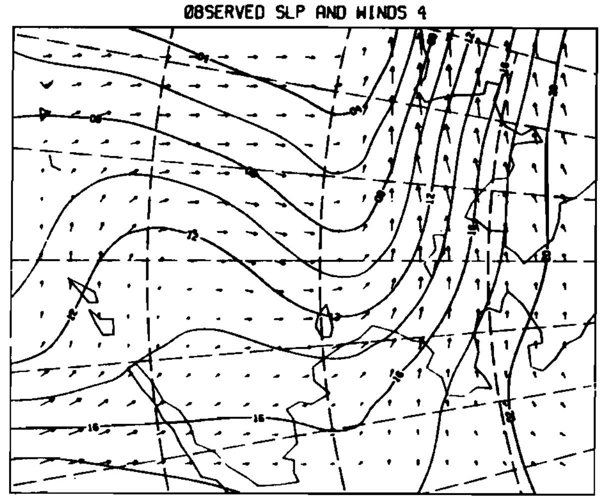

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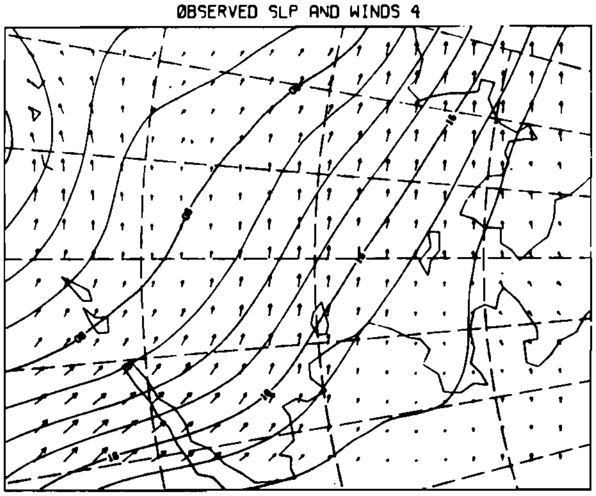

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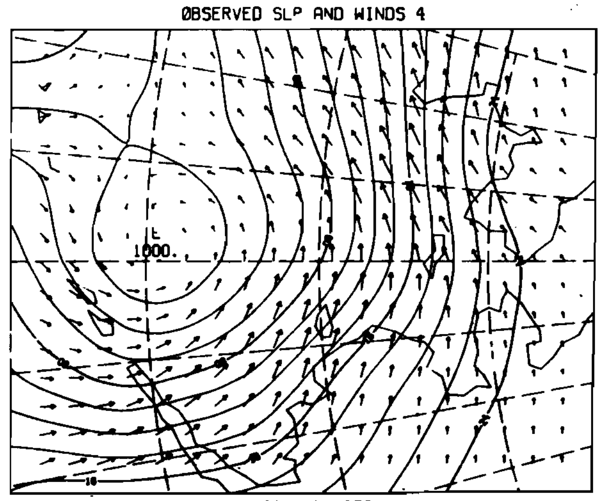

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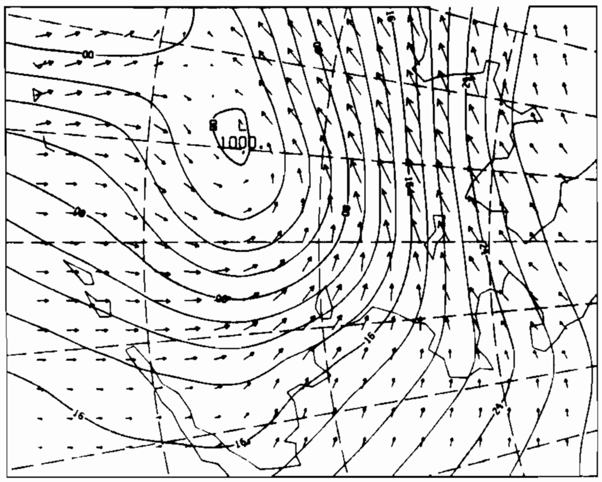

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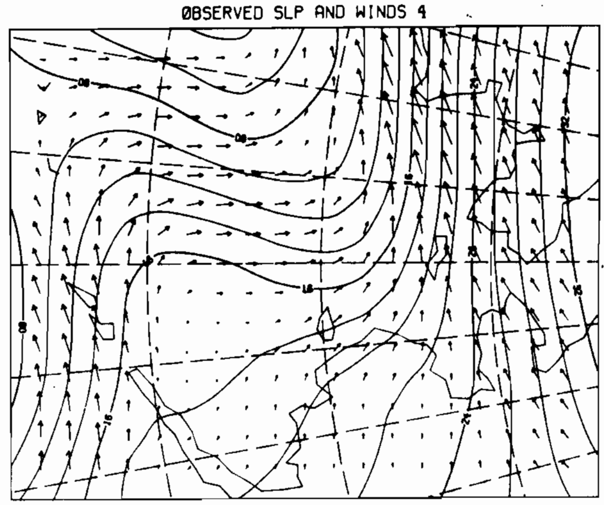

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