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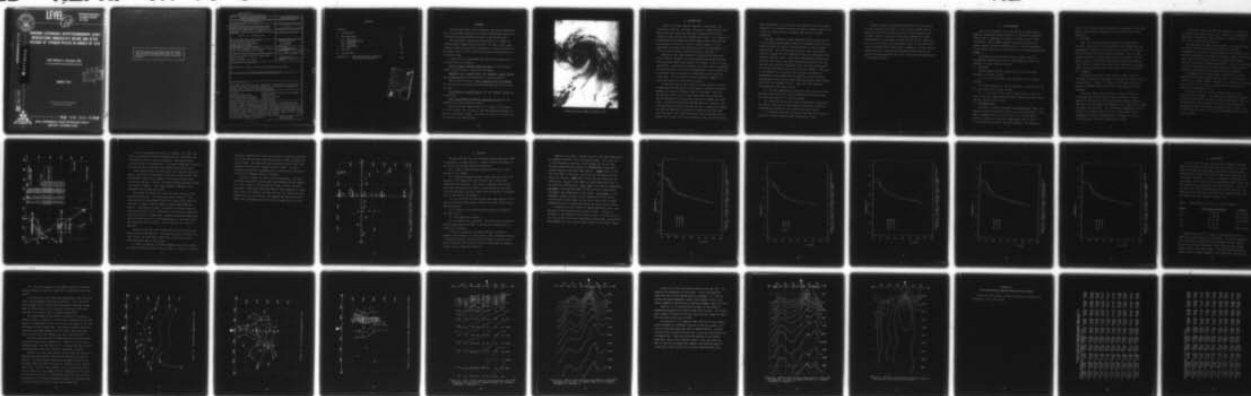
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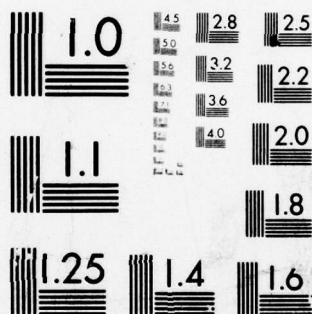
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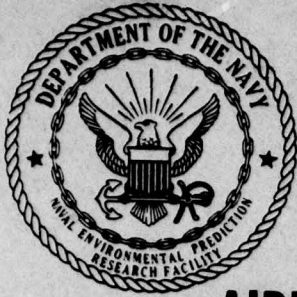
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**AIRBORNE EXPENDABLE BATHYTHERMOGRAPH (AXBT)  
OBSERVATIONS IMMEDIATELY BEFORE AND AFTER  
PASSAGE OF TYPHOON PHYLLIS IN AUGUST OF 1975**

**CAPT William G. Schramm, USN**

Naval Environmental Prediction Research Facility

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## FOREWORD

The work described in this technical report was conducted as part of my doctoral studies at the Naval Postgraduate School and the material contained herein is part of the dissertation.

This experiment required the interaction of a number of different Navy commands and activities. As such it was a good example of how the operational experience of a Naval Officer can be a major factor in the successful planning and execution of a scientific study.

I would like to acknowledge the support and cooperation I received from the following:

Office of Naval Research (ONR Code 480) for the financial support and assistance in obtaining the AXBTs.

Commander, U.S. Seventh Fleet, and Commander, Patrol Forces, U.S. Seventh Fleet for providing the P3 aircraft assets.

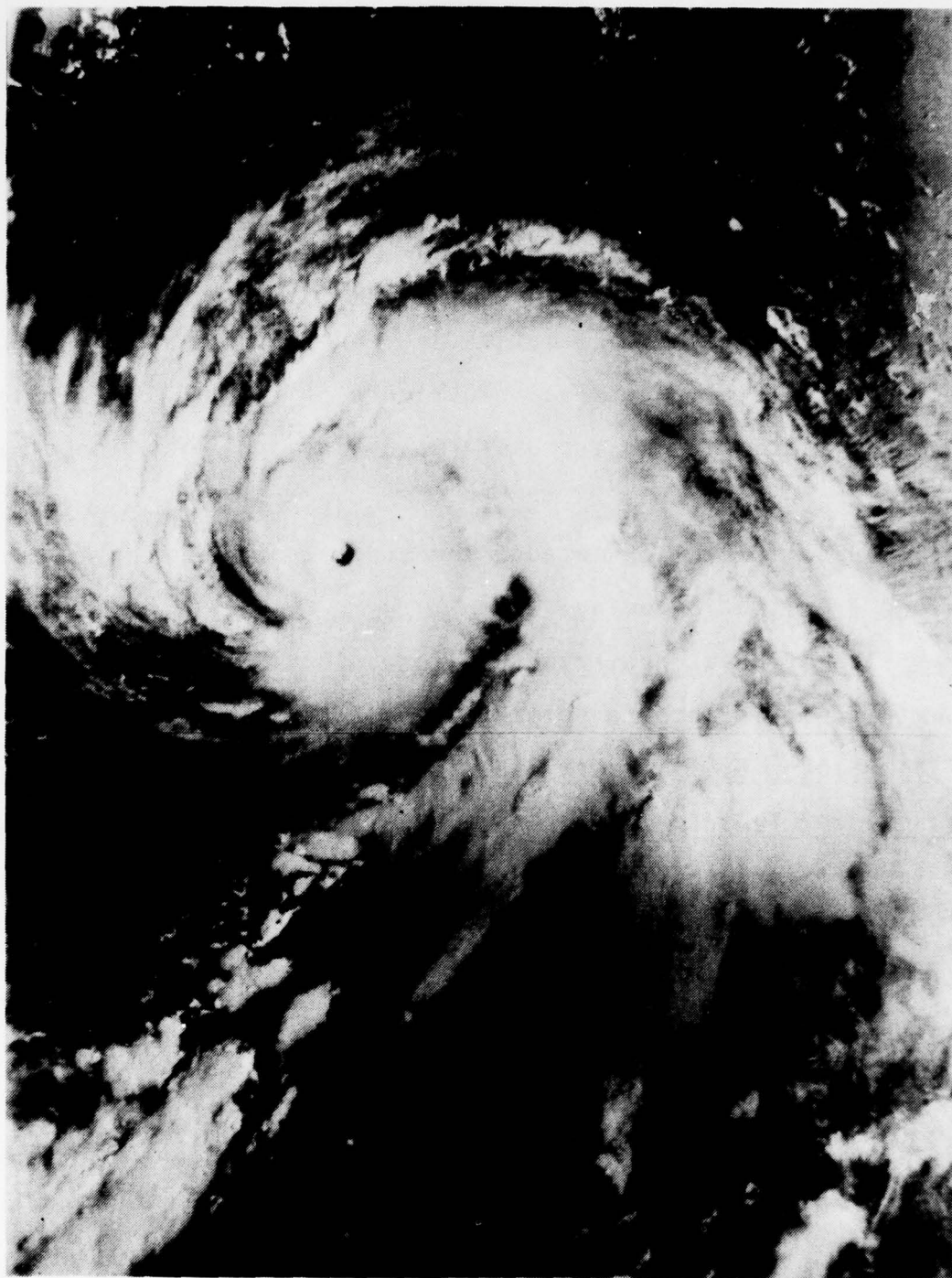
The officers and men of Patrol Squadron Sixty Five (VP65) for doing such an outstanding and professional job of flying the missions.

Fleet Numerical Weather Central for the computer processing of the data.

Naval Environmental Prediction Research Facility for the preparation of this technical report.

Finally and most importantly of all I would like to thank Dr. Dale Leipper, the chairman of the Oceanography Department at NPS and my doctoral advisor, for both his scientific insight and his patience and understanding.





TYPHOON PHYLLIS, 2302Z, 14 AUGUST 1975



## 1. INTRODUCTION

Tropical cyclones, whether typhoons or hurricanes, are creatures of the sea. We know, from years of observations, that these warm-core storms are born over the warm waters of the tropical oceans and rapidly dissipate over land. It is generally accepted that the energy that fuels these storms comes from the heat content of the sea. Little is known, however, of the magnitude of the heat flow from the ocean to the atmosphere, or of the residual effect of this heat loss on the ocean.

Because of the large amounts of precipitation associated with a tropical cyclone, it can be assumed that evaporation and the associated latent heat transfer are factors in the air-ocean interaction. Sensible heat transfer is a factor that is dependent on the difference in air and sea temperatures. Heat transfer due to radiation can be assumed to be negligible due to the heavy cloud cover. The net result of these processes, however, is a significant heat loss from the sea surface.

At the same time as the surface is being cooled, it may be assumed that the high winds of the tropical cyclone are causing mechanical mixing of the upper layer of the ocean. Both the surface heat loss, with its associated convective overturning, and the mechanical mixing could be expected to deepen the mixed layer. Scattered observations through the years, however, have indicated that this was not always the case. Leipper has pointed out that the additional processes of upwelling may take place under the path of the tropical cyclone, bringing colder water up towards the surface and in fact displacing the thermocline upward.

Other researchers, such as Black, have theorized that the upward movement of the thermocline under the path of these storms is due in part to internal waves created by the tropical cyclones themselves.

The major problem in identifying the effects of the various air-sea interaction processes and their resultant effects on the oceans has been the sparse, scattered nature of the available observations. This has been the case for a very good reason. Tropical cyclones are very dangerous storms and responsible ship captains stay well clear. Since most oceanographic observations are taken from ships, the result has been that most of the few reports we do have were taken days after the storms had passed and allowed the ships to visit the areas of interest. The study of the effects of Hurricane Hilda by Leipper is generally considered the most authoritative analysis of post-hurricane oceanographic data, and yet these observations were taken several days after the passage of Hilda. There are three possible shortcomings in this type of data:

(1) Air-sea interactions unrelated to the tropical cyclone may take place during the time lag between the passage of the storm and the arrival of a ship on station.

(2) Advection due to major ocean circulations unrelated to the tropical cyclone may shift layers of water into different relationships relative to the storm and to other layers.

(3) Unstable conditions created by the storm will tend to return to a stable condition with the passage of time.

Another problem in determining the effects of the various air-sea interaction processes is the lack of reliable data to establish the initial conditions prior to the passage of the tropical cyclone. Previous studies have depended on random observations or climatology to establish the initial conditions. As far as this author could determine, prior to 1975 there had been no planned study of the ocean's response to a major tropical cyclone that had included detailed observations prior to the storm's passage along with near real time post-storm observations at the same locations.

## 2. THE EXPERIMENT

Over the past several years, the Office of Naval Research (ONR) has sponsored research projects at the Naval Postgraduate School (NPS) in Monterey, California, in the field of air/sea interaction. One of these projects has been the Oceans and Severe Tropical Cyclones (OSTROC) project. The work described in this report was part of that project and is designated Operation OSTROC 75.

The objective of the operation was to obtain detailed oceanographic observations prior to and immediately after the passage of a major tropical cyclone.

### 2.1 LOCATION

The Philippine Sea was chosen as the site for the data collection for three reasons:

(1) It is an area with a high incidence rate of tropical cyclones.

(2) Ocean advection is minimal compared to regions like the Gulf of Mexico with its loop current.

(3) It is close to the island of Guam, which is both the site of the Joint Typhoon Warning Center (JTWC) and an operational base for Navy P3 patrol planes.

### 2.2 INSTRUMENTATION

The SSQ-36, airborne expendable bathythermograph (AXBT), was chosen to obtain the desired thermal structure measurements. The AXBT is dropped from an aircraft; once it is in the water, a thermistor deploys and measures temperatures down to 1000 ft. As the thermistor descends, the AXBT telemeters the temperature



back to the aircraft, where the signal is displayed on a recorder. Depth is determined by elapsed time and the sink rate of the thermistor.

## 2.2 PLATFORM

Navy P-3 patrol planes were chosen as the measurement platform. Very early in the planning, it was decided that the measurements would have to be taken from an aircraft in order to obtain the near-real-time observations needed. The P-3 then became the logical choice because they are equipped to use the AXBT as part of their normal ASW mission and the Navy deploys these planes to several bases near the Philippine Sea including Guam. The only question was, would fleet P-3's be available?

## 2.4 PLANNING

Preparations started in the spring of 1974. The first action was to obtain a commitment to use Navy P-3 aircraft during the experiment. In May, I traveled to the Western Pacific to present the OSTROC operational plan to the appropriate fleet personnel.

The ocean thermal structure has a strong influence on underwater acoustics and thus on the performance of sonars. Because of the possible application of the planned research to ASW tactics and strategy, the Commander, U.S. Seventh Fleet agreed to support the operation. His subordinate commander for Patrol Forces, U.S. Seventh Fleet (CTF-72) in turn tasked the P-3 detachment in Guam to provide three P-3 flights on a not-to-interfere basis relative to operational flights.

The initial plan called for the experiment to take place during the 1974 typhoon season, but it had to be postponed one year when a problem with the procurement of AXBTs restricted their use to operational missions.

By the spring of 1975, the procurement situation had been corrected and 96 SSQ-36 AXBTs were obtained for OSTROC. Arrangements were made for the instruments to be shipped to the National Oceanographic Instrumentation Center (NOIC) in San Diego, where they were calibrated using the technique developed by Sessions and Barnett for NORPAX experiments. Eleven of the buoys failed the calibration test and the remaining 85 were marked, numbered, and shipped to Guam where they were stockpiled.

Arrangements had also been made in 1974 with the Fleet Weather Central/Joint Typhoon Warning Center to provide early warning of a suitable typhoon (defined as a typhoon with sustained winds of over 100 kt) and to coordinate activities with the patrol wing detachment in Guam.

With the arrival of the 1975 typhoon season, all the preplanning was complete. The AXBTs were stockpiled and ready, the patrol plane crews had been briefed on the general nature of the experiment, the buoy pattern for the initial flight was prepared and JTWC watchstanders had been briefed on their role. All that remained was for me to wait in Monterey for the "right" storm to occur.

## 2.5 OPERATIONS

The 1975 typhoon season got off to a slow start, but finally in mid-August events started to happen. At 0242Z\* on the 12th, JTWC issued warning #1 for tropical depression #7, with 30 kt winds located at 12.7°N, 137.9°E. At 0304Z on the 12th, JTWC issued a prognostic reasoning message that stated that TD 07 was expected to reach typhoon intensity within 72 hours. LCDR Ralph Miller, Oceanography Officer at the Fleet Weather Central, was alerted. At 0540 on the 12th, JTWC upgraded TD 07 to Tropical Storm PHYLLIS based on aircraft observations.

By 1224Z on the 12th, JTWC had revised their estimate and now stated PHYLLIS would be a typhoon within 48 hours. Movement was expected to the northwest at about 8 kt. At this time, LCDR Miller called me and also alerted the P-3 detachment that this might be the storm to be examined for the experiment. It was determined that there were no conflicts with operational missions. By 0824Z on the 13th, PHYLLIS had increased to 65 kt and was now at 14.5°N, 135.1°E. At 1734Z on the 13th, JTWC upgraded PHYLLIS to a typhoon with sustained winds of 85 kt and predicted further intensification. Based on this information, I made the decision to go ahead, and VP-65 was alerted for a flight the next morning.

At 0040Z on the 14th, I departed Monterey for Guam and at 0200Z the same day, the first OSTROC P-3 took off from NAS Agana, Guam. LCDR Miller was on board with the latest satellite fix

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\*Because of the time difference between Guam and the mainland, all times are referenced to Greenwich mean time (GMT).

on the storm to help orient the buoy pattern to be dropped ahead of the storm. By 0600Z on the 14th, PHYLLIS had increased to 100 kt of sustained wind and was moving north at 15 kt toward the area where, at that time, our P-3 was obtaining the critical observations of initial conditions. By the time the first flight (AA141) had returned at 141330Z, after an 11 1/2 hour flight, PHYLLIS had increased to 110 kt and was located at 21.6°N, 137.0°E and continuing north at 18 kt.

The pattern of AXBTs dropped by AA141 consisted of 25 buoys starting at 23°-20°N, 138°-50°E and curving counterclockwise to the southwest. Thirty-four of the SSQ-36's were dropped, and 25 worked properly. I arrived in Guam three hours after the return of AA141, just in time to learn that PHYLLIS had indeed crossed over the pattern with sustained winds of 115 kt and gusts to 140 kt. The radius of the 100 kt winds was 25 n mi; the radius of the 50 kt winds was 125 n mi to the east and northeast, and 75 n mi elsewhere. Sea level pressure was estimated at 920 mb.

Later, PHYLLIS continued on to Japan, striking the islands of Honshu and Shikoku and killing 19 persons. Figure 2.1 shows the path of PHYLLIS with each dot equating to a synoptic fix. The area enclosed by the dashed line represents the area covered by the horizontal analyses discussed later in this report. Section A-B represents that line along which the vertical cross-sections, also discussed later, were analyzed. As shown in Figure 2.1, PHYLLIS crossed the AXBT pattern about 780 n mi northwest of Guam.



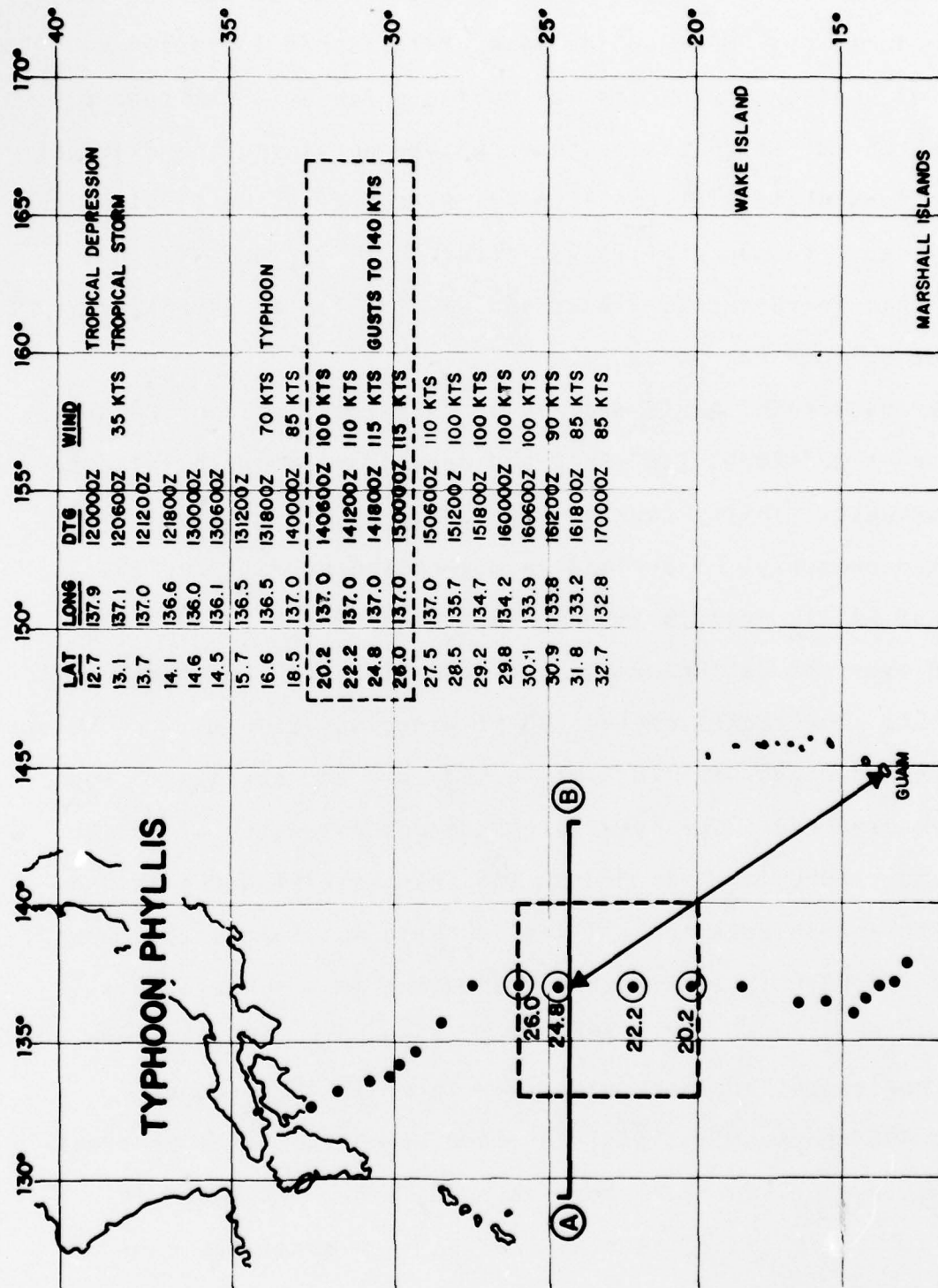


Figure 2.1. Track of Typhoon PHYLLIS.

So far, the operation had gone as planned. The JTWC forecasts for PHYLLIS had been outstanding and the instruments had functioned as well as could be expected. Now came the most critical phase of the operation: the second flight had to revisit the area as soon as possible after PHYLLIS cleared the area.

After worrying over all the things that could go wrong, but didn't, the second flight (AA151) took off at 0415Z on the 15th. We headed to that point northwest of Guam where PHYLLIS had crossed our pattern. Enroute, we passed through the major feeder band south of PHYLLIS. The cloud patterns resembled a well-developed mid-latitude cold front.

We arrived on station just 10 hours after the eye of the storm had passed by. The timing was close to perfect. The surface wind varied between 45 and 20 kt during the flight and there was a broken layer of cumulus clouds between 2000 and 5000 ft. We dropped 27 AXBTs, including 10 at points measured during the earlier flight. These were the 10 points nearest the track of PHYLLIS. An additional 14 observations were made along the lines both parallel to and perpendicular to the storm track, and there were three failures. This flight was 10.1 hours in duration.

Two days later the third flight (AA171) revisited the same area, taking 23 observations. The same 10 points visited on the first flight and revisited on AA151 were visited once again. Three AXBTs were bad on this flight.

In total, 85 SSQ-36's had been dropped on the three flights; of these, 72 were good and 13 were failures. Of the 72, 67 were

correctly recorded and 5 were lost because of recording problems. All of the data had been recorded on two in-flight recorders and also on tape. The tapes were later processed using a Fast-Time Analyzer at the Tactical Support Center on Guam. All the recording and analysis equipment was of high quality and used by the Navy for frequency analysis purposes.

Figure 2.2 shows the area of the investigation. The dots represent the points at which AXBTs were dropped and the numbers 1, 2, and 3 refer to the particular flight on which the drops were made. Additional drops were made to the southwest on flight AA141 (the first flight), but they were too far removed from the typhoon track to be of value. The typhoon was moving due north along 137°E longitude during the time it passed over this area.

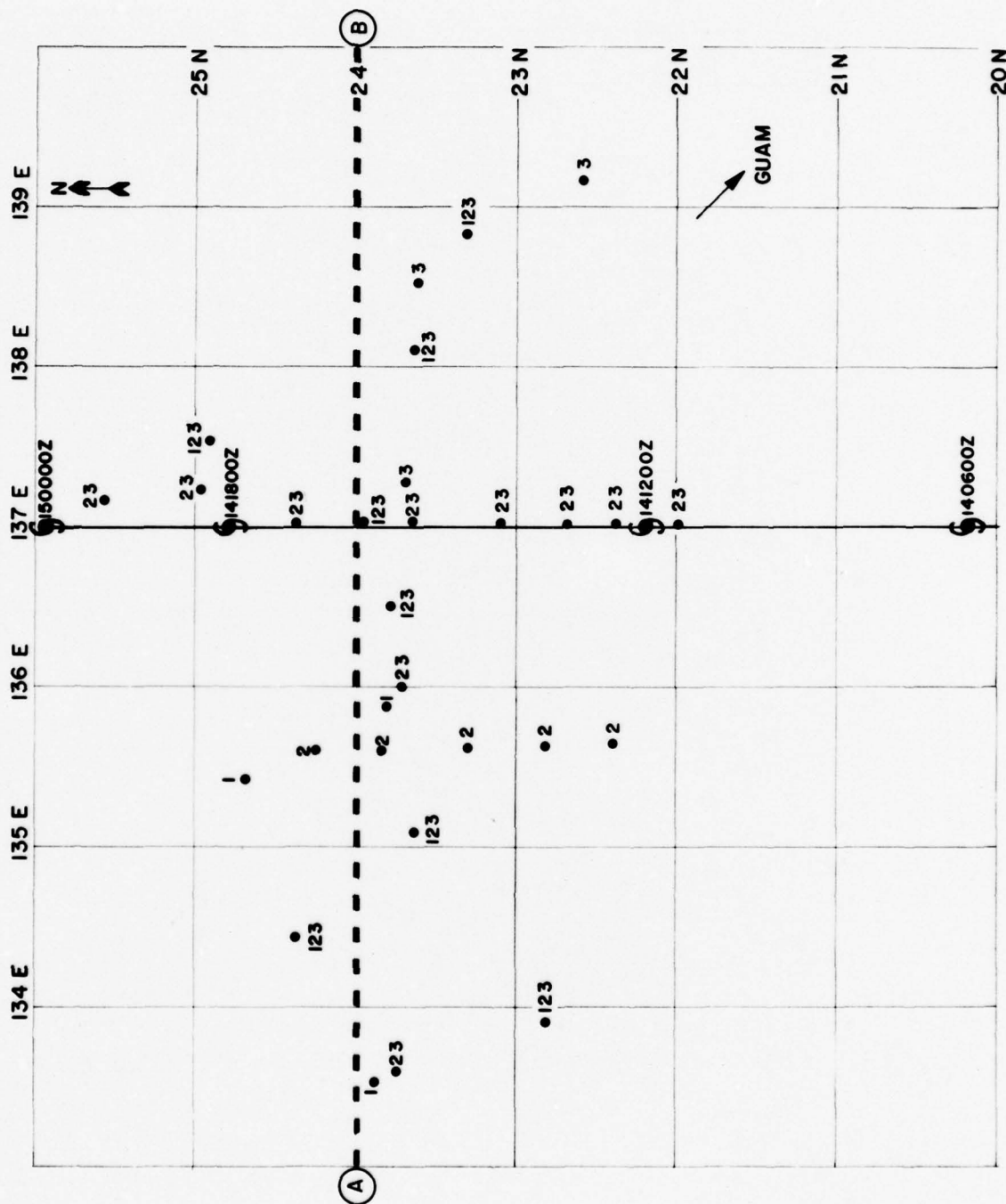


Figure 2.2. Locations of AXBT observations: 1 - observations on 14th;  
2 - observations on 15th; and 3 - observations on 17th.



### 3. THE DATA

Without question, the data collected during Operation OSTROC 75 represents a unique data set. Several factors contribute to the unique and valuable nature of this data:

(1) Initial conditions were observed just prior to the passage of the typhoon.

(2) Reaction observations were taken just hours after the passage of the typhoon and just 24 hours after the initial conditions were observed. This factor, combined with the fact that the investigation took place in the Philippine Sea, away from land and major currents, meant that the measured differences were in fact due to the typhoon.

(3) The third set of observations gave some measure of the rate at which the ocean returns towards its normal state after a typhoon passage.

(4) A number of the observations were actually taken at the same points.

(5) The typhoon was intense.

(6) The AXBTs were calibrated. This last factor cannot be overstressed because the AXBT is not factory calibrated as a scientific instrument.

As noted in Section 2, the AXBT data were recorded on magnetic tape recorders in the aircraft, later processed through a frequency analyzer, and the results plotted as analog traces. These traces were then digitized at the Fleet Numerical Weather Central using a CALMA 408 digitizer.

Appendix A provides a listing of each of the AXBT observations as produced from the file of digitized records. The first line in each observation consists of the appropriate station data. The ship name V026 was assigned at FLENUMWEACEN to keep these records separate from other AXBT reports. YYMMDD refers to the last two digits of the year, two digits for the month, and two digits for the day. HHMM refers to the hour and minute of the observation. No. Pr is the number of depth-temperature pairs in the particular observation. Surf. Temp is the surface temperature. Max Depth is the maximum depth for the particular observations and Temp is the temperature at that depth. Print Count is the sequential number assigned to each observation in the series. Following the station data line are one or more lines of depth-temperature pairs as determined during the digitization process.

In addition to the listings of depth-temperature pairs, each observation was plotted using a Varian plotter. Figures 3.1 through 3.5 are examples of this type of plot. In these particular figures there are three observations overplotted, representing measurements at a given point, made on each of the three flights.

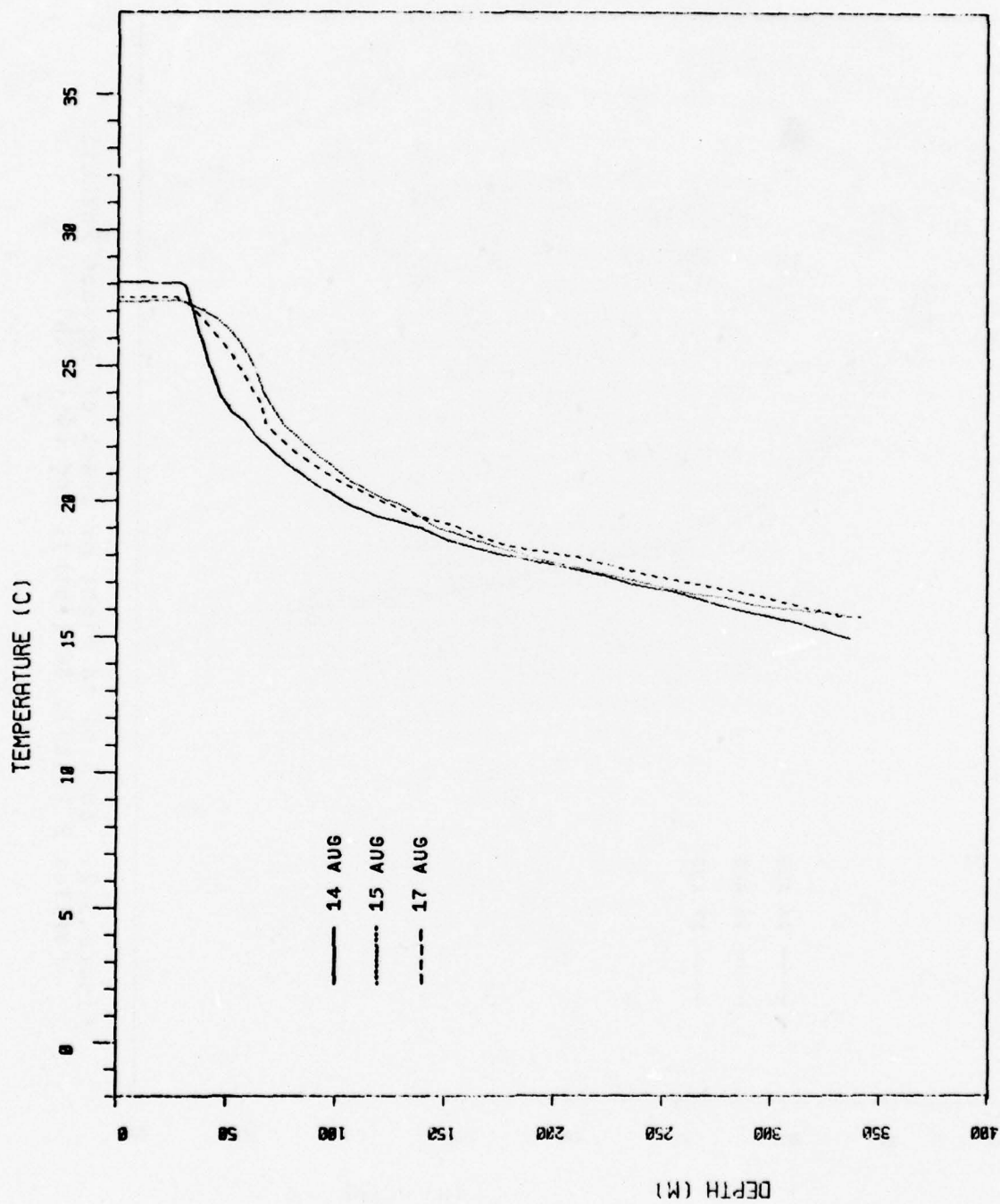


Figure 3.1. 110 n mi to right of track of Typhoon PHYLLIS:  
Profiles 1 (14th), 33 (15th), and 66 (17th).

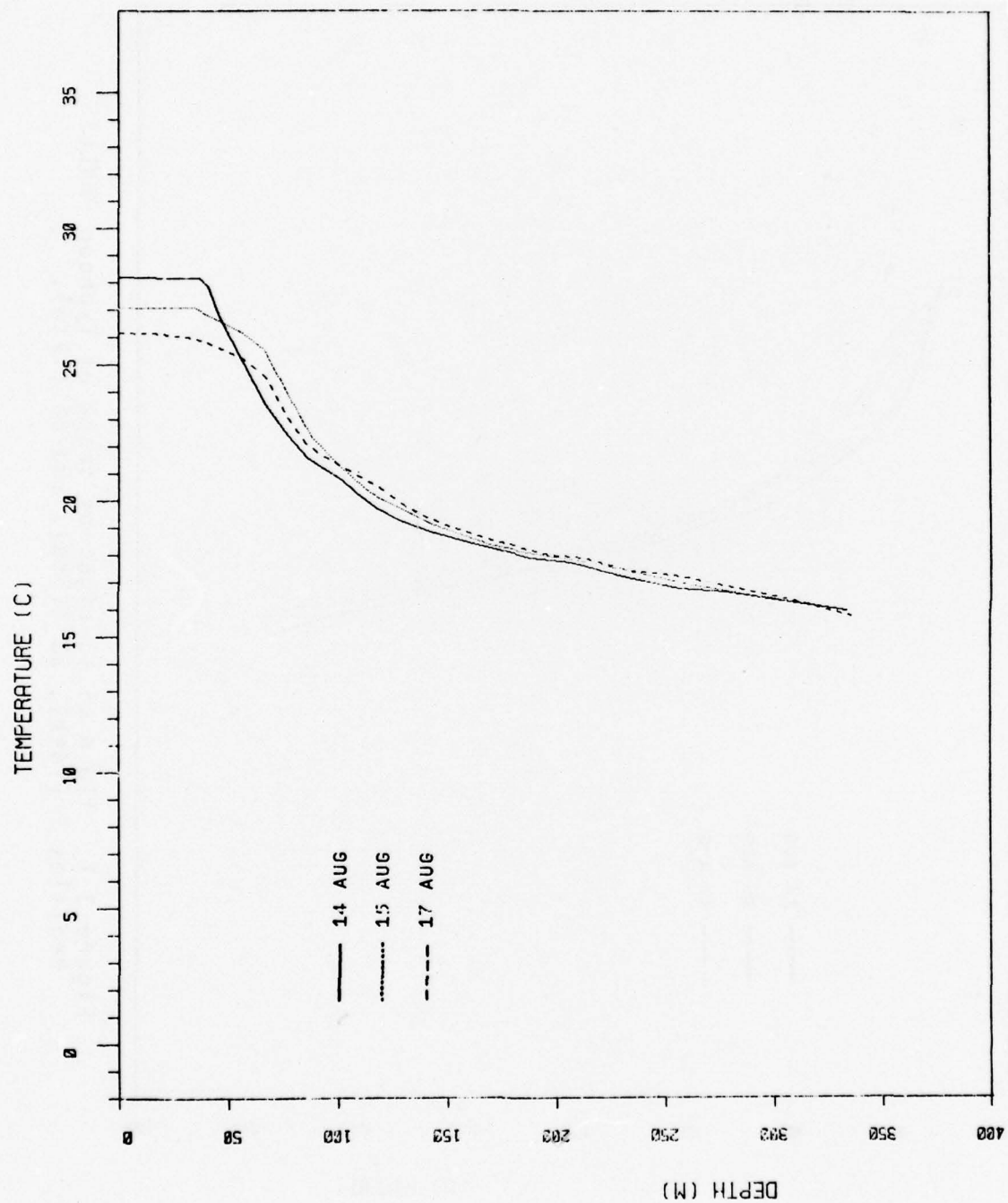


Figure 3.2. 60 n mi to right of track of Typhoon PHYLLIS:  
Profiles 2 (14th), 34 (15th), and 64 (17th).



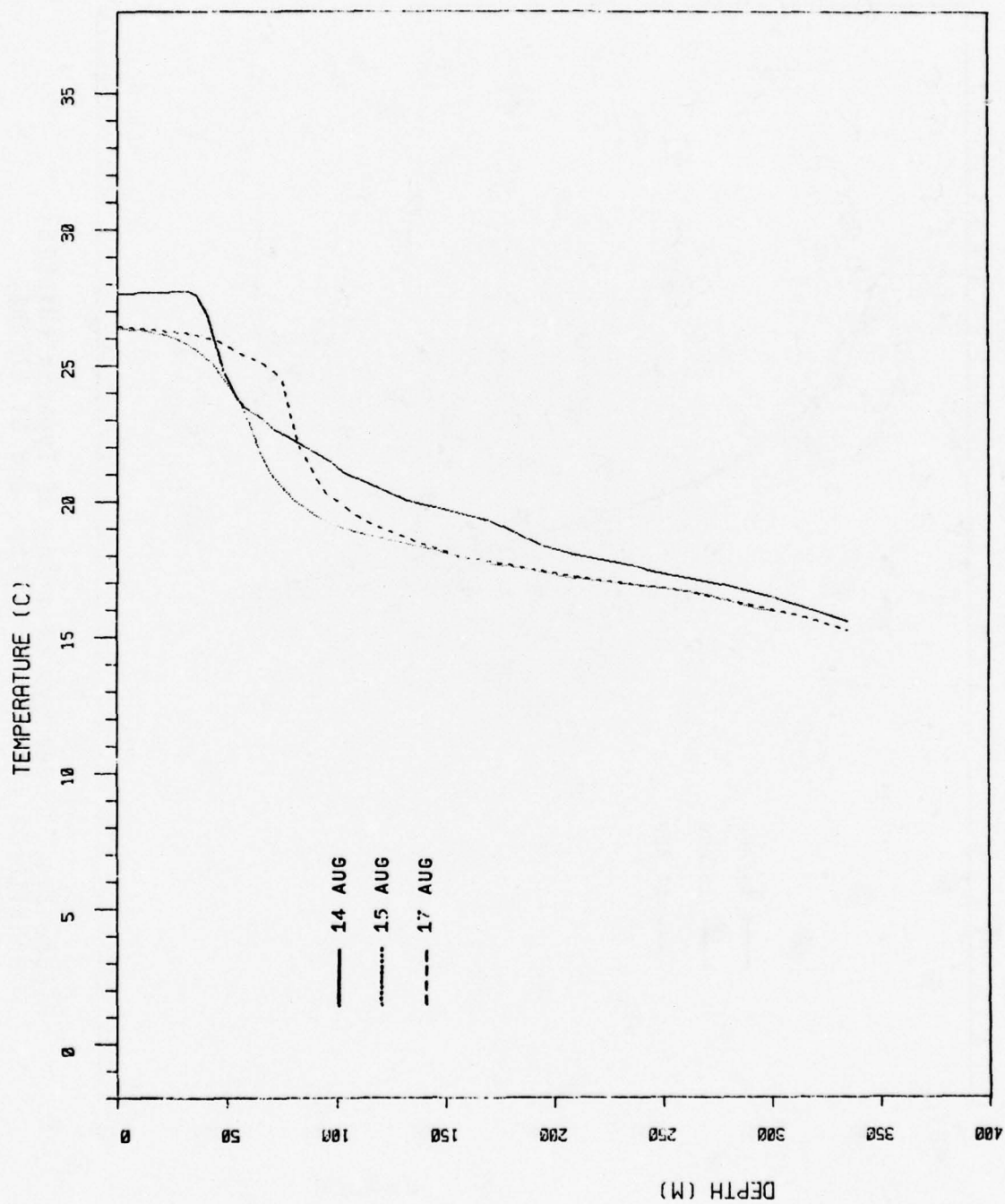


Figure 3.3. 30 n mi to right of track of Typhoon PHYLLIS:  
Profiles 22 (14th), 32 (15th), and 53 (17th).

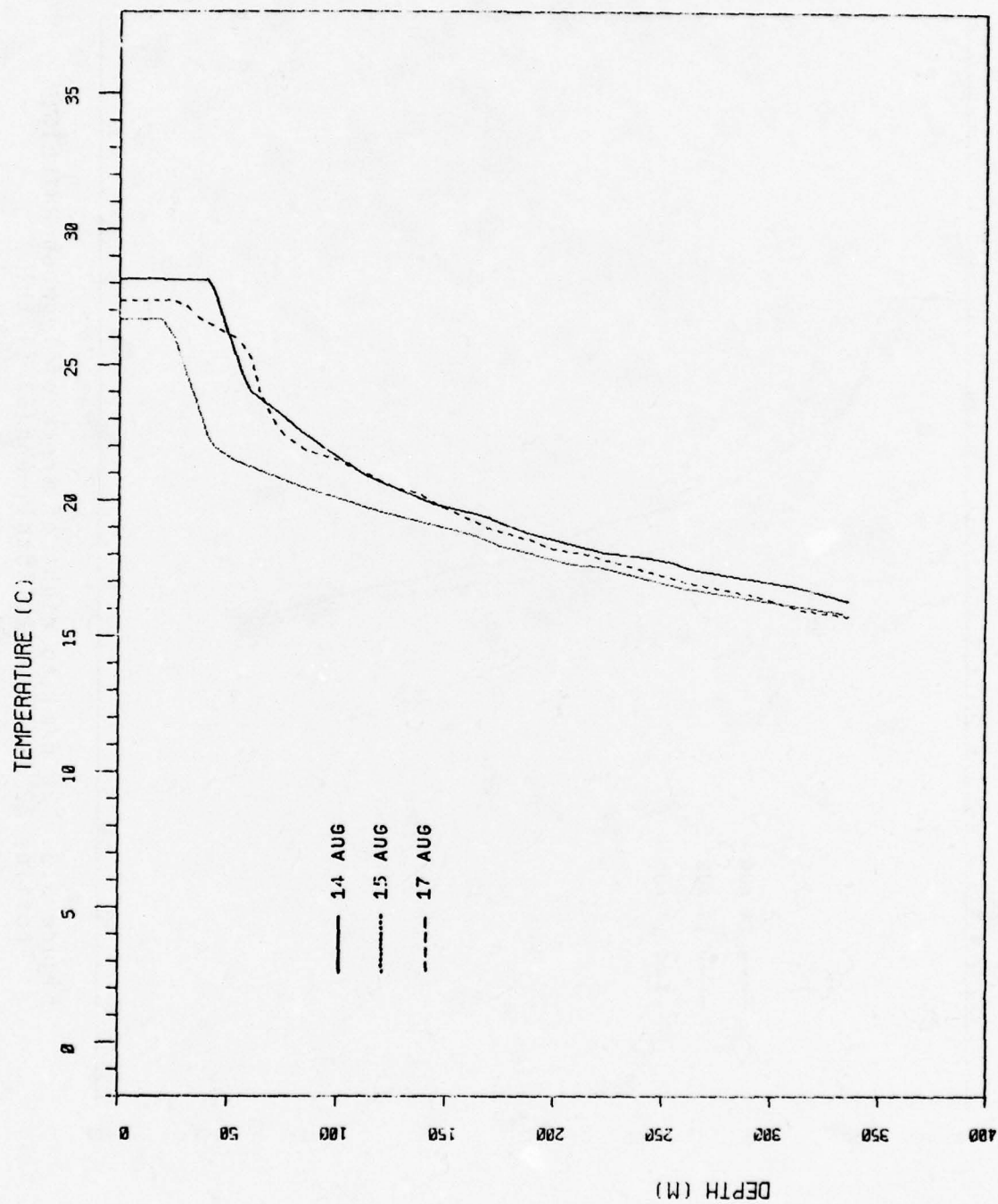


Figure 3.4. Under eye of track of Typhoon PHYLLIS:  
Profiles 3 (14th), 35 (15th), and 51 (17th).

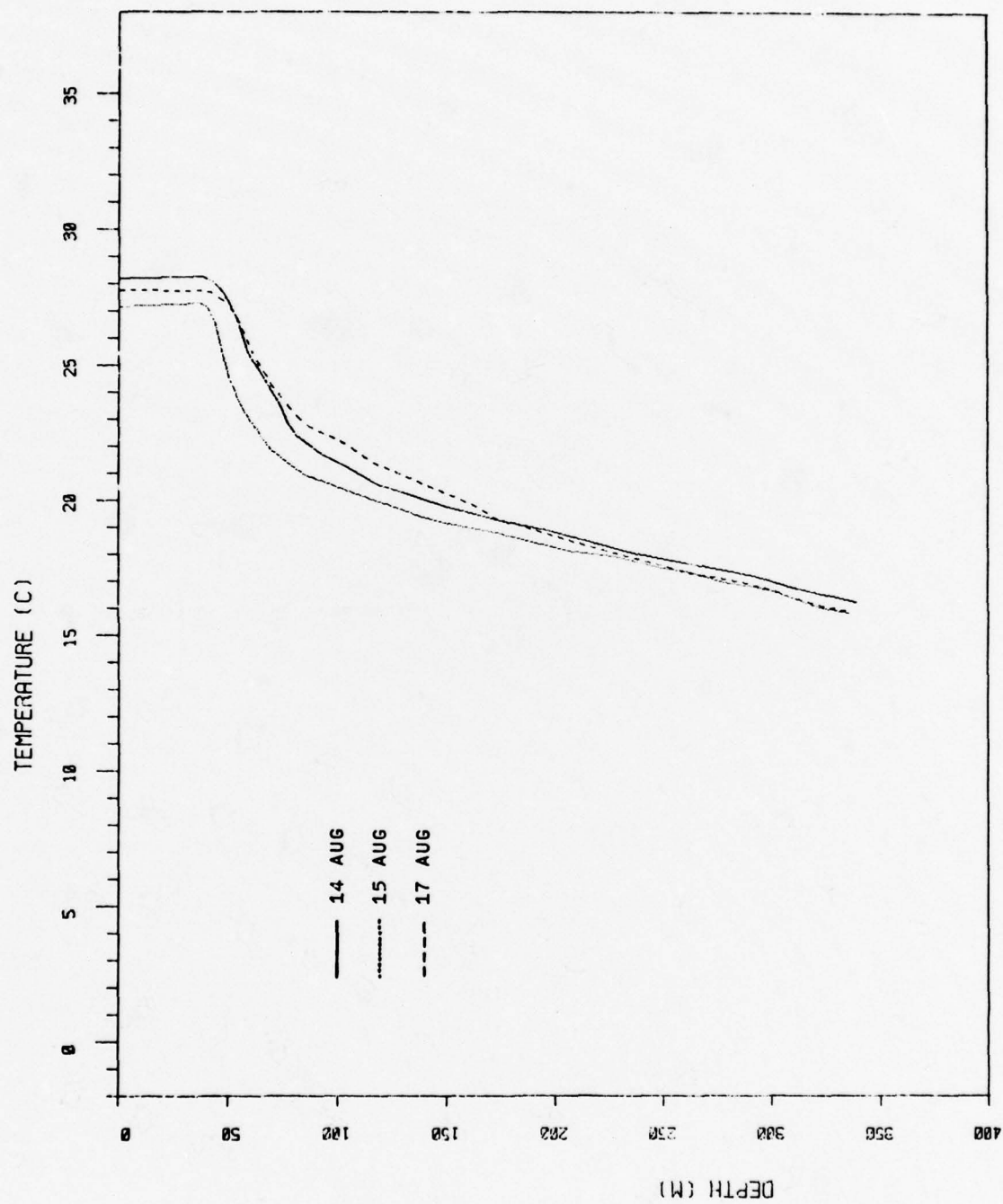


Figure 3.5. 30 n mi to left of track of Typhoon PHYLLIS:  
Profiles 4 (14th), 36 (15th), and 60 (17th).

#### 4. THE ANALYSIS

The first phase in the analysis was to compare individual BATHY traces taken on the before and after flights. To facilitate this comparison those BATHY observations that were made common points on each of the three flights were identified and the traces overplotted. Figures 3.1 through 3.5 represent six such cases. Table 1 shows the relationship of each of these sets of observations to the track of the eye of PHYLLIS. In each of the plots the solid line represents the initial condition, the dotted line the condition right after the typhoon passage, and the dashed line the condition two days later.

Table 1. AXBT positions relative to track of PHYLLIS.

<u>Figure</u>	<u>AXBT Sequential Numbers</u>	<u>Distance</u>
3.1	1, 33, 66	110 n mi east
3.2	2, 34, 64	65 n mi east
3.3	22, 32, 53	30 n mi east
3.4	3, 35, 51	0
3.5	4, 36, 60	30 n mi west

Observations 3, 35, 51 (Figure 3.4) were taken directly under the track of the eye of the typhoon. As would be expected this was the set of observations that showed the most change. The SST at this point decreased  $1.49^{\circ}\text{C}$ , which was the largest change noted on the second flight. The most surprising change, however, was the upward movement of the thermocline from 40 m to



18 m. This shallowing of the mixed layer took place in the presence of winds over 115 kt. Note also the upward displacement of the isotherms at all depths down to 330 m. This movement appears to be fairly uniform, and on the order of 50 m. Two days later there has been a slight increase in SST and a general return of the profile towards the initial conditions.

Thirty n mi to the west of the track of the eye the same pattern of changes took place, but to a lesser degree. The SST decreased  $1.28^{\circ}\text{C}$  and the mixed layer stayed at about 39 m. There was a definite upward displacement of the isotherms, but this time only on the order of 20-30 m. Once again the observation taken on the 17th indicated a warming at the surface and a return of the isotherms to their original levels.

Sixty n mi to the west there was relatively little change. Note in Figures 3.4 and 3.5 how well mixed the upper layer is, and how sharp a break exists at the top of the thermocline as observed right after storm passage.

East (or right) of the track of PHYLLIS is where the maximum winds would be expected, and here the changes were different from those noted to the west. Thirty n mi to the east the surface cooled  $1.28^{\circ}\text{C}$  and once again there was a generally upward movement of the isotherm. Sixty n mi to the east there was only a  $1.15^{\circ}\text{C}$  decrease, but by the 17th the decrease in SST had reached  $2.04^{\circ}\text{C}$ . Moving farther away from the storm track a change of just  $0.58^{\circ}\text{C}$  was observed 110 n mi to the east. Table 2 lists the SST changes for each of the points under consideration.

Table 2. Sea surface temperatures.

	<u>Position Relative to Track of Typhoon PHYLLIS</u>					
	<u>East</u>			<u>West</u>		
<u>Distance (n mi)</u>	<u>110</u>	<u>65</u>	<u>30</u>	<u>0</u>	<u>30</u>	<u>60</u>
SST on 14th	28.09	28.22	27.64	28.18	28.20	28.00
SST on 15th	27.38	27.07	26.36	26.69	27.16	28.00
Change (15th-14th)	-0.71	-1.15	-1.28	-1.49	-1.04	0.0
SST on 17th	27.51	26.18	26.44	27.48	27.76	28.04
Change (17th-14th)	-0.58	-2.04	-1.20	-0.80	-0.44	+0.04

Of particular note in those profiles obtained east of the track, is the ill-defined nature of the bottom of the mixed layer. This characteristic was common to all those observations taken east of the storm track and is in sharp contrast to the observations taken to the west where the mixed layer was well mixed.

Several observations may be made relative to the analysis of the data:

(1) A pronounced upward displacement of the subsurface isotherms took place. This displacement was at a maximum under the track of the eye and decreased both to the left and right of that track.

(2) There was a pronounced decrease of SST between the 14th and 15th with the maximum loss under the path of eye and with a lesser decrease in SST both to the left and right.

(3) By the 17th the SST had started to increase again to the west, but not to the east.

(4) After the passage of the typhoon the mixed layer was sharply defined to the left (west) but ill-defined to the right (east).

In reflecting on the latter two observations, two characteristics of the typhoon should be considered. First, the winds were stronger to the right (east) and second, the major feeder band for PHYLLIS was to the east and it persisted with winds over 50 kt for several days as PHYLLIS moved north.

The second phase of the analysis consisted of preparing analysis charts. Figure 4.1 is the SST as analyzed for the 14th, Figure 4.2 represents the SST on the 15th, and Figure 4.3 is the difference in the previous two. The zone of maximum change was oriented north-south between  $137^{\circ}\text{E}$  and  $138^{\circ}\text{E}$ , while the best track for the eye of the typhoon was due north along  $137^{\circ}\text{E}$ .

Vertical cross-sections of temperature were analyzed along section A-B, which was roughly  $34^{\circ}\text{N}$ . Figure 4.4 is the cross-section analysis for the 14th and it is evident that the initial conditions were those that could be considered as normal.

Figure 4.5 is the cross-section analysis for the 15th and is probably the most dramatic depiction of the changes caused by PHYLLIS. The most obvious change was the upward bulge in the isotherms under the path of the eye or slightly to the right of that track. At  $137^{\circ}\text{E}$ , for example, the  $25^{\circ}$  isotherm went from 54 m to about 30 m, but deeper the  $20^{\circ}$  isotherm went from 144 m to about 97 m and the  $17^{\circ}$  isotherm went from 295 m up to 248 m. Less obvious is the smaller downward movement of isotherms both to the east and west of the sharp zone of upwelling.

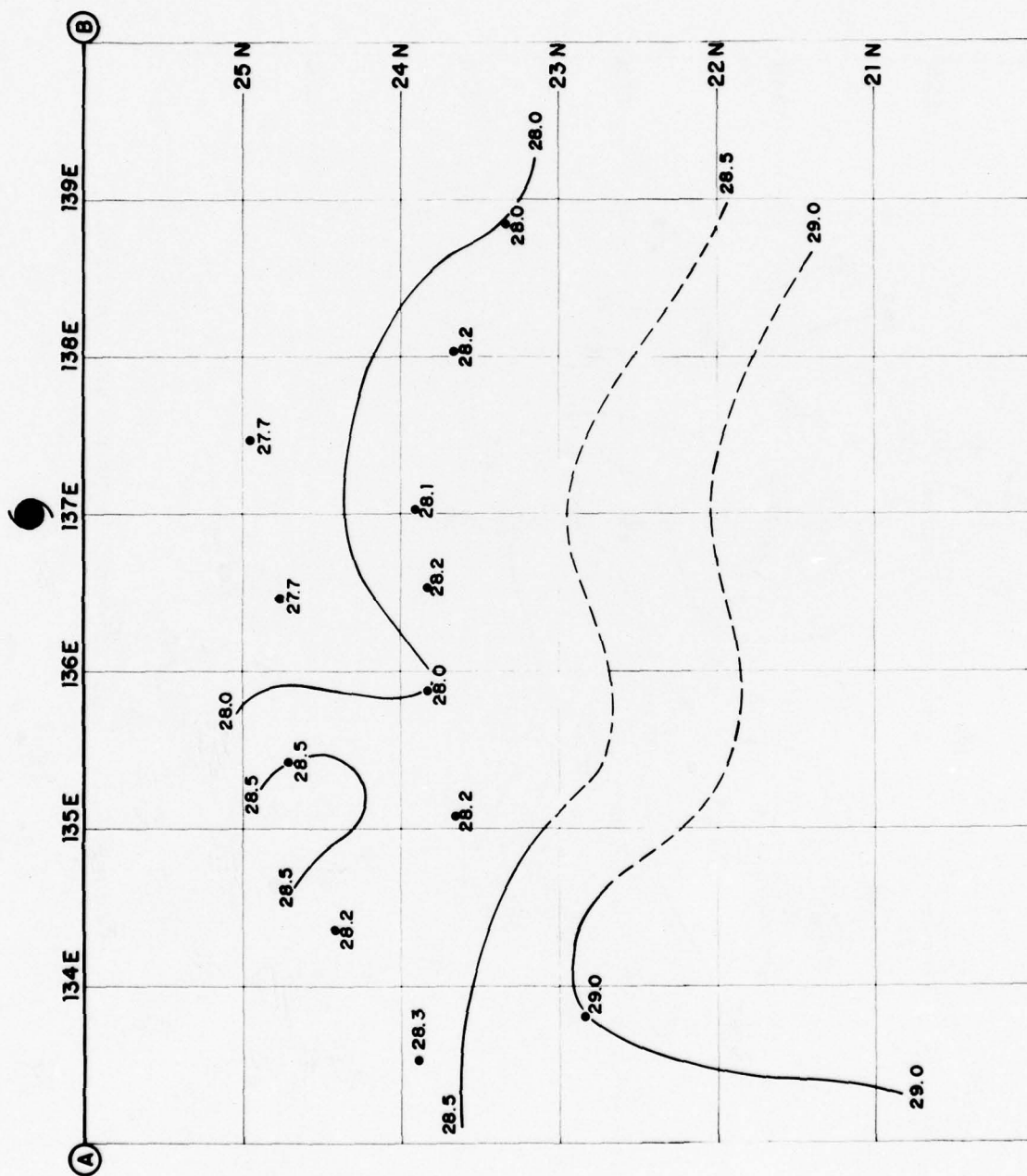


Figure 4.1. Sea surface temperature on 14th.





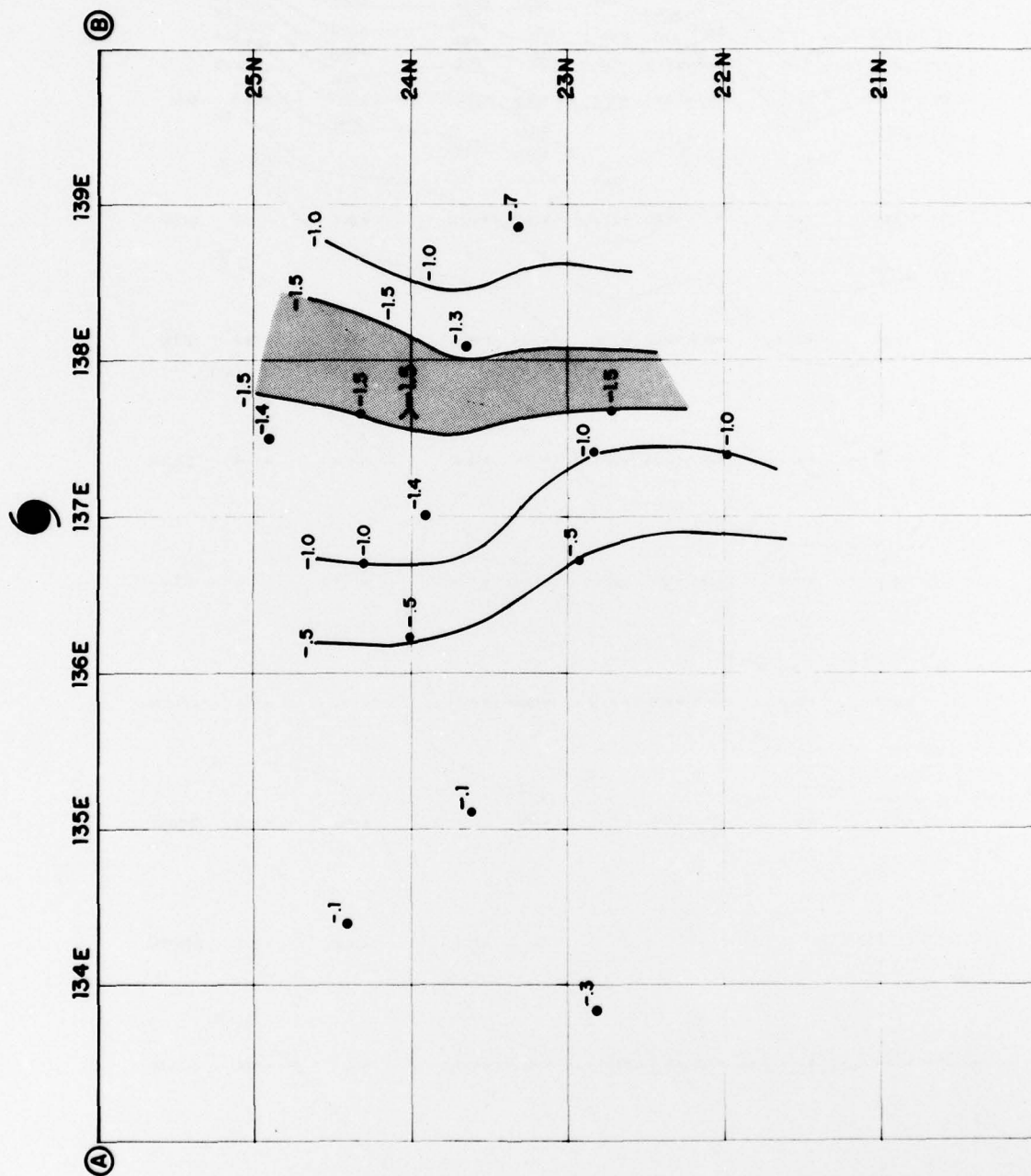


Figure 4.3. Changes in sea surface temperature from 14th to 15th.

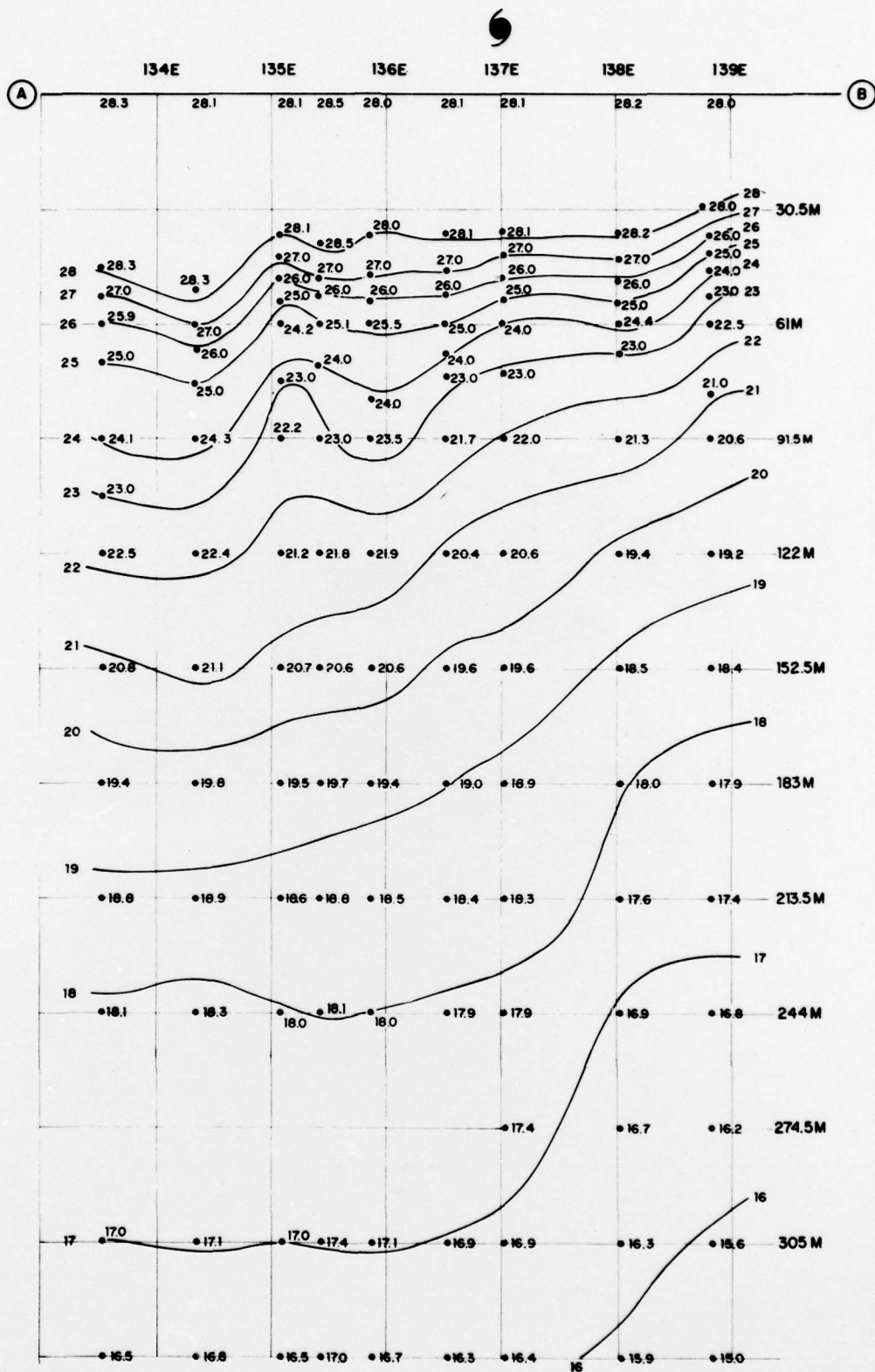


Figure 4.4. West to east vertical cross-section, along  $24^{\circ}\text{N}$ , perpendicular to track of Typhoon PHYLLIS, on 14 August. (Isotherms in degrees C.)

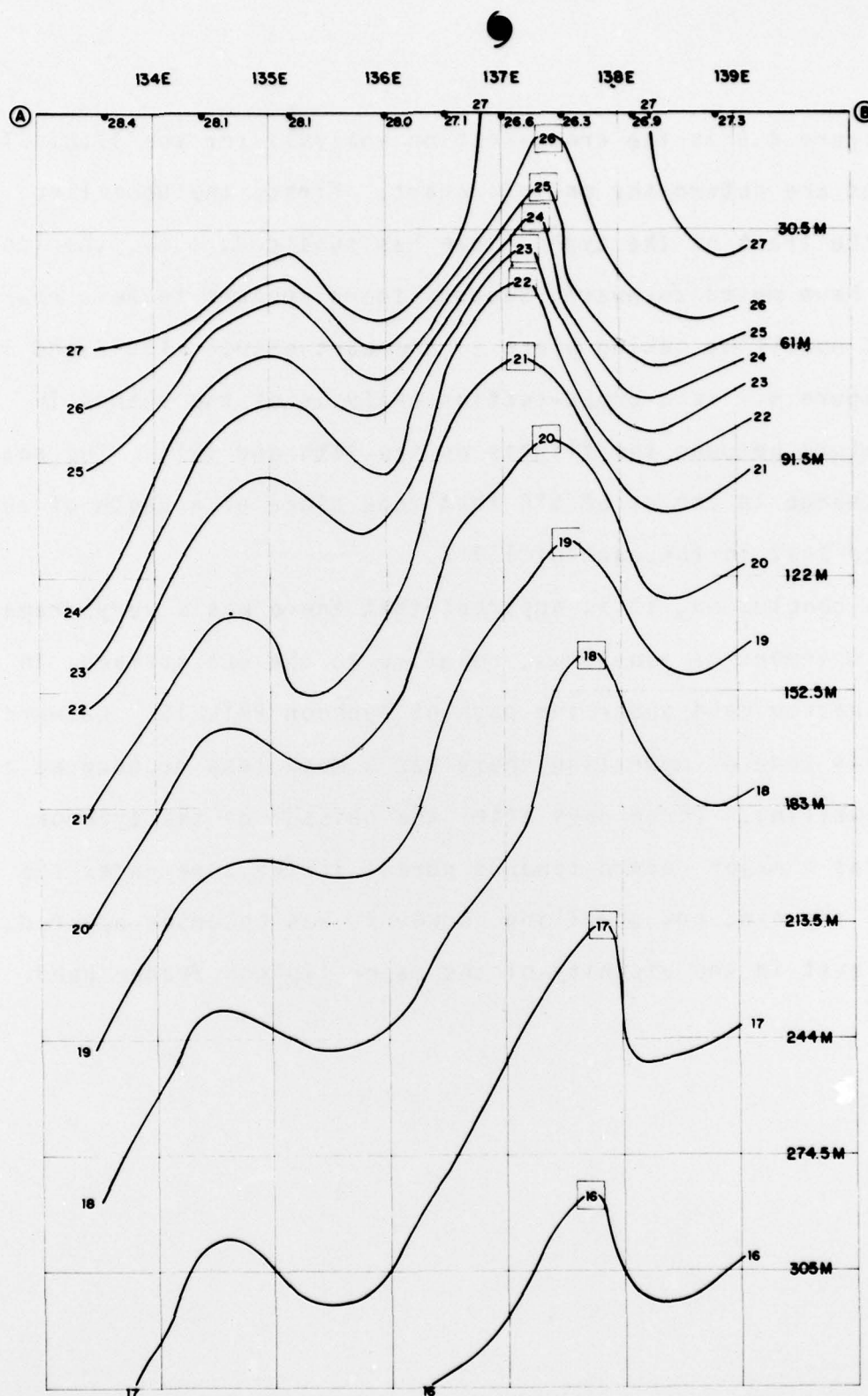


Figure 4.5. West to east vertical cross-section, along  $24^{\circ}\text{N}$ , perpendicular to track of Typhoon PHYLLIS, on 15 August. (Isotherms in degrees C.)



Figure 4.6 is the cross-section analysis for the 17th. Two features are noteworthy on this chart. First, the upwelling under the track of the typhoon eye has subsided, i.e., the isotherms have moved downward; second, there appears to be a new zone of upwelling taking place to the east between 138°E and 139°E.

Figure 4.7 is a cross-section analysis of the change in temperature between the flights on the 14th and 15th. The maximum was a change in excess of 5°C that took place at a depth of about 40 m and just to the east of 137°E.

In conclusion, it is apparent that there was a very dramatic upward movement of isotherms, relative to the sea surface, in a fairly narrow band under the path of Typhoon PHYLLIS. Outward from this zone of upwelling there was a much less pronounced zone of downwelling. Three days after the passage of the typhoon there was a major return towards normal in the zone under the path of the eye; new upwelling, however, was becoming apparent to the east in the vicinity of the major typhoon feeder band.

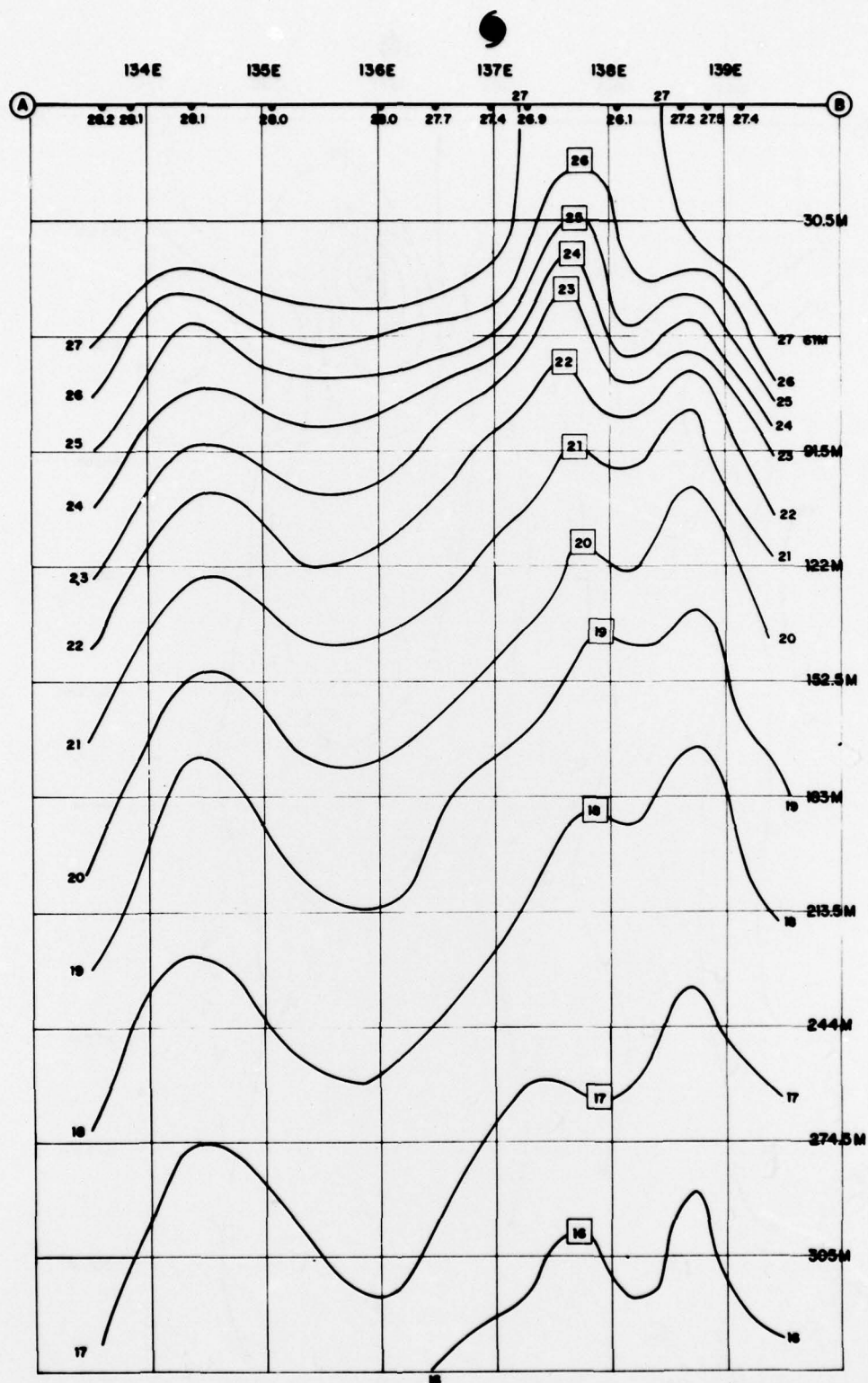


Figure 4.6. West to east vertical cross-section, along  $24^{\circ}\text{N}$ , perpendicular to track of Typhoon PHYLLIS, on 17 August. (Isotherms in degrees C.)

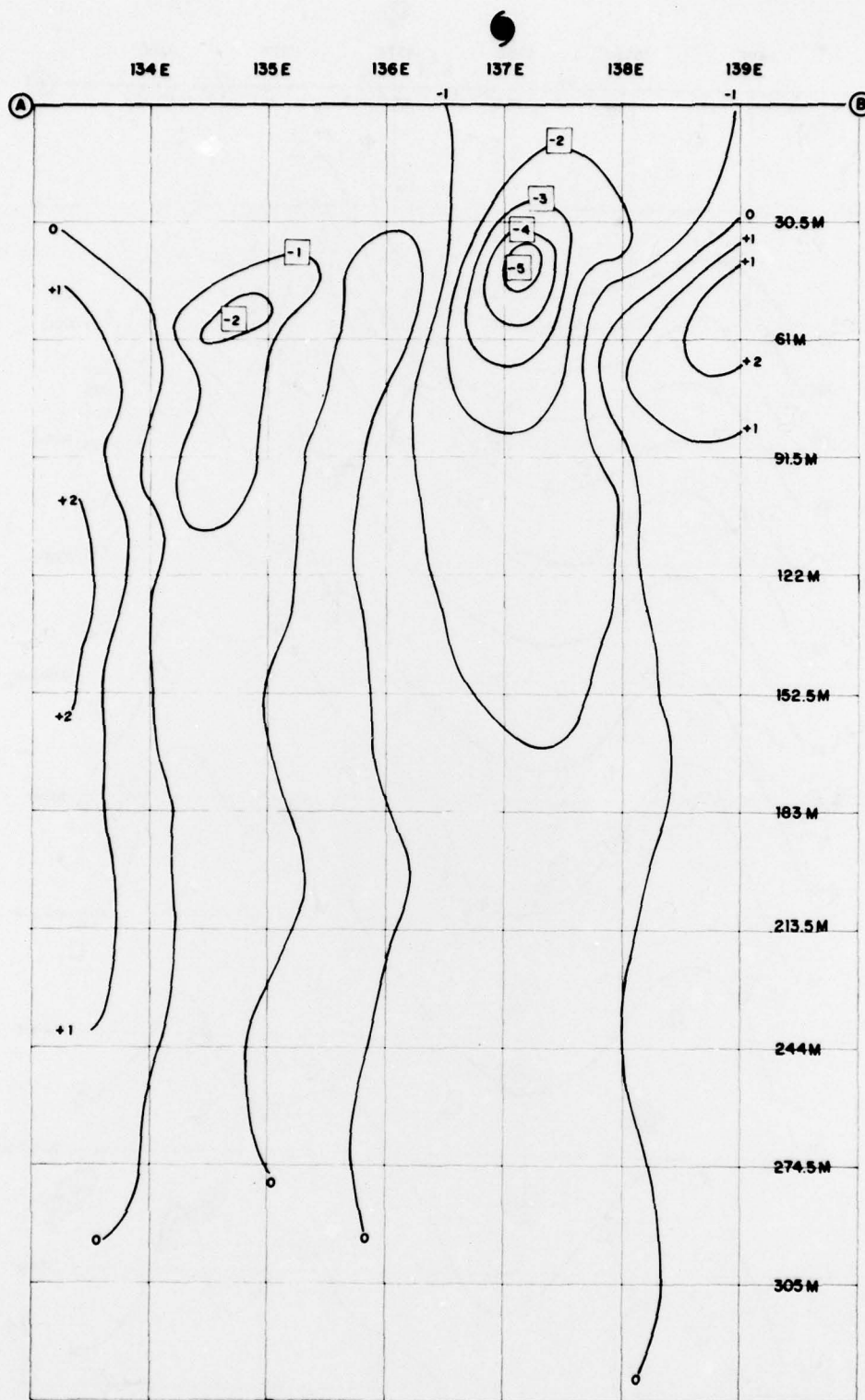


Figure 4.7. Vertical cross-section depicting changes in temperatures from the 14th to the 15th.

## APPENDIX A

### AXBT OBSERVATIONS PRODUCED FROM DIGITIZED RECORDS

Column and line entries on these listings are discussed and defined on p. 16 of this report.



[illegible]

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SHIP	TIME	NAME	LAT	LONG	AC	PR	SURF	TEMP	MAX	DEPTH	TEMP	PRINT	COUNT
V026	754917	1326	2304N	13700E	16		2762			335	1500		51
			DEPTH	TEMP	DEPTH	TEMP	DEPTH	TEMP	DEPTH	TEMP	DEPTH	TEMP	
			2762	48	2767	50	2747	58	2808	61	2560	76	2432
			222	1452	294	1650	292	1667	306	1676	321	1607	335
V026	754917	1351	2404N	13701E	23		2738			335	1578		51
			DEPTH	TEMP	DEPTH	TEMP	DEPTH	TEMP	DEPTH	TEMP	DEPTH	TEMP	
			2738	36	2673	30	2722	36	2673	53	2595	56	2572
			85	2134	99	2147	126	2045	137	2023	142	1995	159
			294	1552	343	1638	339	1578					
V026	754917	1359	2423N	13701E	19		2733			335	1507		52
			DEPTH	TEMP	DEPTH	TEMP	DEPTH	TEMP	DEPTH	TEMP	DEPTH	TEMP	
			2733	47	2673	34	2731	40	2704	54	2617	59	2556
			143	1463	169	1889	194	1839	205	1800	267	1656	240
V026	754917	1429	2458N	13733E	18		2644			334	1524		51
			DEPTH	TEMP	DEPTH	TEMP	DEPTH	TEMP	DEPTH	TEMP	DEPTH	TEMP	
			2644	58	2534	34	2616	45	2593	65	2512	72	2470
			1.9	1340	115	1915	132	1443	155	1799	216	1711	257
V026	754917	1442	2536N	13711E	19		2640			335	1591		54
			DEPTH	TEMP	DEPTH	TEMP	DEPTH	TEMP	DEPTH	TEMP	DEPTH	TEMP	
			2640	49	2577	36	2622	42	2622	56	2544	63	2507
			146	2174	128	1983	155	1892	165	1856	196	1806	222
V026	754917	1343	2425N	13423E	25		2822			335	1596		55
			DEPTH	TEMP	DEPTH	TEMP	DEPTH	TEMP	DEPTH	TEMP	DEPTH	TEMP	
			2822	40	2789	33	2814	45	2731	45	2731	56	2499
			90	2216	94	2218	1.7	2156	111	2148	123	2089	135
			211	1443	247	1760	245	1693	302	1676	335	1596	135
V026	754917	1453	2345N	13337E	16		2833			333	1645		56
			DEPTH	TEMP	DEPTH	TEMP	DEPTH	TEMP	DEPTH	TEMP	DEPTH	TEMP	
			2833	61	2700	53	2812	61	2700	83	2534	109	2389
			149	2010	231	1921	242	1878	269	1846	322	1695	333
V026	754917	1519	2249N	13351E	17		2811			335	1642		57
			DEPTH	TEMP	DEPTH	TEMP	DEPTH	TEMP	DEPTH	TEMP	DEPTH	TEMP	
			2811	53	2659	44	2761	53	2659	57	2620	72	2507
			150	2091	176	1977	193	1919	223	1844	267	1809	293
V026	754917	1541	2345N	13505E	19		2804			334	1657		58
			DEPTH	TEMP	DEPTH	TEMP	DEPTH	TEMP	DEPTH	TEMP	DEPTH	TEMP	
			2804	41	2810	48	2715	55	2674	63	2612	65	2500
			155	2053	175	1954	203	1931	210	1908	222	1885	255
V026	754917	1634	2348N	13602E	17		2809			333	1694		59
			DEPTH	TEMP	DEPTH	TEMP	DEPTH	TEMP	DEPTH	TEMP	DEPTH	TEMP	
			2809	51	2808	59	2643	64	2554	84	2410	92	2333
			223	1430	263	1810	281	1836	297	1766	304	1751	324

