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Aircraft Expendable Bathythermograph Data Collected Along 47N in May, 1987

by

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1.0 Introduction

This paper briefly presents bathythermograph data collected by aircraft along the 47 N section offshore of Newfoundland during May, 1987. Oceanographic conditions persisting on the Grand Banks at the time, and their relation to the historical averaged records (Keeley 1981) are indicated.

A series of aircraft expendable bathythermograph (AXBT) probes were deployed during Aurora aircraft missions originating from CFB Greenwood, Nova Scotia (3 and 30 May, 1987) and from Torbay, Newfoundland (24 May, 1987). The surveillance flights were tasked by the Department of Fisheries and Oceans -Enforcement Branch to monitor fishing activities along the Canadian 200 mile limit. A pilot program was implimented to obtain AXBT data on an opportunistic basis, without distracting from the primary mission of the surveillance flights.

2.0 Methods

Sippican model SSQ-36 AXBTs were used during the program. These XBTs were designed compatable to the launching and receiving hardware installed on Aurora aircraft for military bathythermograph and sono-buoy work. The accuracy of the temperature and pressure sensors were $\pm$ .1'C and $\pm$ .2% respectively, with .3m spacial resolution. The AXBT was jettisoned from the Aurora on command, and dropped to the sea surface by parachute at 30m/sec. A saltwater activated battery discharged the sensor module from the floating VHF transmitter, which communicated data from the descending probe to the aircraft-born receiver. The transmission range limit is 60 miles. The entry position was computed from the aircraft position at launch time, with consideration for air speed, altitude, wind speed, wind direction and other factors.

The probe descent rate through the water column was 1.5m/sec. Temperature and depth data were logged in degrees farenheit and feet in NATO format on 28-track magnetic tape. The profile depth was limited to 300m (1000 feet) by system software. On-board signal processing and logging required a four minute cycle per probe. Operational limitations included aircraft speed, deployment altitude, meteorological conditions and sea state.

The event recorder tape and the AXBT data records were taken to the base operations center at CFB Greenwood for processing by the Data Interpretation and Analysis Center (DIAC). A printout of BT data, in ten foot increments, and vertical temperature plots was generated for each flight.

The AXBT values corresponding to standard oceanographic station depths (Trites, 1978) were extracted from the profiles, converted to metric units and compared to the average May temperatures listed by Keeley (1981). In most cases the AXBT drop locations were close enough to the corresponding standard 47 N section ICNAF stations (Trites, 1978) for direct comparison. Occasionally some values were interpolated between values for standard stations.

3.0 Results

Twenty-one probes were dropped on three flights (see table 1) on the days and locations summarized in figure 1.

3 May, 1987

A total of seven temperature profiles were obtained during the flight. Six were spaced at thirty nautical mile intervals, approximately along the 47th degree north latitude. A seventh probe was deployed equidistant between two dropsites to better define the boundary between the eastern edge of the Labrador Current and the North Atlantic Drift. The transect spanned the Flemish Pass, with one terminal on the Flemish Cap and the other mid-way between the Cap and the Avalon Peninsula (Figure 1).

24 May, 1987

Four temperature profiles were collected along 47 N on 24 May, 1987. The successful drops were widely spaced.

30 May, 1987

Complete AXBT profiles were obtained from ten stations during the 30 May flight. Drop locations were not evenly spaced. Probes were launched sequentially, as soon processing for the previous drop had been completed, so that a high resolution section was obtained without requiring the aircraft to circle. Spacing varied between fifteen and nineteen mile intervals along 47 degrees North latitude commencing at approximately 46 degrees, 30 minutes West longtitude and terminating at 50 degrees, 38 minutes West (figure 1).

For each transect, the sign of the anomalies was presented in relation to depth and distance along the transect (figures 2 to 4), allowing comparison to the the Keeley (1981) mean profile (figure 5).

The raw data recovered are not presented in this account but were transmitted through IGOSS and are available from the MEDS database.

4.0 Discussion

The mean profile for 47 N in May shows extensive sub-zero water below 50 m and west of 47 W (figure 5). The AXBT anomalies for the Grand Bank surface layer show a transition from below average on 03 May to above average on 30 May, 1987. The heating involved is from a maximum anomaly of-2.1 at 20m at station 6, to an anomaly of +1.7 at 30 m at the same station. This exceeds the mean seasonal heating calculated from Keeley (1981). Deeper levels of the Grand Bank, isolated from solar heating, show a consistent pattern of negative anomalies (-.2 to -.7 at stations 6 and 7) throughout the 3 surveys. The AXBT records show negative anomalies of up to -1.2 degrees in the 150-300 m levels through Flemish Pass. On May 3 1987 at least, the waters deeper than 50 m on Flemish Cap were colder by -0.5 to-1.5 degrees.

Performance and data recovery during this AXBT trial were satisfactory, expecially given the lack of experience involved in many stages. Transmission of IGOSS messages from this data was performed a few days after each flight, and involved translation from military to scientific formats.

Sufficient resolution of ocean climate anomalies is apparently availabel, through a single transect of say 10 probes, that this technique could serve as a reliable ocean climate indicator should such a need arise for fisheries operations purposes. Future developments will be accelerated by reduction in the cost of individual probes, and by establishment of ocean climate normals accompanied by the appropriate standard deviations. The utility of ocean climate observations such as this are increased by their expression as standard deviations or probability of being more extreme.

5.0 Acknowledgements

Lt. Col. E. McCurdy of Maritime Command and M. Whittick of C.F.B. Greenwood made the Aurora flights possible, through the cooperation of R. Rockwell and L. Penney of D.F.O. W. Lumsden of METOC Halifax and R. Stoddart of D.F.O. looked after the IGOSS transmissions. R. Stoddart was valuable in securing the DSS/DFO U.P. funding that allowed this experiment.

References

Keeley, J.R. 1981. Mean Conditions of Potential Temperature and Salinity along the Flemish Cap Section. M.E.D.S. Tech. Rpt. #9

Trites, R.W. 1978. Recommendations for Standard Sections in the Northwest Atlantic. ICNAF Sel. Papers # 3 114pp

Table 1 Summary of AXBT Drop Locations, May, 1987

Drop #	Latitude	Longtitude	Time (UCT)	Profile Depth
1	46 58'58"N	47 55'09"W	1730	125m
2	46 59'20"N	47 11'06"W	1738	300m
3	46 59'01"N	46 29'02"W	1749	U/S
4	46 58'58"N	46 29'15"W	1800	300m
5	46 58'06"N	45 45'47"W	1810	300m
6	46 59'59"N	44 59'51"W	1829	150m
7	46 59'46"N	47 32'43"W	1930	200m
8	46 58'59"N	48 37'23"W	1940	100m

AXBT DROP LOCATIONS FOR 24 MAY, 1987 - AURORA FLIGHT TY241

Drop #	Latitude	Longtitude	Time (UCT)	Profile Depth
1	46 59'58"N	52 23'02"W	1207	U/S
2	46 59'53"N	51 46'25"W	1213	125m
3	46 59'46"N	51 09'53"W	1218	U/S
4	46 59'41"N	50 33'21"W	1223	U/S
5	46 59'03"N	49 55'52"W	1227	U/S
6	46 59'27"N	49 20'21"W	1233	U/S
7	46 59'22"N	48 43'48"W	1238	125m
8	46 59'17"N	48 07'17"W	1247	125m
9	46 59'09"N	47 30'45"W	1251	U/S
10	46 59'11"N	46 50'27"W	1257	300m

AXBT DROP LOCATIONS FOR 30 MAY, 1987 - AURORA FLIGHT GD301

Drop #	Latitude	Longtitude	Time (UCT)	Profile Depth
1	46 49'48"N	46 30'15"W	1748	300m
2	46 59'16"N	46 53'47"W	1749	U/S
3	46 59'20"N	47 07'40"W	1756	300m
4	46 59'38"N	47 31'38"W	1801	300m
5	46 59'53"N	47 56'14"W	1806	125m
6	46 59'53"N	48 22'44"W	1811	150m
7	46 59'53"N	48 51'17"W	1817	100m
8	46 59'34"N	49 16'41"W	1822	75m
9	46 59'25"N	49 41'48"W	1827	125m
10	46 59'31"N	50 05'42"W	1832	125m
11	46 59'40"N	59 28'09"W	1837	175m
12	46 59'20"N	50 56'46"W	1844	U/S

U/S - Unservicable Data

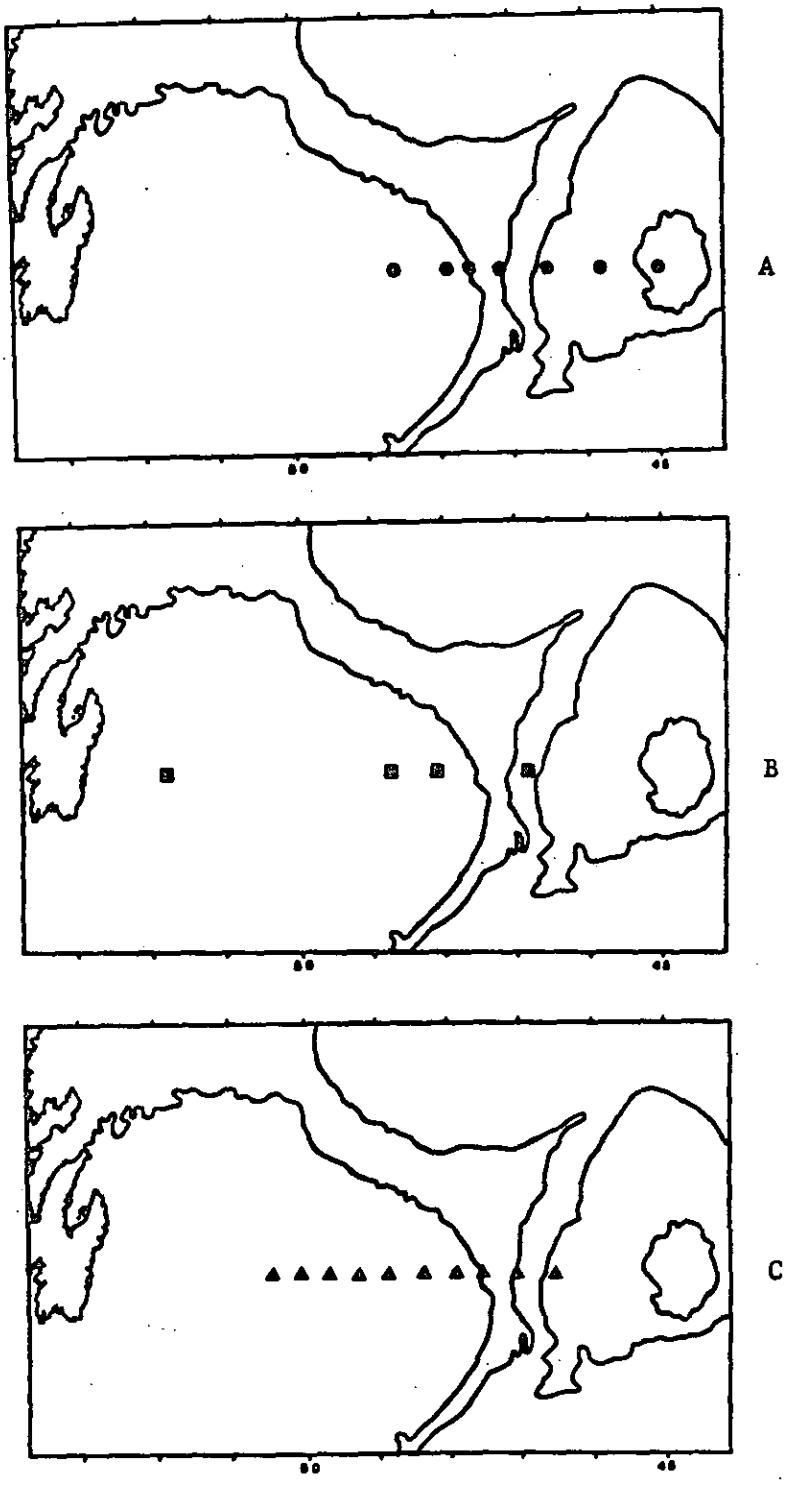

Figure 1 AXBT Deployment Locations : A) 3 May, 1987
B) 24 May, 1987 C) 30 May, 1987

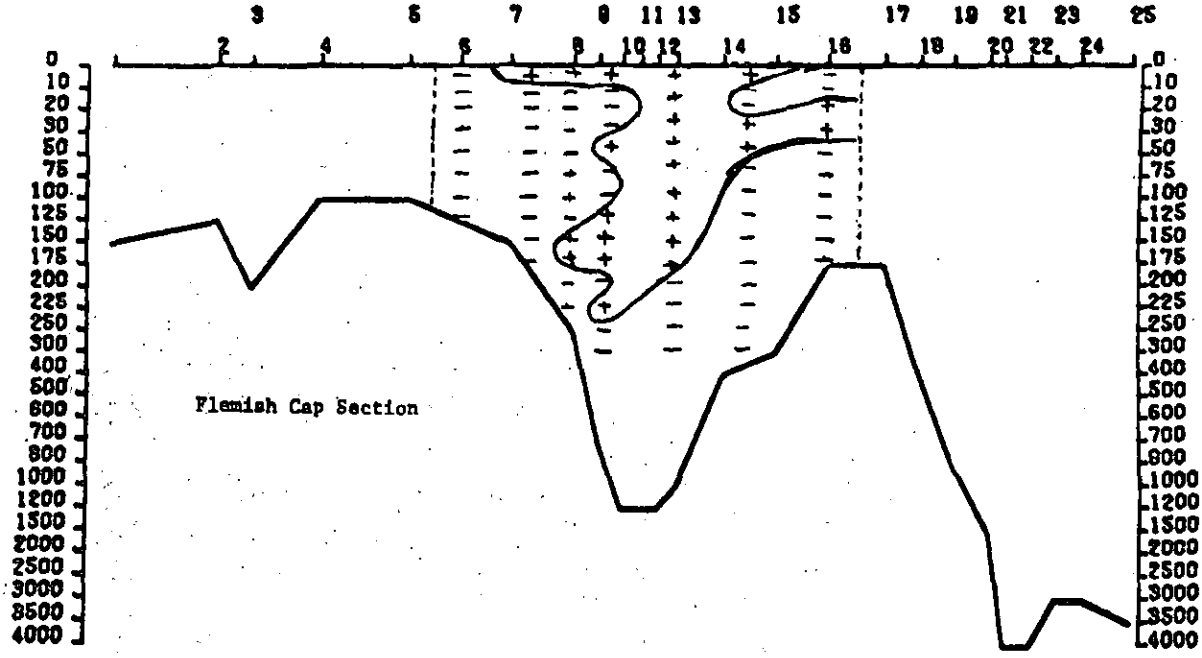

Figure 2 3 May, 1987 Temperature Anomalies

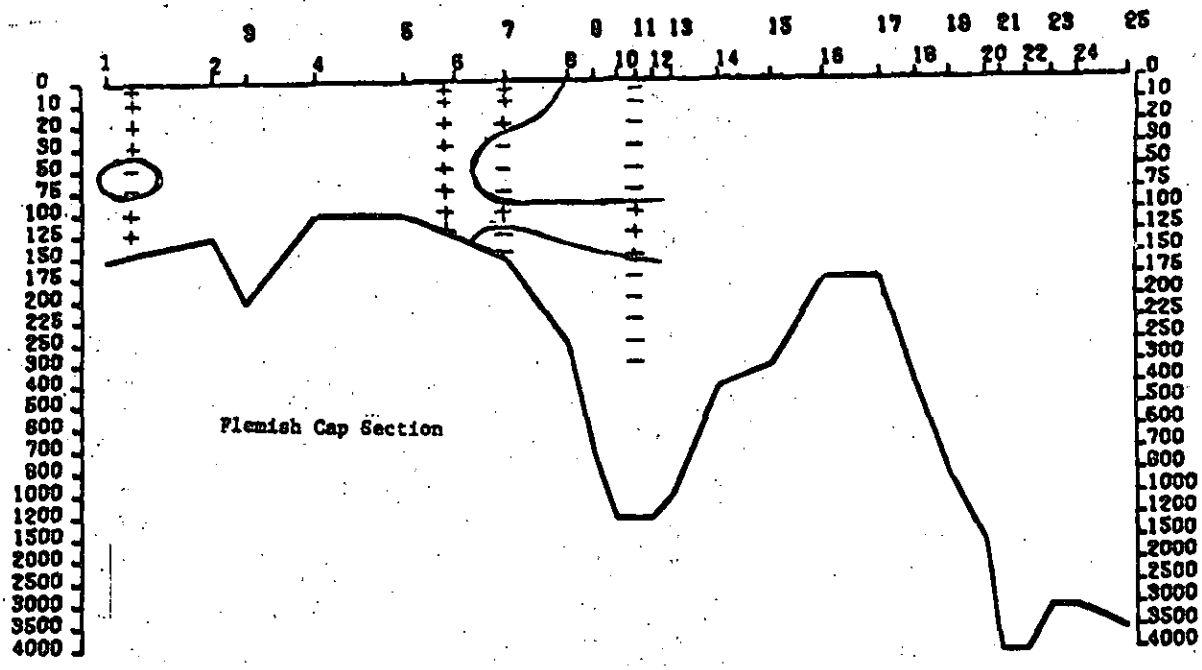

Figure 3 24 May, 1987 Temperature Anomalies

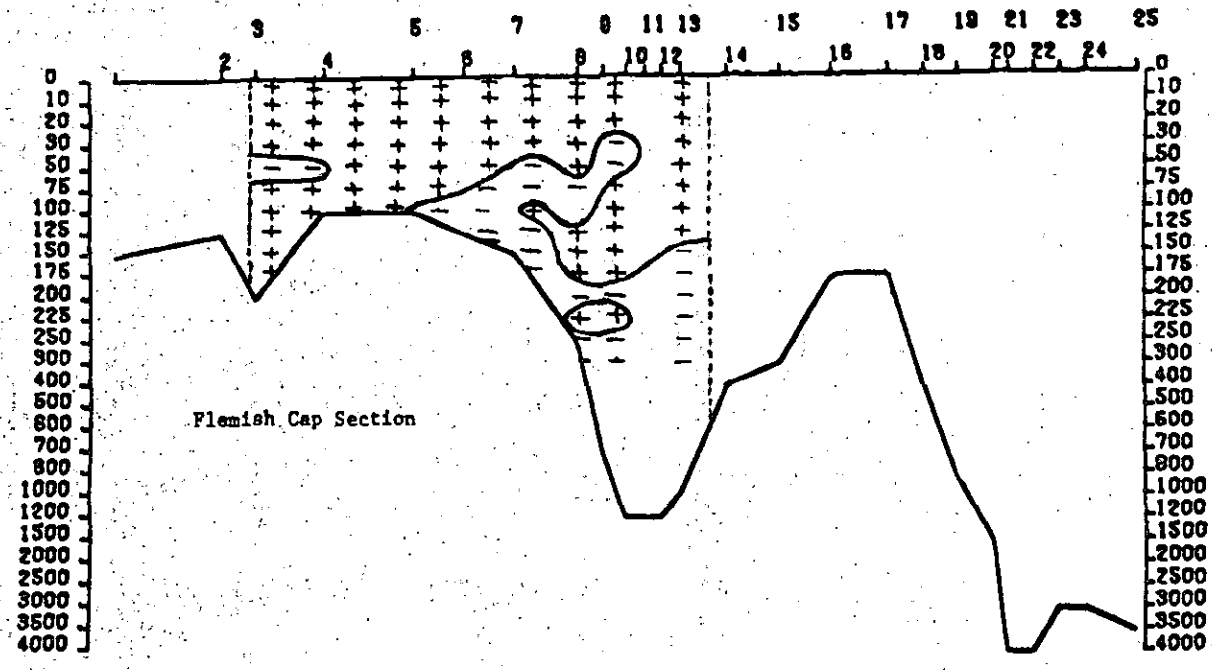

Figure 4 30 May, 1987 Temperature Anomalies

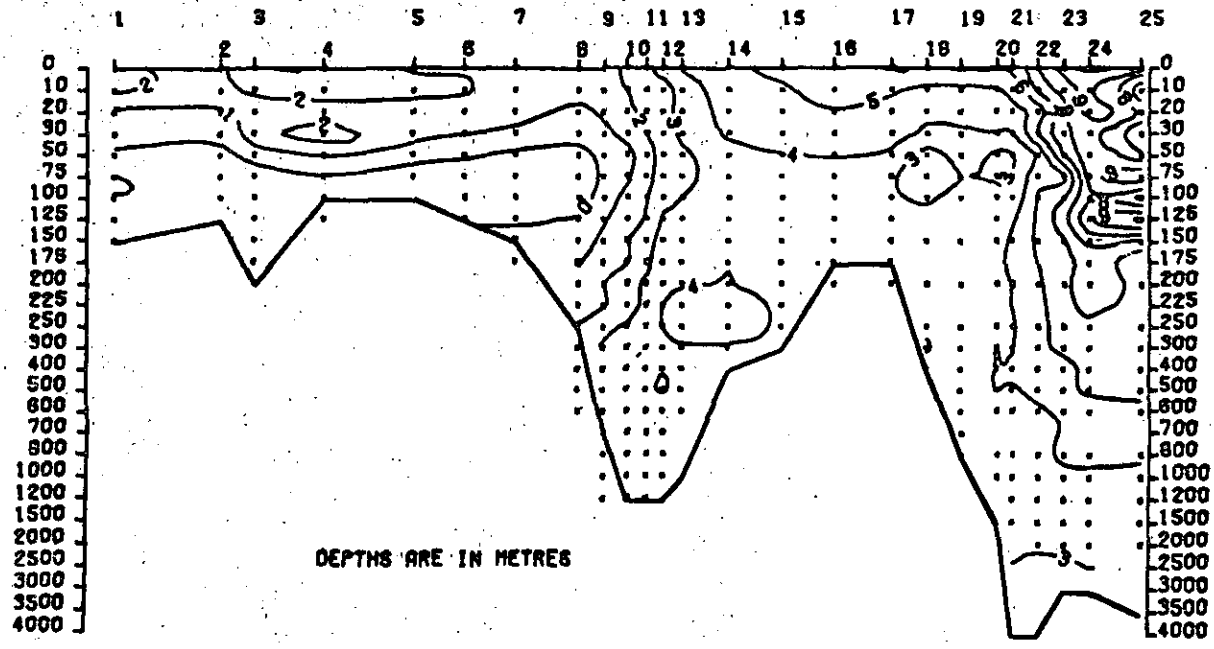

Figure 5 Average Potential May Temperature for 47°N Section (after Keeley, 1981)