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Water temperature in the Labrador, Newfoundland and West Greenland areas in 1976

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Abstract

In the paper the water temperature in the Labrador, Newfoundland and West Greenland areas in 1976 is compared with that of the previous years and the long term means.

In the spring 1976 the water temperature in the Labrador and Newfoundland areas was $0.5 - 1^{\circ}$ below the norm, in the summer it was close to it and in the fall it was on the average 0.3° below the norm. The highest negative anomalies were observed in March on the eastern slope while the highest positive anomalies were observed in April on the southern slope of the Grand Newfoundland Bank. Compared with 1975 in 1976 the water temperature decreased considerably in the 0 - 200 m layer of the Labrador Current and to a lesser degree - in the 200 - 500 m layer; in the 0 - 200 m layer it was about the norm and in the 200 - 500 m layer the temperature was at the level of the coldest years.

In December 1976 the temperature off West Greenland compared with the corresponding period of some previous years was on the average 1° higher in the 0 - 200 m layer and about 0.5° lower in the 200 - 500 m layer.

Introduction

In 1976 the analysis of the thermal condition of the water masses in the Labrador, Newfoundland and West Greenland areas was done as earlier (Elizarov, 1962; Burmakin, 1972; Svetlov, 1976) on the basis of the average temperature of the various layers and branches of the Labrador and West Greenland currents on standard sections (Fig.1). The observations were carried out at standard depths up to 2 000 m from R/V " PERSEUS III in March - July and November - December and from R/V ODYSSEUS in June 1976 (the total of 665 stations were worked).

Methods

The average water temperature was calculated for 0 - 50, 50 - 200, 0 - 200, 200 - 500 and 0 - 500 m layers for the indicated sectors of the sections (Fig.1). The temperature anomalies on the date of observations for the 0 - 200 and 200 - 500 m layers were determined on the graphs of the normal (average) annual temperature course (Burmakin, 1972, 1976). For some of the sections are given the average temperature of the layers relative to the stated dates and its anomalies in 1976 calculated by the methods used previously (Elizarov, 1962, Burmakin, 1972, 1975b)

On sections 10 - A, 11 - A and 28 - A in the West Greenland and Davis strait area the thermal state of the water masses is characterized by the vertical distribution of the temperature and by its average value by layers.

Results

As it has been suggested earlier on the basis of a 4 year cycle (Burmakin, 1975a) the year of 1976 in the Labrador and Newfoundland areas was a cold one.

The temperature anomalies varied in March - July and November - December from - 0.2° to - 2.5° in the 0 - 200 m layer and from - 0.5° to - 1.4° in the 200 - 500 m layer (tables 1 and

2).The positive anomalies were observed in April and June on the southern and south - western slopes of the Grand Bank (from 0.5° to 2.8° in the 0 - 200 m layer and from 2.1° to 4.0° in the 200 - 500 m layer).They were caused by the onflow of the Gulf Stream meanders as was the case earlier in April 1973, June 1974 and September 1975 (Burmakin,1976).As a result of this in April 1976 the near bottom temperature at depths 130 - 240 m on the south - western Grand Bank ranged from 10.68° to 9.18° .

The temperatures of the 0 - 200 m layer relative to the stated dates and their anomalies in 1976 are shown in tables 3 and 5.

In June 1976 compared with 1975 the temperature on the sides of the " triangle " was $0.11 - 1.32^{\circ}$ lower in the core of the Labrador current (50 - 200 m layer) and $0.06 - 0.53^{\circ}$ lower in the mixed waters of the Current (200 - 500 m layer) (table 4).

On November 1 1976 on section 8 - A compared with 1975 the temperature of the Labrador current was also lower and the departures from the long term mean for 1964 - 76 varied from $- 0.26^{\circ}$ to $- 0.59^{\circ}$ the minimum departures being registered in the core of the cold component (50 - 200 m layer,AB) and maximum ones - in the core of the warm component of the Labrador current (200 - 500 m layer,C) (table 5).

In the West Greenland area the hydrological observations in 1976 were carried out only in December on sections 10 - A,11 - A, 28 - A.

On section 10 - A the temperature of the Arctic component of the West Greenland current in the 0 - 200 m layer was $0.6^{\circ} - 2.0^{\circ}$, on section 11 - A $0.8^{\circ} - 2.3^{\circ}$, on section 28 - A $0.2^{\circ} - 2.8^{\circ}$ (Fig.2).

The temperature of the Irminger component of this current at 100 - 600 m was $4^{\circ} - 5^{\circ}$ on section 10 - A,mainly about 5° on 11 - A and $4^{\circ} - 5^{\circ}$ on 28 - A.

On the basis of a number of layers the average water temperature in December 1976 was calculated as well as in some other years for which the observations were available (Svetlov, 1976).The insufficient data precludes a detailed analysis but it should be noted that in the majority of cases in December 1975 and 1976 the water temperature of the 0 - 200 m layer increased on the average by 1° while in the 200 - 500 m layer it decreased by about 0.5° relative to the other years shown in table 6.

Conclusion

In 1976 compared with 1975 the water temperature of the Labrador current decreased considerably in the surface layer and in the core of the Current and to a lesser degree in the 200 - 500 m layer whereas in the upper layers it was close to the long term mean and in the layers below 200 m at the level of the coldest years.

Taken as a whole the year of 1976 in the area of Labrador and Newfoundland falls in the hydrologically cold years the nearest analogous year being 1974.

According to the earlier established 4 - 5 year periodicity the present cycle which started with anomalous cold 1972 must end also with cold 1976 or 1977 after which by 1978 a temperature rise to the norm or higher should be expected.

The water temperature in the West Greenland area in December 1976 compared with December of some previous years was on the average 1° higher in the 0 - 200 m layer and about 0.5° lower in the 200 - 500 m layer

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Table 1

Temperature anomalies of the 0 - 200 m layer (°C) in 1976

Section and date	March	April	May	June	July	Novem	Dec
8 - A (B) 1 July 1 November, 3 December					-0.6	-0.4	-0.6
triangle (NW) 18 June				-1.0			
triangle (SW) 19 June				-0.2			
triangle (SE) 20 June				-0.6			
7 - A 21 May			-0.5				
6 - A (G) 24 March, 18 May - 2.5			-1.2				
4 - A 11 May			-1.0				
3 - A 1 April, 23 June		-1.3		+0.5			
2 - A 3 April		+2.8					
1 - A 14 April		+2.8					

Table 2

Temperature anomalies of the 200 - 500 m layer (°C) in 1976

Section and date	March	April	May	June	July	Nov	Dec
8 - A (B) 1 July							
1 November, 3 December					-0.8	-0.5	-0.9
7 - A 21 May			-0.6				
6 - A (G) 24 March, 18 May	-0.6		-0.7				
4 - A 11 May			-0.8				
3 - A 1 April, 23 June		-1.2		-1.4			
2 - A 3 April		+4.0					
1 - A 14 April		+2.1					

Table 3

Average temperature of the 0 - 200 m layer (°C) relative to stated dates and its anomalies in 1976

Section	15 May	29 June	15 July
8-A (A)			-0.59 (-0.14)
8-A (B)			0.35 (+0.06)
8-A (C)			3.45 (-0.07)
8-A (AB)			-0.13(+0.02)
8-A (ABC)			0.83 (+0.02)
triangle (SE) shelf		0.86 (+0.38)	
triangle (SE)slope		0.19 (-0.85)	
7-A	0.02(-0.25)		
6-A (G)	0.29(-0.68)		
4-A	0.93(-0.52)		
3-A	0.49(+0.11)		
period of averaging	1968-1974, 76	1972-1976	1948-1976

Table 4
 Temperature of the Labrador current on the sides of
 " triangle " in June 1974 - 1976

side of triangle	Date	Layer, m			
		0-50	50-200	0-200	200-500
NW	28.06.75	2.28	0.84	1.20	2.33
	18.06.76	1.20	-0.48	-0.07	1.80
SW	27.06.75	2.59	-0.37	0.72	-
	19.06.76	2.16	-0.48	0.36	-
SE	29.06.75	3.58	1.12	1.95	2.84
	20.06.76	1.70	0.17	0.66	2.78

Table 5
 Water temperature on section 8 - A in various branches and
 layers of the Labrador current on 1 November 1974 - 1976
 and a long term mean norm for 1964 - 1976

sector of section 8-A	Year	L A Y E R, m									
		0-50		50-200		0-200		200-500		0-500	
		temper	norm	temper	norm	temper	norm	temper	norm	temper	norm
A	1975	1.38	1.22	0.48	0.09	0.78	0.42	-	-	0.78	0.44
	1976	0.80		-0.18		0.13		-		0.16	
B	1975	0.97	1.26	0.69	1.04	0.77	1.07	1.45	1.87	1.14	1.53
	1976	0.75		0.69		0.70		1.51		1.13	
C	1975	3.40	3.62	3.44	3.62	3.53	3.66	3.72	4.05	3.68	3.94
	1976	3.29		3.40		3.37		3.46		3.43	
AB	1975	1.14	1.26	0.51	0.46	0.70	0.69	1.45	1.87	0.92	1.02
	1976	0.74		0.20		0.36		1.51		0.68	
BC	1975	2.03	2.21	1.97	2.04	1.89	2.08	2.48	2.79	2.50	2.86
	1976	1.82		1.86		1.85		2.41		2.42	
ABC	1975	1.61	1.76	1.26	1.12	1.34	1.29	-	-	2.04	2.10
	1976	1.33		0.96		1.07		-		1.82	

Table 6. Average water temperature (°C) on sections 10 - A, 11 - A and 28 - A off Western Greenland in December

Layer, m	10-A				11-A				28-A				
	02-04. XII	01-02. XII	13-16. XII	27. XII	09-10. XII	11. XII	17. XII	07. XII	24-25. XII	27-28. XII	09. XII	9-13. XII	12. XII
	1963	1964	1965	1976	1963	1965	1970	1971	1975	1976	1961	1974	1976
0-50	1.42	2.66	0.71	1.37	0.39	0.30	-0.98	0.32	1.14	1.84	2.07	1.26	2.10
0-200	2.09	3.94	3.09	3.48	1.70	2.37	1.52	3.04	2.73	2.94	3.56	3.16	3.22
50-200	2.31	4.43	3.92	4.18	1.77	2.76	2.23	3.94	2.99	3.23	4.19	3.96	3.59
200-500	4.93	5.93	5.23	4.60	4.35	5.52	3.80	4.96	4.83	4.85	5.57	4.74	4.62
0-500	3.73	5.38	4.52	4.04	3.42	3.94	2.60	4.25	3.95	4.14	4.98	4.12	4.17

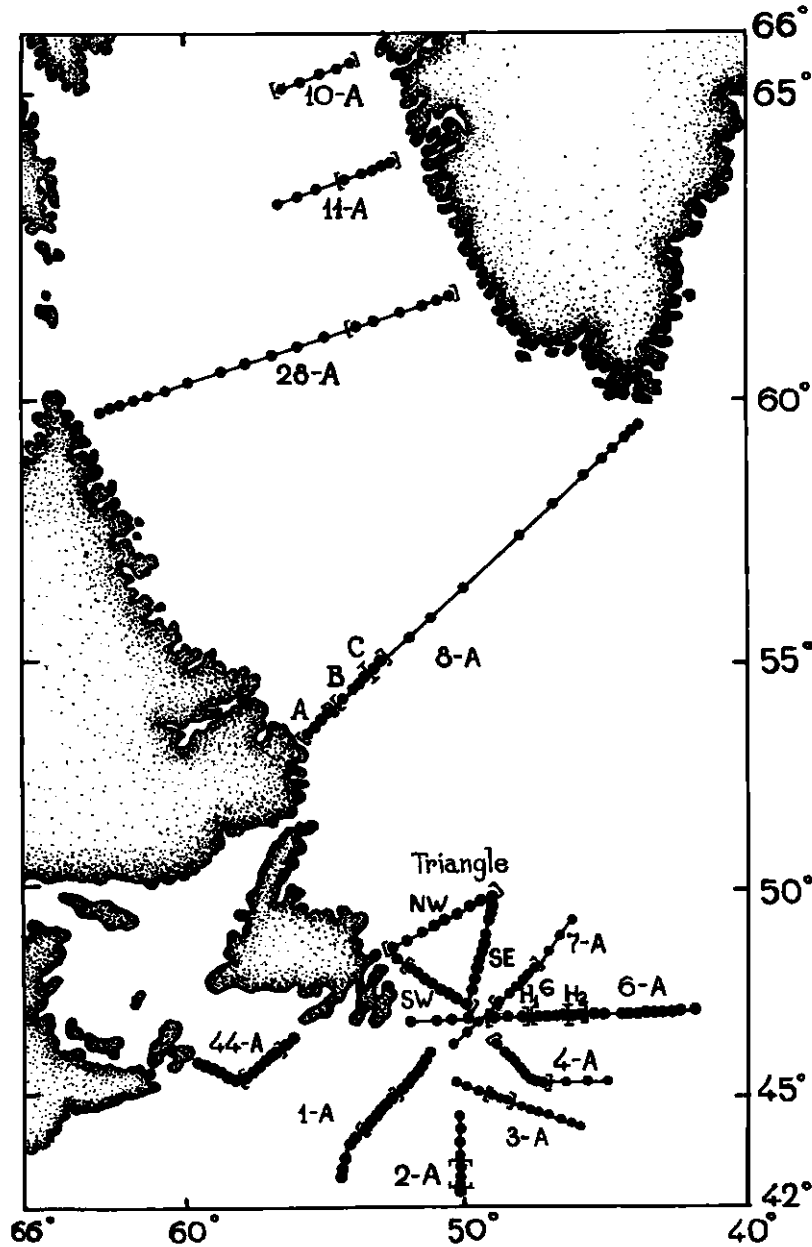


Fig. 1. Location of standard oceanological sections in the Labrador, Newfoundland and Greenland areas (square brackets indicate sectors of the sections for which the average temperature was calculated).

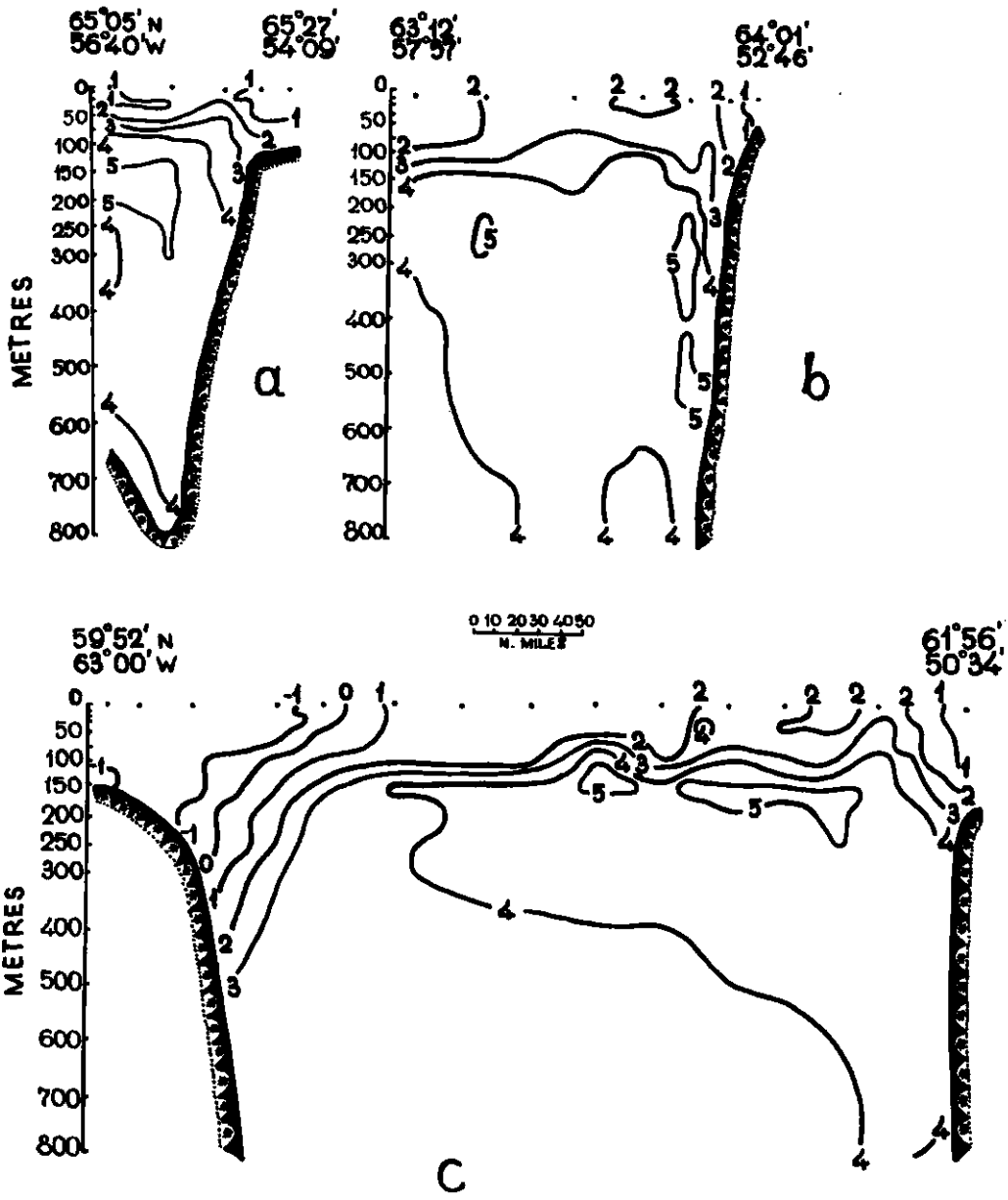


Fig.2. Water temperature in December 1976 on sections 10 - A (a),
11 - A (b) and 28 - A (c).

