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ANNUAL MEETING - JUNE 1976Changes in water temperature in the west Greenland area in 1975

by

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Abstract

Heat conditions of water masses of the Arctic component of the West-Greenland Current on the section to the south-west of Godthab based on observations by Soviet vessels in March, July and December 1975 is analyzed.

Data on water temperature in July 1950-1970 were treated by the periodogram analysis method; there were obtained amplitudes and phases of three- and four-year harmonics by which the temperature changes were approximated.

Three- and four-year periodicity was used for calculation of water temperature in the 0-200 m layer in 1971-1976. The calculated and observed water temperature for July 1975 made up 2.03° and 1.90° respectively.

Water temperature was the lowest in March, which was increasing by December practically in all the layers (with the exception of the 0-50 m layer).

In July 1975 water temperature was lower than long term mean value on the section; in March it was about 0.5° lower than in 1969 and 1974; and in December it was 1° higher than in 1965 and 1970.

This paper is based on data from Soviet scouting vessels "Nikolai Kononov", "Polyarnoye Siyanie" and "Zarnitsa" who worked standard hydrological Section II-A to the south-west of Godthab in March, July and December 1975 respectively. These data were correlated with those of some of the previous years.

An average water temperature in the 0-50, 0-200, 50-200, 200-500, 0-500 m layers on the sector of Section II-A from 63°45'N 54°30'W to 64°01'N 52°46'W, which characterizes the Arctic component of the West-Greenland Current, is given in Table 1. July observations by Danish research vessels "Dana" and "Adolf Jensen" were used for calculations.

Water temperature for 1951 and 1967 was calculated by the rectilinear correlation method on the basis of July water temperature at Godthab station ($r=0.72 \pm 0.08$). Water temperature was interpolated for July 1969 on the basis of data obtained in June and August (Herman, 1970). Data for the 0-200 m layer were treated by the periodogram analysis method as a result of which an amplitude and phase of three- and four-year harmonics was found and the following equation was derived:

$$\bar{T}_{0-200}^{\circ} = 2.12 + 0.371 \sin(120^{\circ}t + 27^{\circ}) + 0.336 \sin(90t + 149^{\circ})$$

where 2.12° is an average water temperature in July 1950-1970, second and third members of the equation are variations in water temperature of the three- and four-year periodicity, time t is equal to 0 in 1950, $t = 1$ in 1951 etc.

Observed (solid curve) and calculated (broken line) water temperatures in the 0-200 m layer on Section II-A from 1950 to 1970 are shown in Fig. 1. Mean-root-square deviation (σ observed) of the observed series of water temperature is equal to 0.784 and that of the calculated series (σ calculated) is equal to 0.378. An analogous three- and four-year cycle is also noted for the Labrador area (Burmakin, 1972) and Barents Sea (Bochkov et al, 1968). Data are not available for 1971-1974. Calculated and observed temperatures are equal to 2.03°C and 1.90°C respectively for July 1975.

The suggested method of the assessment of the expected temperature changes enables one to forecast areas where it is possible to conduct fish scouting (Svetlov, 1970, 1971).

Some peculiarities of the seasonal distribution of water temperature on Section II-A are presented in Fig. 2 and Table 2.

It can be seen from Fig.2 that waters of the Arctic component of the West-Greenland Current are cooled down to 100 m in March. In July a cold intermediate layer with temperature below 1°, which occupied depths from 50 to 150 m west of the Fyllas Bank, was formed. In December, with the beginning of winter cooling, temperature of the sea surface decreased by about 1°, compared with July.

In some layers average water temperature (Table 2) increased by 0.7-3.6° (with the exception of the 200-500 m layer) from March to July and by 0.8°-1.4° (with the exception of the 0-50 m layer) from July to December.

An average water temperature of the 50-100, 100-200, 200-300, 300-400, 400-500 m layers and its deviations from the mean value for the years 1950-1966 were also calculated for July 1975 to compare it with the data obtained by Danish vessels at the station at 63°53'N 53°22'W on Section II-A (Herman, 1967).

As it is seen from Table 3, anomalies of water temperature in July were negative practically in all the layers, with the exception of the 0-50 and 300-400 m layers. Comparing Tables 1 and 3 it should be noted that anomalies of water temperature in July 1975 both at the station and on the sector of Section II-A have the same sign in different layers. Therefore, the present station characterizes to some extent the heat condition of waters of the Arctic component of the West-Greenland Current.

Water temperature in 1975, compared with that of some of the previous years, is shown in Table 4. A slight decrease in temperature in March, compared with 1969 and 1974, and its increase in December, compared with 1965 and 1970, should be noted.

Conclusions

1. Water temperature in the 0-200 m layer on Section II-A in July 1950 to 1970 was calculated with regard to three- and four-year cyclic changes; a definite agreement between the observed and calculated temperatures was obtained. Water tem-

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perature for July 1971-1976 was calculated as well. Calculated and observed water temperatures for July 1975 are equal to 2.03° and 1.90° respectively.

2. In July 1975 water temperature was lower than long-term mean value; in March it was about 0.5° lower than in 1969 and 1974; and in December it was 1° higher than in 1965 and 1970.

Table 1. Average water temperature and its anomalies (°C) in July on Section II-A

Year	0-50 m	50-200m	0-200m	200-500m	0-500 m
1950	2.91	3.12 ^x	3.10	3.84	3.53
1951	-	1.81	2.45 ^x	2.73 ^x	2.23 ^x
1952	1.70	0.53	0.81	1.94	1.38
1953	3.53	2.32	2.66	4.14	3.60
1954	2.80	2.32	2.46	3.70	3.50
1955	1.13	1.00	1.05	3.50	2.38
1956	2.89	3.00	2.90	4.31	3.99
1957	3.18	3.28	3.26	3.91	3.65
1958	2.46	1.93	2.14	3.99	3.30
1959	2.42	1.46	1.74	3.89	3.09
1960	3.17	2.28	2.43	3.96	3.06
1961	3.49	2.24	2.59	3.92	3.43
1962	2.73	1.80	2.18	4.00	2.94
1963	2.81	2.40	2.57	4.10	3.75
1964	3.13	3.18	3.19	4.92	4.51
1965	2.88	2.37	2.67	4.58	3.63
1966	2.03	2.07 ^x	2.00 ^x	4.80 ^x	3.68 ^x
1967	1.46 ^x	1.72	1.59	3.82 ^x	2.76 ^x
1968	1.60 ^x	0.63 ^x	0.81 ^x	3.08	2.06
1969	0.81	0.82	1.10	4.02 ^x	2.85 ^x
1970	1.62	0.74	0.90	3.19	2.22

1970-1975 Mean	2.44	1.95	2.12	3.83	3.12
1975	2.69	1.63	1.90	3.69	3.06

Anomaly	+0.25	-0.32	-0.22	-0.14	-0.06

Note: interpolated temperature is shown by ^x

Table 2. Average water temperature (°C) on Section II-A
in 1975

Layers, m	27-28. III	18 VII	24-25 XII
0-50	-0.90	2.69	1.14
0-200	0.08	1.90	2.73
50-200	0.38	1.63	2.99
200-500	3.86	3.69	4.83
0-500	2.36	3.06	3.95

Table 3. Water temperature and its anomalies (°C) at station
63°53'N 53°22'W in July

Layers, m	Mean T 1950-1966	Mean T in July 1975	Anomaly
0-50	2.07	2.51	+0.44
50-100	1.33	0.64	-0.69
100-200	1.85	0.86	-0.99
200-300	2.88	2.70	-0.18
300-400	3.79	3.90	+0.11
400-500	4.22	4.03	-0.19
0-500	2.89	2.61	-0.28

Table 4. Average water temperature in March and December (°C) on Section II-A

Layers , m	24.III.1969	22.III.1974	27-28. III.1975
0-50	-0.83	-0.72	-0.90
50-200	0.93	0.88	0.38
0-200	0.56	0.55	0.08
200-500	3.98	3.79	3.87
0-500	2.82	2.49	2.36

Layers , m	11.XII.1965	17.XII.1970	07.XII.1971	24-25.XII.1975
0-50	0.30	-0.98	0.32	1.14
0-200	2.37	1.52	3.04	2.73
50-200	2.76	2.23	3.94	2.99
200-500	5.52	3.80	4.96	4.83
0-500	3.94	2.60	4.25	3.95

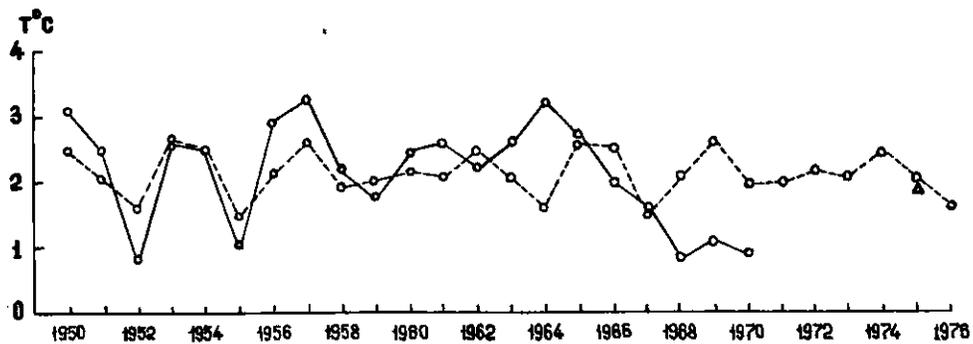


Fig. 1. Observed (solid line) and calculated (broken line) water temperatures in the 0-200 m layer in July based on three- and four-year harmonics. Observed water temperature in July 1975 is designated by the triangle.

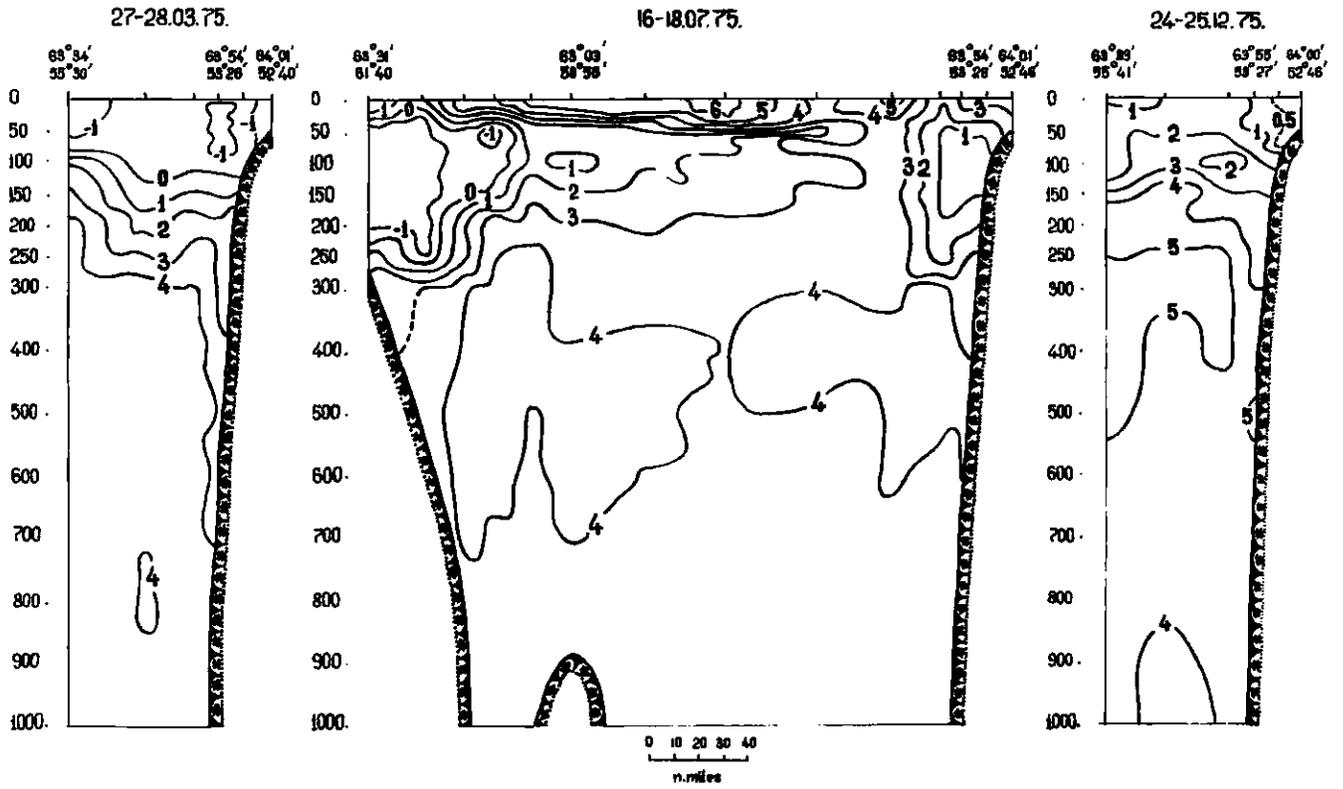


Fig. 2. Water temperature on Section II-A in 1975