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Dynamics and salinity of waters in the Newfoundland area in 1976-1977

by

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Abstract

Peculiarities of geostrophic circulation of waters of separate ICNAF areas in April-July 1977 are considered using the charts of dynamic topography constructed on the basis of observations conducted by PINRO research vessels. Values of transport and salinity of the Labrador Current waters on some standard hydrological sections in 1976-1977 and their anomalies from the long-term means are calculated.

Material and methods

From April to July 1977 FRV "Perseus III" in her 18th cruise has conducted a hydrological survey of the Newfoundland area and Flemish Cap Bank during which observations on standard sections and separate stations were made. On the basis of these data charts of geostrophic circulation of the area investigated are constructed and seasonal changes of transport and salinity of the Labrador Current waters are considered.

Geostrophic circulation

The first chart of dynamic topography was constructed according to data of the survey carried out from 20 April to 29 May 1977 in the area of Flemish Cap Bank and eastern and southern slopes of the Great Newfoundland Bank (Fig.1). In 1976 observations in Divisions

3L and 3N were approximately made in the same periods but the survey in the Flemish Cap Bank area was conducted a month earlier (Kudlo, Boytsov, 1977). In June-July 1977 hydrological observations covered the Northern Newfoundland Bank and also the northern and southern parts of the Grand Bank. In 1976 an analogous survey of Divisions 3N and 3O was conducted 2 months earlier.

In late April 1977 in the Flemish Cap Bank area three vortices were observed; among those an anticyclonic eddy occupying the southern and central parts of the bank was the largest (Fig.1). Early in July 1977 water motion clockwise over the top of the Flemish Cap Bank has retained.

In May 1977 for the lack of observations conducted along the deep-sea part of the eastern and southern slopes of the Grand Bank the main flow of the Labrador Current could be observed only in Division 3L. Separate jets of the coastal branch of the Labrador Current penetrated into the central part of the Grand Bank. Those waters having reached the southern extremity of the bank turned about and flew in the north-western direction.

In June-July 1977 and in summer 1976 the field structure of geostrophic circulation in the area of the Northern Newfoundland Bank and in the northern part of the Grand Bank (Divisions 3K and 3L) was very similar: availability of distinctly pronounced flow of the Labrador Current waters over the continental slope and presence of the coastal jet crossing those two areas from north to south (Fig.2).

In June-July 1977 in Divisions 3N and 3O there was the anticyclonic eddy which covered almost the whole area of the southern part of the Grand Bank. Water motion clockwise was also observed in this area earlier (Kudlo, Boytsov, 1977).

Waters transport intensity of the Labrador Current.

Table 1 lists values of water transport of the Labrador Current on standard sections calculated by the dynamic method as well as magnitudes of departures of water transport for the date of observation from the long-term means taken from the average curves of annual run of transport (Kudlo, 1973; Kudlo, Borovkov, 1975; Kudlo, Borovkov, Boytsov, 1976).

Division 2J. In late October and in early November 1976 the value of water transport of the Labrador Current on the section 8-A was $1.5 \times 10^6 \text{ m}^3/\text{sec}$ above the norm and exceeded water transport in early ~~July~~ 1976 by $1.0 \times 10^6 \text{ m}^3/\text{sec}$.

In April-May 1977 on the section 6-A situated in Division 3L water transport considerably exceeded the norm and its values on sections 4-A and 2-A crossing the Labrador Current in Division 3N were some times higher compared to those of spring 1976.

Section 3-A (Division 3N), on which the water transport value in mid-May 1977 was lower than the long-term mean by $2.4 \cdot 10^6 \text{ m}^3/\text{sec}$, is an exception. However, it should be noted that in the 18th cruise of FRV "Perseus III" this section was carried out for the first time at other positions according to the ICNAF scheme which somewhat differed from previously accepted by PINRO (according to the ICNAF scheme the section is situated further south).

Changes of salinity of the Labrador Current waters.

Intensification of the Labrador Current is usually accompanied with the increasing of transfer of cold Arctic waters of lower salinity into the fishing areas. As can be seen from Table 2 which lists the values of the average salinity of the Labrador Current waters in the 0-200 m layer, its norms and anomalies for the date of observations, in late 1976 and in April-June 1977 water salinity on the sections 8-A, 6-A, 4-A and 3-A was below the norm and slightly exceeded the long-term mean on the section 2-A.

Conclusions

1. In June-July 1977 the field structure of geostrophic circulation in the area of the Northern Newfoundland Bank and northern part of the Great Newfoundland Bank was quite similar with that of summer 1976 due to the availability of distinctly pronounced flow of the Labrador Current waters over the continental slope and of the coastal jet.

2. In April-June 1977 the increase in water transport and decrease of average salinity in the 0-200 layer relative to the norm in the

area of the Great Newfoundland Bank are indicative of the intensification of the Labrador Current waters in this period.

References

1. Kudlo, B.P. 1972. Water circulation in the ICNAF area in 1971-72. Annu.Meet.Int.Comm.Northw.Atlant.Fish.1973. Res.Doc.No.42, Ser.No.2981.
2. Kudlo, B.P., and V.A.Borovkov. 1975. Circulation of waters in the ICNAF area in 1973-1974 (12p.).Annu.Meet.ICNAF,Res.Doc.75/78.Ser.No.3506.
3. Kudlo, B.P., V.A.Borovkov, and V.D.Boytsov. 1976. Circulation and salinity of waters in the Davis Strait, South Labrador and Newfoundland areas in 1974-75 (14p.). Sum.Doc.No.75 (YI) 70, No.3874.
4. Kudlo, B.P., and V.D.Boytsov. 1977. Circulation and salinity of waters in the South Labrador and Newfoundland in 1975-1976 (8p.). ICNAF Res.Doc.77/VI/36. Ser.No.5061.

Table 1.

Values of transport of the Labrador Current waters, their norms and anomalies on the stanuar. sections in 1976-1977

Section, : sector, : layer :	Vessel, cruise : : : :	Date of obser- : vation : :	Transport, 10^6 m ³ /sec : : : :	norm : anomaly
8-A (ABC)	PERSEUS III, cruise 15	01-02 July 1976	5.40	4.3 1.1
0-2000 m	PERSEUS III, cruise 17	31 October-02 November 1976	6.43	4.9 1.5
Division 2J				
6-A	PERSEUS III, cruise 15	23-24 March 1976	4.70	2.9 1.8
(H ₁ GH ₂)	PERSEUS III, cruise 15	18-19 May 1976	4.82	3.2 1.5
0-bottom	PERSEUS III, cruise 18	26-27 April 1977	4.69	3.1 1.6
Division 3L	PERSEUS III, cruise 18	04-05 June 1977	6.27	3.3 3.0
4-A (1-12 st.)	PERSEUS III, cruise 15	11-12 May 1976	2.10	4.2 -2.1
0-1000 m	PERSEUS III, cruise 18	23-24 May 1977	6.46	4.0 2.5
Division 3N				
3-A 0-2000 m	PERSEUS III, cruise 18	12 May 1977	1.87	4.3 -2.4
Division 3N				
2-A	PERSEUS III, cruise 15	02 April 1976	0.28	2.8 -2.5
0-1000 m	PERSEUS III, cruise 18	06-07 May 1977	4.70	1.4 3.3
Division 3N				

Table 2.

Average salinity of the Labrador Current waters in the 0-200 m layer, its norms and anomalies on the stanuar. sections in 1976-1977

Section, : sector, : : :	Vessel, cruise : : : :	Date of obser- : vation : :	Salinity, ‰ : : : :	norm : anomaly
8-A,	PERSEUS III, cruise 15	01-02 July 1976	33.62	33.69 -0.07
(B)	PERSEUS III, cruise 17	31 October-02 November 1976	33.26	33.56 -0.30
Division 2J				
	PERSEUS III, cruise 15	23-24 March 1976	33.76	33.99 -0.27
6-A,	PERSEUS III, cruise 15	18-19 May 1976	33.64	33.76 -0.12
(G)	PERSEUS III, cruise 18	26-27 April 1977	33.89	33.82 0.07
Division 3L	PERSEUS III, cruise 18	04-05 June 1977	33.70	33.80 -0.10
4-A	PERSEUS III, cruise 15	11-12 May 1976	33.65	34.06 -0.41
(6-12 st.)	PERSEUS III, cruise 18	23-24 May 1977	33.88	34.02 -0.14
Division 3N				
3-A (6-11 st.)	PERSEUS III, cruise 18	12 May 1977	33.28	33.72 -0.44
Division 3N				
2-A	PERSEUS III, cruise 15	02 April 1976	33.01	33.71 -0.70
Division 3N	PERSEUS III, cruise 18	06-07 May 1977	33.66	33.58 0.08

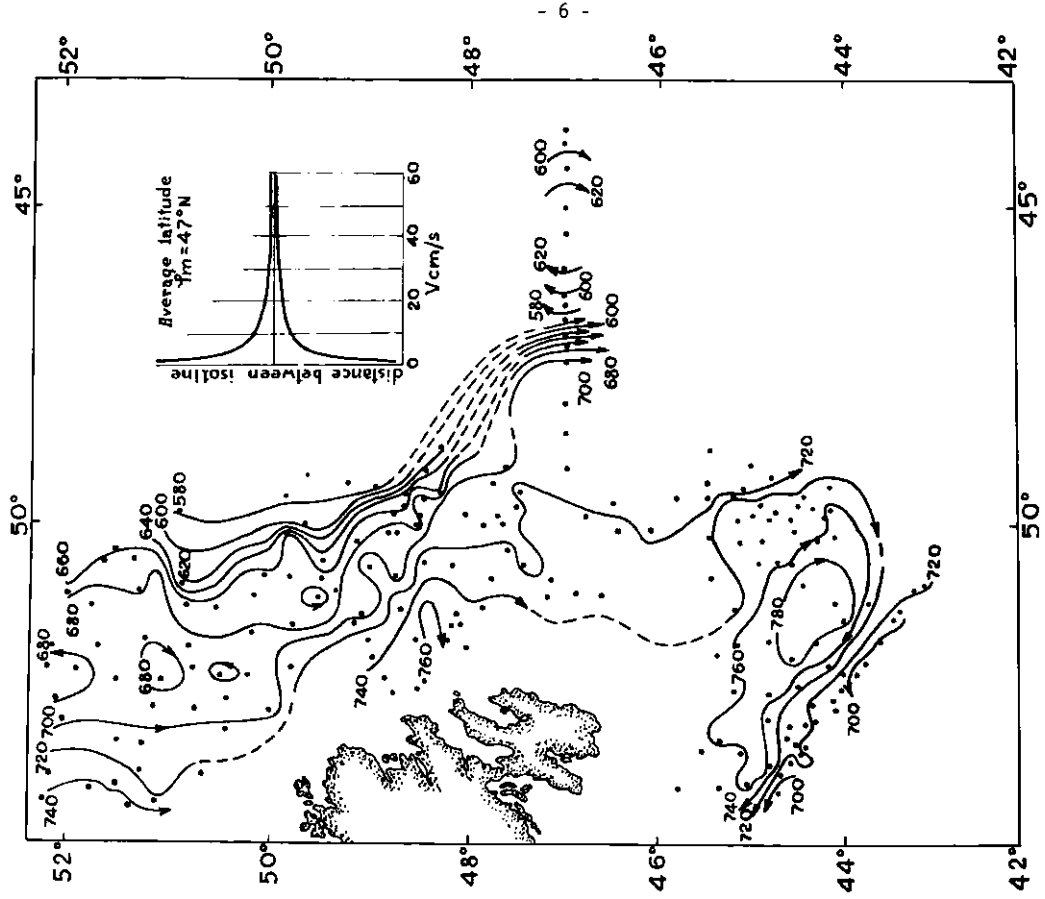


Fig. 2. Geostrophic circulation in the area of the northern Newfoundland Bank and off Newfoundland in June-July 1977 (FRV *Petiscus III*, Cruise 18).

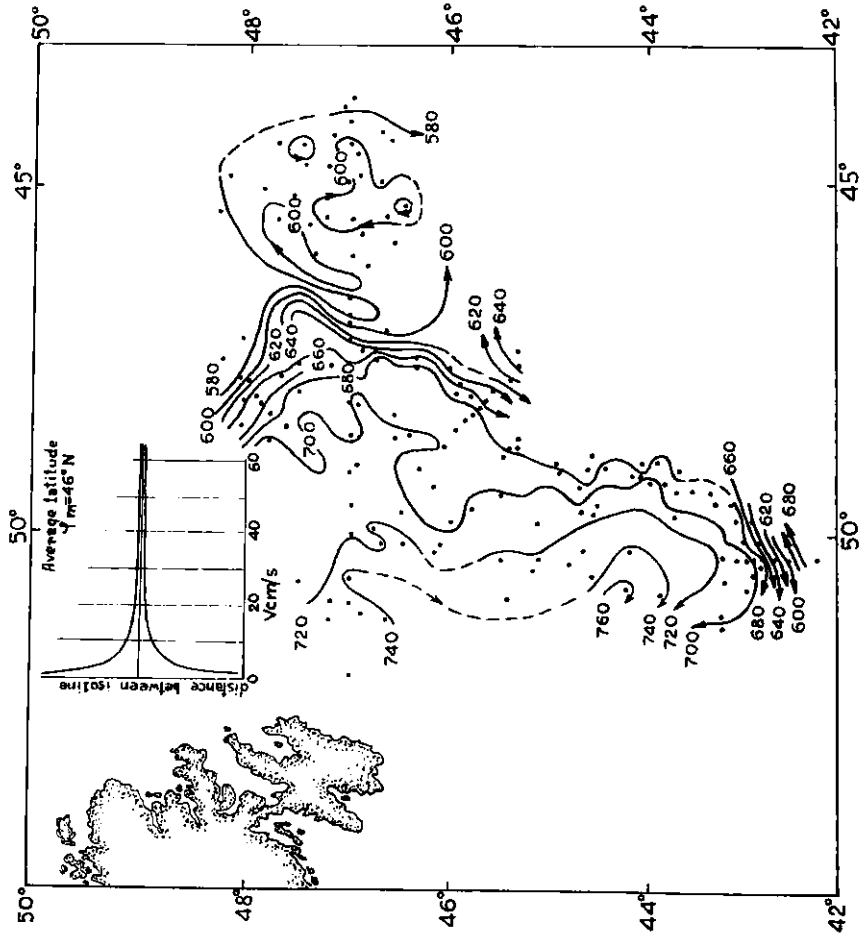


Fig. 1. Geostrophic circulation in the Newfoundland area and Flemish Cap Bank in April-May 1977 (FRV *Petiscus III*, Cruise 18).