Northwest Atlantic Fisheries Organization

Serial No. N091 NAFO SCR Doc. 80/VI/54

SCIENTIFIC COUNCIL MEETING - JUNE 1980

Some Results of the USSR Oceanographic Investigations in Accordance with the Flemish Cap Project in 1979

by

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Abstract

The article presents the results of analysis of geostrophic water circulation charts, those of temperature and salinity distribution on water surface in the Flemish Cap area; these charts drawn up in accordance with the data of four hydrologic surveys of the bank which were conducted during the Soviet research vessels "Suloy" and "Gemma" cruises in the first half-year, 1979. The data confirming authenticity of geostrophic circulation charts which are used for investigation of water dynamics on the bank are also presented in this article.

Introduction

In 1977-1978 seven hydrologic surveys of the Flemish Cap bank were conducted by the Soviet vessels. The results of collected material analysis were presented in a special article (Borovkov, Kudlo, 1979). The main characteristics of general water circulation on the bank, the character of its changeability and possible ecologic importance are described in the article mentioned.

The investigations of 1979 aimed to receive new materials confirming the character of water circulation on the bank in the period after the Flemish Cap cod spawning peak that is from March till June.

Materials and methods

The following hydrologic observations in accordance with the "Flemish Cap" project were conducted by the PINRO research vessels in 1979 (Table)

Vessel, cruise	Date	Number of stations
Suloy, 2 cruise	20.03-07.04. 1979	34
Gemma, 17 cruise	07-20.04. 1979	42
Gemma, 17 cruise	03-10.05. 1979	42
Suloy, 2 cruise	05-18.06. 1979	34

During the "Suloy" cruise hydrologic observations were conducted at trawl stations which were made by a grid of fish-counting survey standard trawling.

In the 17th cruise of the RV "Gemma" observations were conducted in accordance with a regular grid of 42 stations on the Flemish Cap ground.

The materials obtained were treated by a dynamic method (Zubov and Mamayev, 1956), then a series of charts of the sea surface dynamic topography relating to 200dbar level was drawn up (Fig.1). Hydrologic observations data obtained on the Flemish Cap ground in January 15-22, 1979, by the Canadian RV "Hudson" were treated the same way.

Results

Materials of investigations of 1979, which are shown on Fig.1, supplement substantially the formed notions about the peculiarities of water dynamics on the Flemish Cap bank. Thus, if data of 1977-78 (Borovkov and Kudlo, 1979) showed that in periods from December to February and also in May and June there was a quasistationary anticyclonic water gyre in the bank area; then in 1979 observations confirm that just the same mode of circulation can be observed in the period from the end of March till June. Hence, in the period beginning just after the Flemish Cap cod spawning peak which takes place in the south-western part of the bank there exist dynamic

conditions contributing to retention of eggs and larvae within the limits of the bank.

Comparing the charts of water temperature horizontal distribution within the limits of the bank (Fig.2) with the water circulation diagrams (Fig.1) indicates that the primary location of spawning grounds in the south-western part of the Flemish Cap contributes to the maximal prolongation of the period of cod eggs and larvae staying in waters, the temperature and salinity values of which (Fig.3) are close to those of the spawning grounds area. Under unfavourable circumstances larvae may get into the zone of higher gradients of temperature and salinity in the south-eastern part of the bank only in case of having passed a long way clockwise around the bank. Unfortunately, it is still difficult to estimate a period of time necessary for that. Apparently, it will vary widely depending on larvae drift conditions.

Authenticity of geostrophic circulation charts

It is well known that the results of sea current elements calculations by means of the dynamic method depend considerably on observation of a series of conditions of its applicability (Zubov and Mamayev, 1956; Fomin, 1961).

Comparatively small depths over the central part of the bank as well as availability of currents at the depth of 200m which is taken for a zero surface; non-synchronism of observations on the ground (duration of the ground hydrologic survey was 7-13 days); the unstable character of summary current - all these and some other circumstances call into doubt the rightfulness of applying the dynamic method to the processing of the ground hydrologic surveys data. In other words, it is extremely important to find out to what extent the geostrophic circulation charts correspond to the actual system of currents in the survey period.

It is possible to tackle the problem by way of qualitative comparison of dynamic charts with mechanical trajectory of drifting buoys, the location of which is fixed by an artificial earth satellite. Launchings of such buoys were conducted by Canadian resear-

chors (Akenhead, 1978, 1979, Wells, 1979).

Unluckily, the terms of hydrologic surveys conducted by PINRO vessels on the Flemish Cap Bank in 1977/1978 do not coincide with those of the buoys launching and we have no complete data concerning the buoys drift in March, 1979. That's why we had an opportunity to compare only the diagram of water geostrophic circulation on the bank which was drawn up in accordance with the data of hydrologic survey conducted by the Canadian RV "Hudson" in January 15-22, 1979, with two buoys drift trajectories in the period from January 14 till February 27, 1979. We were kindly given those data in St. John's in April, 1979, by Mr. J.Gagnon (radio code JGOSS "T SAC") and by Dr. C.K.Ross (positions of buoys) and those data are shown in Fig.4. It's worth noticing that in both cases we obtain water particles trajectories but their physical essence is different. Observations on a drifting buoy allow to obtain a particle motion trajectory at a period of time whereas using the dynamic method we get a line of current or a photo of mechanical trajectories of a great number of particles which are in the similar dynamic conditions in the period of a hydrologic survey.

Thus, Figures 4a and 4c are comparable (only in their minor part) where initial observations are synchronous. At the same time prolonged observations on drifting buoys apparently give close to reality notion about general water circulation in the area of drift.

The drift trajectory of canadian buoys launched in the central part of the Flemish Cap Bank delineates, as a rule, the existing and strongly pronounced here anticyclonic water circulation. Thus, a buoy launched there in May, 1977 (Akenhead, 1978) had drifted over the bank for 98 days. It rounded clockwise the central part of the bank following closed trajectory for 16 days, then it made a half-turn in the same direction for 22 days and after that it was carried out off the bank borders. Two buoys launched in January, 1979, had drifted over the bank for 34 and 21 days (Akenhead, 1979). Their trajectories are shown in Figures 4a and

4b. As it can be seen in those cases the anticyclonic water movement also took place. Buoys launched in March, 1979, had drifted over the bank for 43 and 70 days.

Thus, investigations of currents with the help of drifting buoys conducted by Canadian Scientists showed that there exists a steady clockwise water circulation on the Flemish Cap Bank.

Hence, water circulation diagrams obtained by mean of the dynamic method outline quite objectively the actually existing system of water circulation on the Flemish Cap Bank, at least, concerning the direction of water movement.

These conclusions testify convincingly to a possibility of using geostrophic water circulation chaats for ecological investigations.

Acknowledgement

The authors express their gratitude to Mr. J.Gagnon and Dr. C.K.Ross for the opportunity to use the data of Canadian investigations on the Flemish Cap Bank conducted in January-February, 1979.

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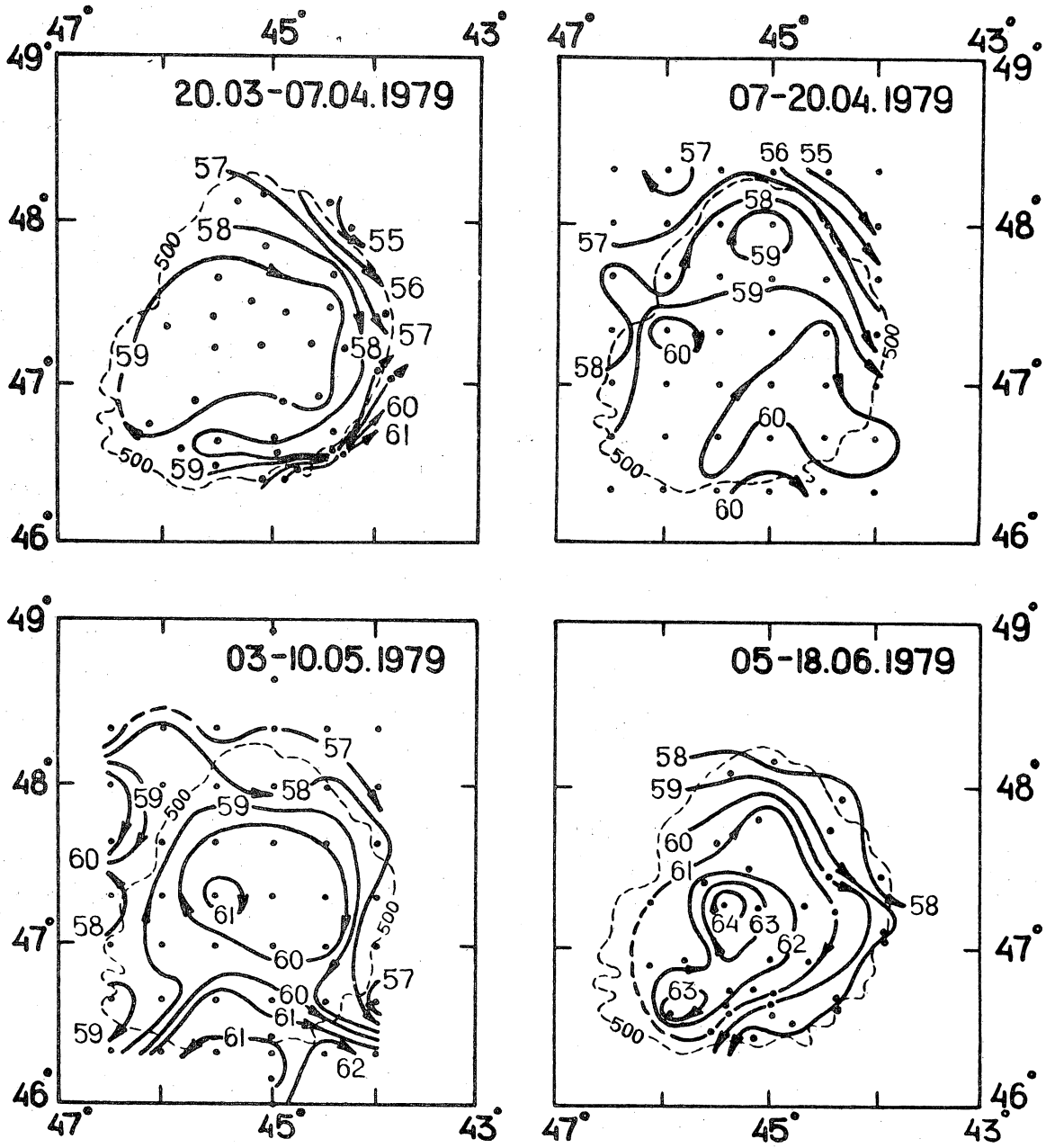

Fig.1. Geostrophic water circulation over the Flemish Cap Bank 0-200 dbar. Data of the RV "Suloy" 2 cruise in March-April 1979 and the RV "Gemma" 17 cruise in April and May, 1979.

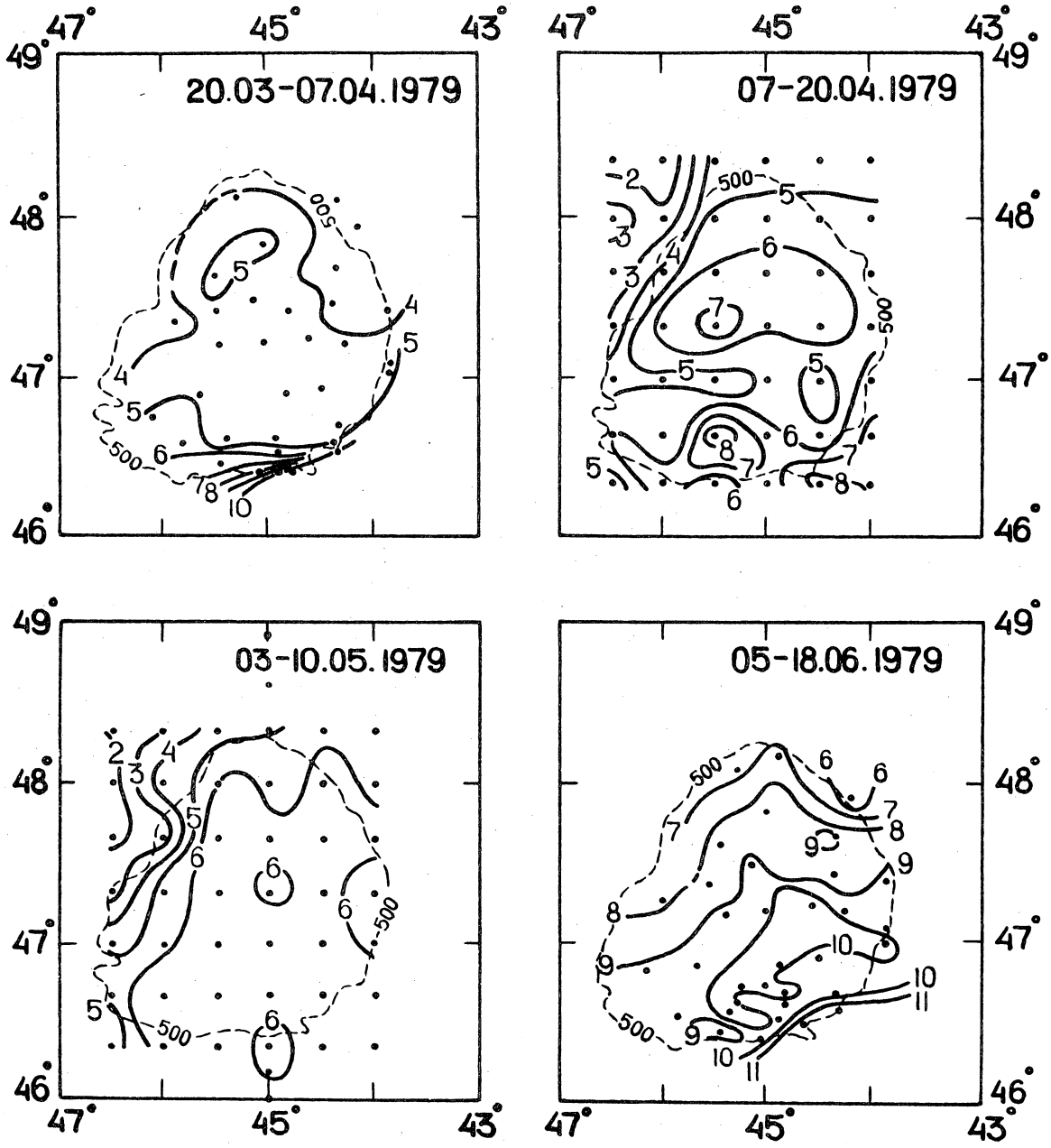

Fig.2. Horizontal distributions of water temperature on the surface in the Flemish Cap Bank area in some periods of 1979. Data of the RV "Suloy" 2 cruise and the RV "Gemma" 17 cruise. Dates of observations are indicated in the figure.

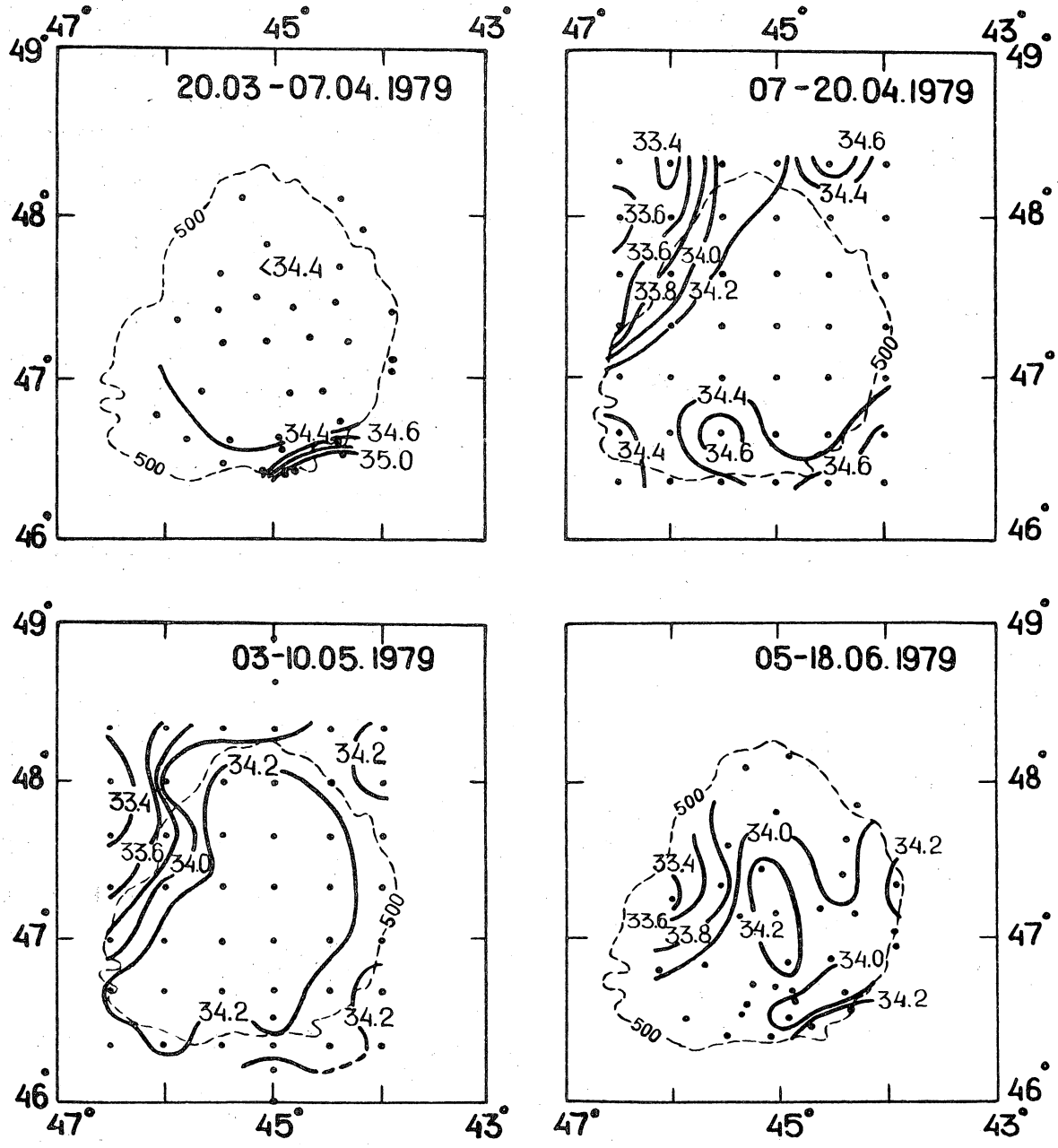

Fig.3. Horizontal distribution of salinity on the surface in the Flemiah Cap Bank area in some periods of 1979. Data of the RV "Suloy" 2 cruise and RV "Gemma" 17 cruise Dates of observations are indicated in the figure.

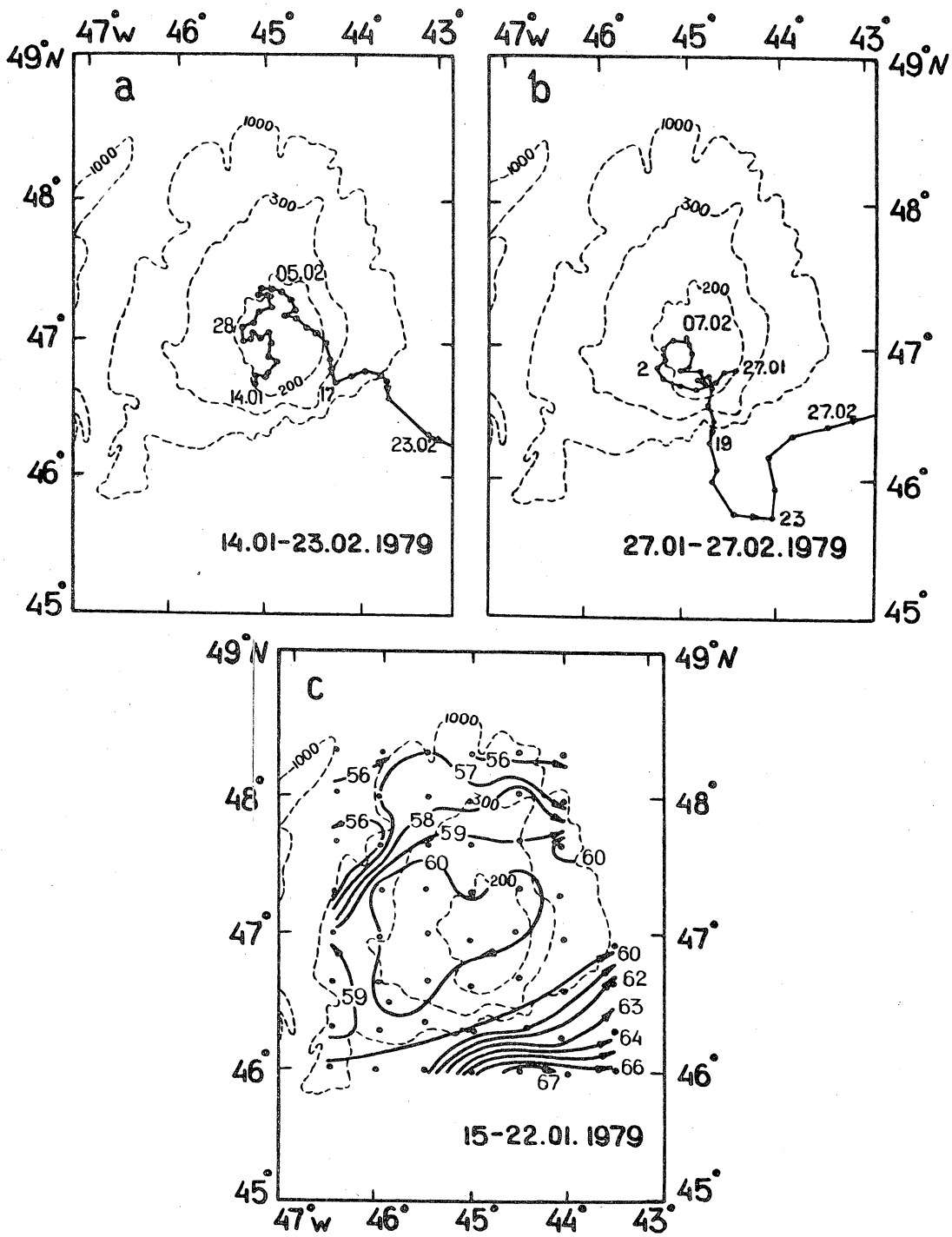

Fig.4. Trajectories of movement of two Canadian drifting buoys fixed from an Earth artificial satellite (a,b) and the diagram of geostrophic water circulation on the Flemish Cap Bank in accordance with the data of the Canadian RV "Hudson" (C) in January-February, 1979, 0-200dbar.