NAFO Sci. Coun. Studies, No. 1: 47-50

Drift of Satellite-tracked Buoys on Flemish Cap, 1979-80

C. K. Ross
Atlantic Oceanographic Laboratory
Bedford Institute of Oceanography
Dartmouth, Nova Scotia, Canada

Abstract

Six satellite-tracked drifting buoys were deployed on Flemish Cap at intervals between early January 1979 and May 1980. The buoys drifted over the bank for an average of 50 days. The trajectories show a general sluggish circulation over the central part of the bank with an indication of clockwise circulation. All of the buoys eventually exitted from the southeastern sector of the bank to enter the North Atlantic Current.

Introduction

One of the objectives of the international research program on Flemish Cap (ICNAF, 1977) relates to the investigation of the effects of water circulation on the retention and survival of fish eggs and larvae. It was proposed that all available tools, including remote sensing techniques and satellite tracking of drifting buoys, should be used as aids in clarifying the circulation pattern and the oceanograhic regime. As part of the research program, six satellite-tracked drifting buoys were released on Flemish Cap between January 1979 and May 1980. Analysis of the data from these buoys during their presence in the Flemish Cap area are presented in this paper.

Materials and Methods

The buoys were manufactured by Hermes Electronics, Dartmouth, Nova Scotia, Canada, and are very similar to those used during the First GARP (Global Atmospheric Research Programme) Experiment in the Southern Ocean. Each buoy was equipped with a large 'window-shade' drogue extending from 2 to 10 m deep and with instruments to sense water temperature which was transmitted via communication satellite. The position of each buoy was monitored by Service Argos in Toulousse, France. From January to July 1979, only one satellite was in operation and about five positional fixes were obtained each day. A second satellite became operational in July 1979, resulting in approximately 10 positional fixes each day.

The data received from Service Argos were checked for obvious errors and the arithmetic means of all positions and temperatures were calculated over 12-hour intervals. These data form the primary time series for each buoy. The mean 12-hour values of position were differenced over 24 hours to form the time series of buoy velocities.

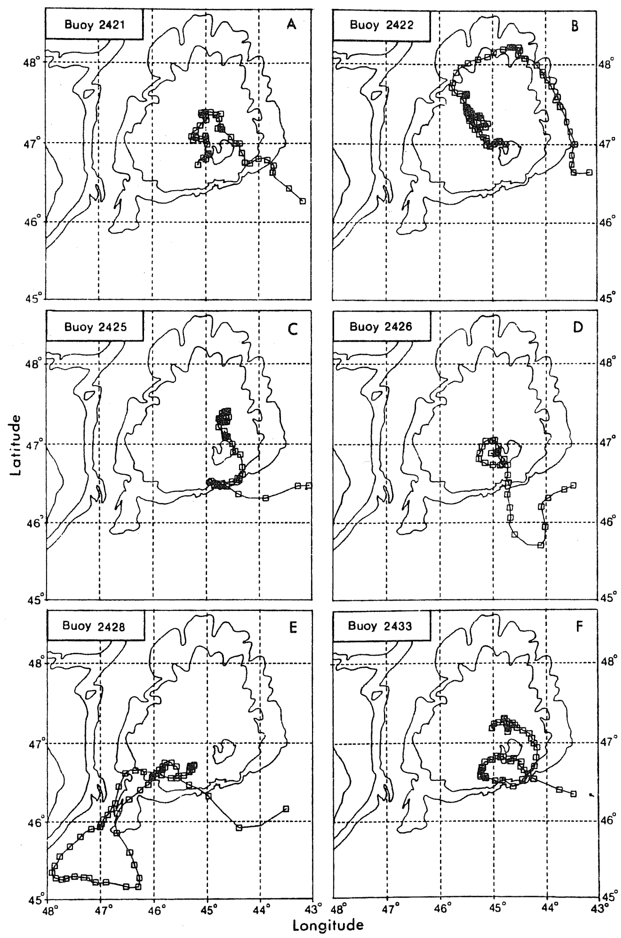

Fig. 1. Drift tracks of six buoys released on Flemish Cap during 1979-80, with symbols plotted at 24-hour intervals. (See Table 1 for starting and ending times and deployment positions.)

The synoptic meteorological charts of sea surface barometric pressure, produced by the Canadian Atmospheric Environment Service, were used to create a time series of geostrophic wind on Flemish Cap. The geostrophic wind values were computed at 6-hour intervals and averaged over 24 hours.

Results and Discussion

The start and end times and positions for the 6 buoys released on Flemish Cap are given in Table 1 and the tracks are plotted in Fig. 1. Most buoys experienced very slow motion while on the bank, with a

TABLE 1. Starting and ending times and positions for 6 buoys released on Flemish Cap in 1979-80.

	Start of track				End of track			Days on
Buoy	GMT	Day	Year	Position	GMT	Day	Year	bank
2421	1800	14	1979	46.72°N,45.16°W	1800	54	1979	41
2422	1800	77	1979	46.99°N,44.50°W	0600	148	1979	72
2425	0600	88	1979	47.31°N,44.83°W	1800	131	1979	44
2426	1800	27	1979	46.84°N,44.45°W	1800	58	1979	32
2428	0800	189	1979	46.69°N,45.19°W	0800	250	1979	62
2433	0800	144	1980	47.19°N,45.03°W	2000	194	1980	51
						Average		50

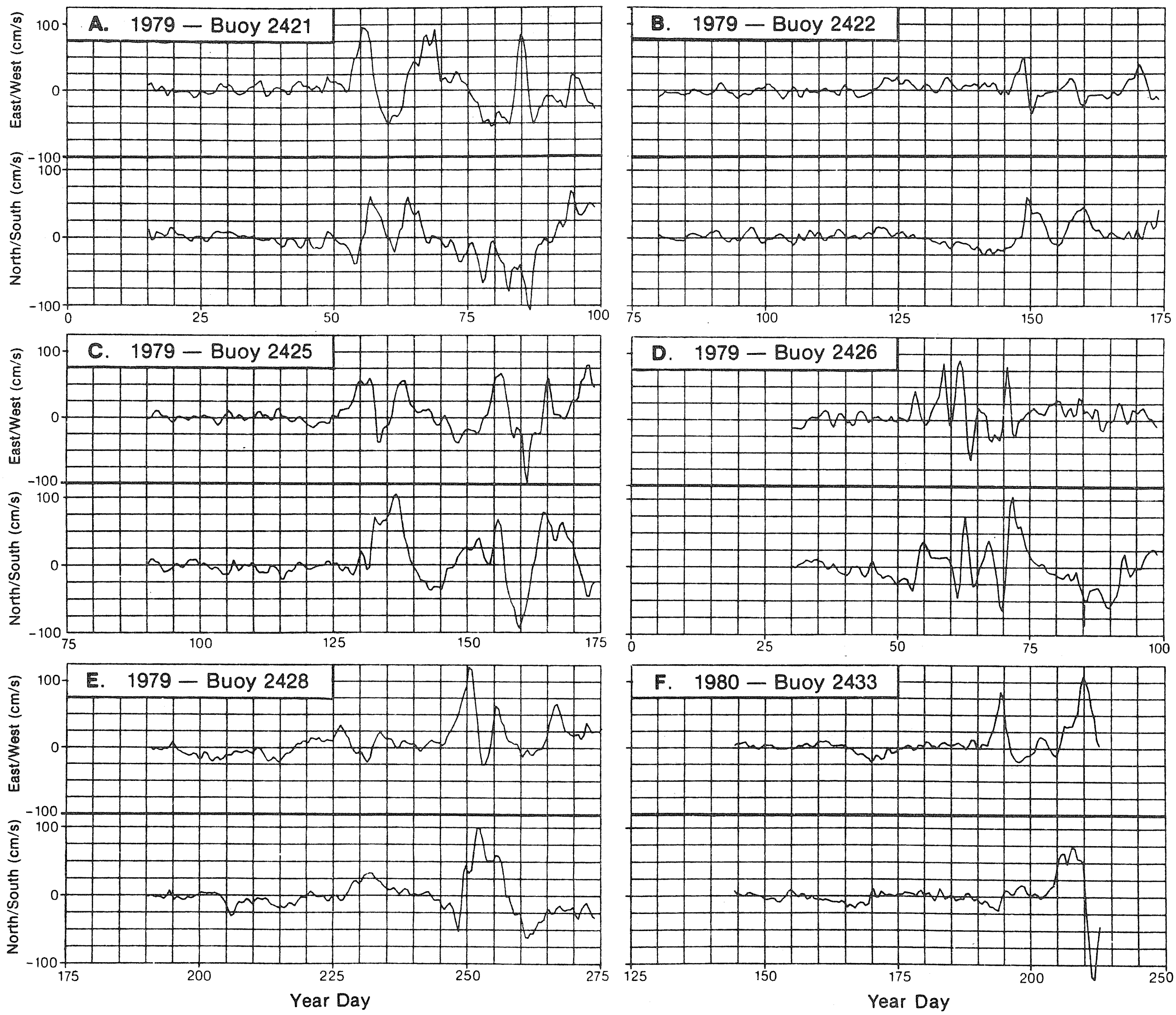

Fig. 2. Average daily components of velocity for six buoys released on Flemish Cap during 1979-80. (Positive components are to the east and to the north.)

general trend toward an anticyclonic rotation, but the path of each buoy is unique. Buoy 2422 managed to get to the northwest slope of the bank and then proceeded in a very regular track around the outer limits of the bank. This pattern quite possibly indicates the outer branch of the Labrador Current noted previously in the literature (Templeman, 1976). Buoy 2428 had the most unexpected track. Initially, it proceeded to the west and came under the influence of the Labrador Current which carried it southwestward away from the bank. It then moved eastward before being carried northward to cross the southwestern part of the bank. The other buoys described slow anticyclonic motions over the central part of the bank and finally exitted from the southeastern sector where they encountered the North Atlantic Current and were advected out of the region.

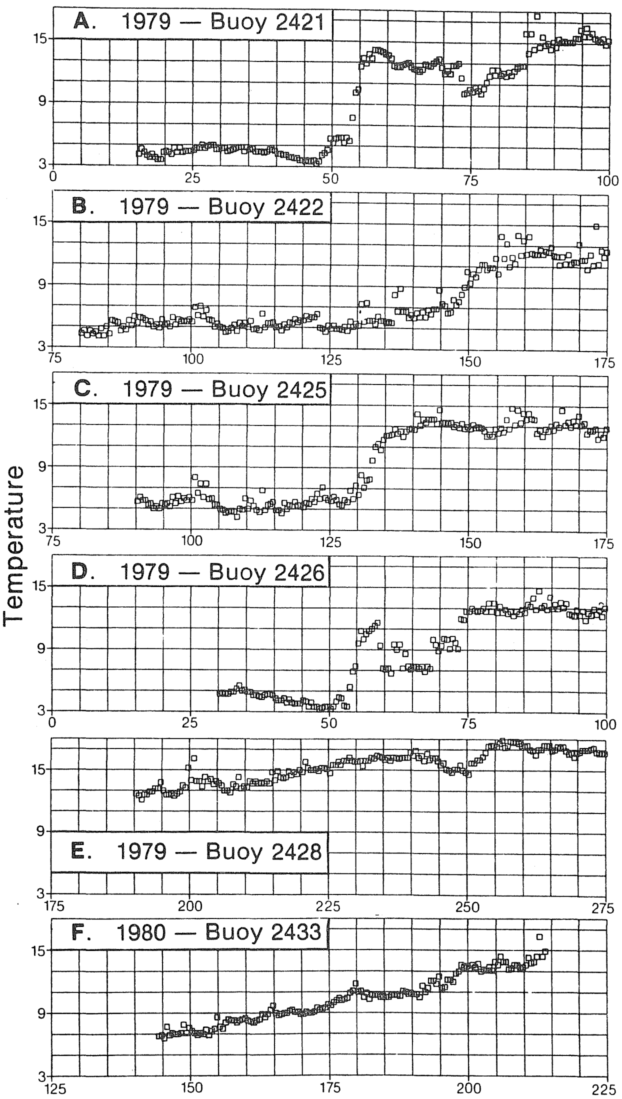

Fig. 3. Average temperatures (°C) at 12-hour intervals from six buoys released on Flemish Cap during 1979-80.

Figure 2 shows the mean daily velocity (cm/sec) of each buoy for a period well beyond the time when they left the Flemish Cap. In all cases, the speeds were very low during their presence on the bank in comparison with the speeds after their departure.

The temperature trends shown in Fig. 3 indicate relatively constant low values for four of the buoys on the bank, followed by sharp increases in temperature when they entered the North Atlantic Current. For buoys 2428 and 2433, the gradual increasing trend in temperature during their presence on the bank represents summer warming of the surface layer, thus blurring the constrast with the North Atlantic Current.

It is not readily apparent that there is a close relationship between geostrophic wind (Fig. 4 and 5) and buoy displacement. The buoy's location on the bank may be very critical to what effect the wind direction will have. Any given wind direction will tend

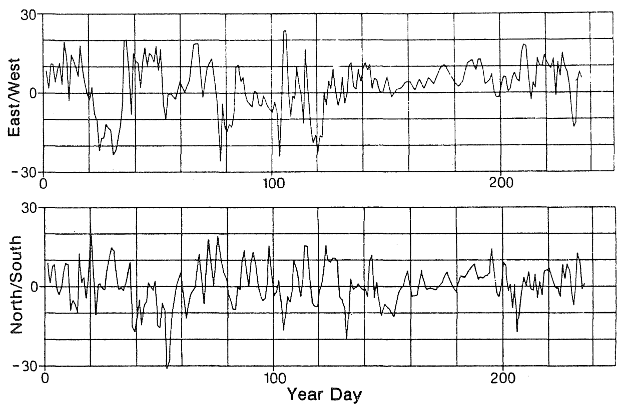

Fig. 4. Average daily components of geostrophic wind on Flemish Cap in 1979. (Positive components are winds blowing to the east and to the north.)

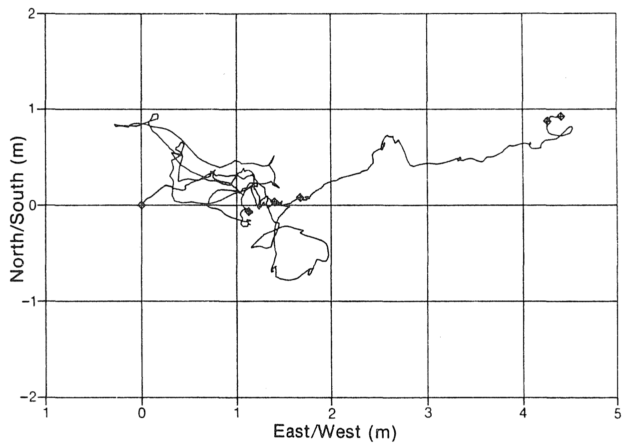

Fig. 5. Progressive vector diagram of geostrophic winds on Flemish Cap, starting at the coordinates (0, 0) with symbols at 50-day intervals.

to move the buoy on to or away from the bank, depending on whether the buoy is on the windward or leeward side. Buoys 2421 and 2426 were both in the interior of the circulation around the bank when they were forced to the southeast almost simultaneously. It also appears that wind is not required to eject the buoys from the bank once they approach the southeastern slope, as the influence of the North Atlantic Current is sufficient to trap the buoys and quickly advect them from the area.

References

ICNAF. 1977. Report of Standing Committee on Research and Statistics. App. IV. Report of Environment Subcommittee. *ICNAF Redbook 1977*: 77-87.

TEMPLEMAN, W. 1976. Biological and oceanographic background of Flemish Cap as an area for research on the reasons for year-class success and failure in cod and redfish. *ICNAF Res. Bull.*, No. 12: 91-117.