THE GEOSTROPHIC CIRCULATION AND CURRENT STRUCTURE IN THE EASTERN MEDITERRANEAN BETWEEN THE SYRIAN COAST AND CYPRUS ISLAND IN WINTER AND SUMMER SEASONS

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Abstract

The geostrophic circulation and the structure of currents have been examined on the basis of quasi-synchronous hydrophysical surveys and current measurements on 7 mooring carried out in this area for the first time in February 1992 and October 1993.

Key-words: Levantine Sea, Deep Waters

In spite of a long history of the Mediterranean Sea oceanographic research, the north-eastern Levantine Basin between the Syrian coast and the Cyprus island (we suggest to call it "Lattakia Strait") was the least studied one till recently. From 1 to 14 hydrological stations in one-degree square can be numbered there (1, 2, 3, 4). Later, large investigations were fulfilled in the Levantine Basin within the POEM Project (5, 6, 7), but only few stations were carried out in Lattakia Strait. There were no current measurements at all performed at a modern technical and methodological standard.

Two expeditions of the P.P. Shirshov Institute of Oceanology, Russian Academy of Sciences, and Higher Institute of Applied Sciences and Technology of Syria in winter 1992 and autumn 1993 have made the greatest contribution into oceanographic research of Lattakia Strait. The first expedition (the 24th Cruise of the R/V *Vityaz*, February 6 - March 16, 1992) has performed two hydrophysical surveys down to the bottom with the help of performant instruments (107 STD stations 10 miles apart and simultaneously 7 mooring buoy stations (MBS) during 20 days; Fig. 1) (8). The second expedition (the 27th cruise of the R/V *Vityaz*, September 26 - November 17, 1993) has also performed two similar surveys (110 STD stations 10 miles apart and current measurements at 7 MBS for 24 days) (9). The main results of these investigations are given hereafter.

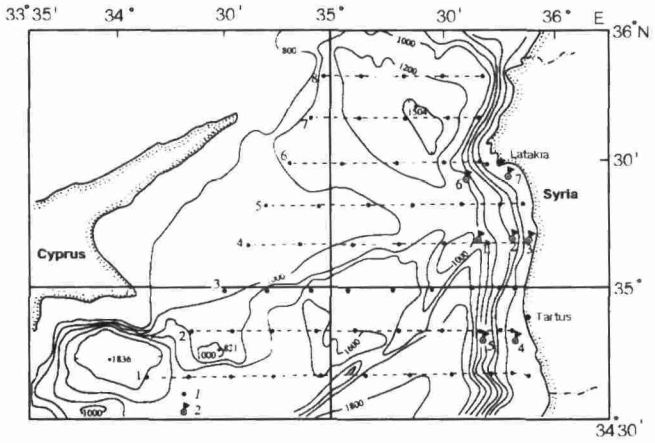

Fig. 1. The bottom topography and the location of hydrophysical stations (1) and mooring buoy stations (2). (1-8 : number of the latitudinal hydrophysical sections).

Maps of geostrophic currents are calculated for the two surveys (Fig. 2). The current field is an intensively meandering northward flow with a number of eddies on its edges, *i.e.* cyclonic eddies on the left and anticyclonic ones on the right. Three cyclonic and one anticyclonic eddies were observed during the first survey (Fig. 2a). Two cyclonic eddies were in the southern part of the area (34°50'N) and the third one was in the north (only a part of it was covered). Cyclonic eddies southward of 35°N are, apparently, a part of the Lattakia cyclonic eddy (5, 6). The anticyclonic eddy was situated between the flow and the Syrian coast (35°15'N). Eastward of the anticyclone near the shore there is a slightly marked secondary cyclonic eddy.

According to the second survey data the dynamic picture was quite different. This survey was done east of 35°E. An anticyclonic eddy, stretching in the meridional direction, was found at the place occupying by a cyclonic eddy during the first survey (Fig. 2b). On the north the southern part of a second anticyclone might be signed. In the central part of this area, a cyclonic eddy was encountered.

When comparing the location of the characteristic eddy centres, it can be concluded on the basis of the first and second survey data that the whole dynamic system has seemingly shifted to the north in the direction of the general flow for 40-50 miles, with a mean velocity of 2.5-3 miles per day. The wave length of the meander is about 40-45 miles.

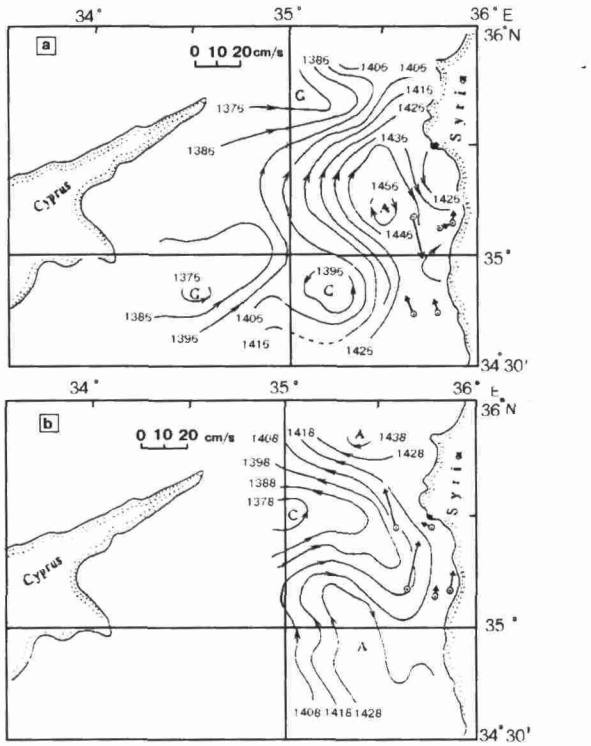

Fig. 2. Dynamical topography maps of the sea surface relative to reference level of 800 dbar according to the data (a) of the first survey (15.02-22.02.92) and (b) of the second survey (05.03-08.03.92). (A - anticyclone, C - cyclone. The arrows show mean currents from moored instruments).

The above mentioned character of the geostrophic circulation and its large-scale elements (meanders, eddies) are observed within the whole water column, as confirmed by currents measurements : water flow is running in one direction from the surface down to the bottom. Changes of current velocity and direction happen simultaneously at all levels (Fig. 3). Such peculiarities of the current field are typical of eddies and meanders whose vertical structure is quasi-homogeneous in winter. Homogeneity of winter hydrological structure is characterized by vertical gradients whose maximum values are :

$$\frac{dT}{dz} = -0.0104°C/m, \quad \frac{dS}{dz} = 0.0018/m, \quad \frac{d\sigma}{dz}dz = 0.0007/m$$

(depth is 325-350 m). Above and below this layer, vertical gradients were close to zero (10). A joint analysis of wind and currents showed that the changes in the current field depend on the spatial shift of meanders and eddies and are not connected with local winds (Fig. 3) (8).

Thus, in winter a flow to the north crosses the Lattakia Strait from its surface down to the bottom. This current is, probably, a part of the Mid-Levantine Jet, which divides into three streams near the Cyprus Island. One of them swerves to the left (to the south-west of Cyprus) and enters the Cyprus eddy, the second turns to the south and flows into the Shikmora Gyre (7, 11, 12), and the third one returns to the north to the Lattakia Strait (4). This stream carries Modified Atlantic Water (MAW), Levantine Intermediate Water (LIW) and a part of Deep Water (DW) to the Cilicia Basin. According to the data of two hydrophysical surveys in October 1993 the maps of dynamical topography were calculated for levels 0, 100, 250 and 500 m relative to a reference level of 800 dbars. The field of geostrophic currents was characterized by an intensive space-time variability.