AVERAGE MONTHLY PATTERNS OF SURFACE CURRENTS MEASURED IN THE SOUTHEASTERN MEDITERRANEAN OFF THE EGYPTIAN COAST

Makram A. Gerges

Institute of Oceanography and Fisheries, Alexandria, Egypt.

ABSTRACT

The paper presents the monthly patterns of surface currents obtained by averaging all current measurements carried out in each one-degree square of the studied area over a period of about 50 years. The obtained patterns indicate that the current speeds are generally variable and fluctuate between 2 and 20 cm/sec, but rarely reach values up to 35 cm/sec. It was also shown that the surface currents in the southeastern Mediterranean are mostly eastward and southeastward, except in a few cases when the currents near the Egyptian coast are towards the West or South-West. Some important features of the current distribution and its seasonal variability are described in relation to the prevailing wind conditions over the investigated area.

INTRODUCTION

To date, our knowledge of the current distribution in the southeastern Mediterranean depends mainly on information obtained through indirect methods and computations. In most of the previous investigations of this area, the general circulation characteristics have been described in terms of the hydrographic structure and water masses (e.g. Morcos and Moustafa-Hassan, 1976), or on the basis of dynamical computations (e.g. Sharaf El-Din and Karam, 1976). The recent approach of numerical modelling was also used to investigate the circulation in the eastern Mediterranean by Moskalenko (1974) and Gerges (1976). However, in all these studies, data of direct measurements of currents were generally needed to confirm or to correct the circulation patterns revealed from these speculations. Therefore, it is the concern of the present study to provide such needed information which could shed light on the actual surface circulation pattern in the investigated area. This could also help in understanding the process of exchange of water between the coastal and off-shore regions in this part of the Mediterranean Sea, the importance of which is quite evident.

MATERIAL AND PROCEDURE

The data used in the present study was obtained through the Oceanographic World Data Centres, which provided all available surface current measurements collected throughout a period of about 50 years, up to the early Seventies. The monthly averages were calculated by a special computer programme which provides the mean current velocity and direction in each 1-degree square of the area of our concern. The information obtained through such procedure is considered to be more representative of the actual current conditions than that based on a single reading or short-term observations of currents.

RESULTS AND DISCUSSION

The results obtained are presented in Figure (1), which illustrates the average conditions of the observed surface current field in the different months: from January to June (Figure 1-a) and from July to December (Figure 1-b).

Although these figures are rather self-explanatory, the following important features of the obtained current patterns may be pointed out:

1) In the months of January and February, which are typical winter months, the surface currents are mainly directed towards the SE with a clearly eastward current existing very close to the coast. During this time of the year, the prevailing winds over the Egyptian coast are usually westerly in both the NW and SW directions, with almost equal frequencies. Hence the observed currents are mostly in the direction of the blowing wind. Their velocities ranging between 3 and 20 cm/sec.

2) In the month of March, when the spring season practically starts and the NW component of the wind prevails, the currents are still directed towards the SE. The eastward coastal currents also exist, but their velocities are generally weaker (from 2 to 15 cm/sec).

3) During the rest of the spring season, which lasts until May, the currents continue to be southeastward. However, in the month of April, the existence of an anticyclonic gyre to the south of Crete extending close to the Egyptian coast was clearly indicated. It is worthwhile mentioning here that this particular gyre was also obtained from the numerical model of circulation using the density field in the Eastern Mediterranean, referred to above (Gerges, 1976).

4) Throughout the summer months (June to August), southeastward currents are still observed, apparently under the action of the prevailing NW winds. Only in a few cases, southwestward currents were observed, especially along the western part of the Egyptian coast, where currents of greater velocities, up to 25 cm/sec, could be found.

5) During the autumn months (September to November) the surface currents are directed southeastwards from the off-shore regions to the coast with velocities reaching up to 25 cm/sec. These off-shore currents are directed more to the South, so that when reaching the coast they sometimes create southwestward and sometimes northwestward currents, as is observed, in particular, in the area of the Arab Gulf.

6) In the early winter month of December, the southeastward currents become directed more towards the East, and a general eastward current is observed everywhere along the coast, with velocities ranging from 3 to 20 cm/sec. This is obviously due to the fact that during this month, generally southwesterly winds prevail over the investigated area. This reflects the important role of wind in driving the surface currents in this area.

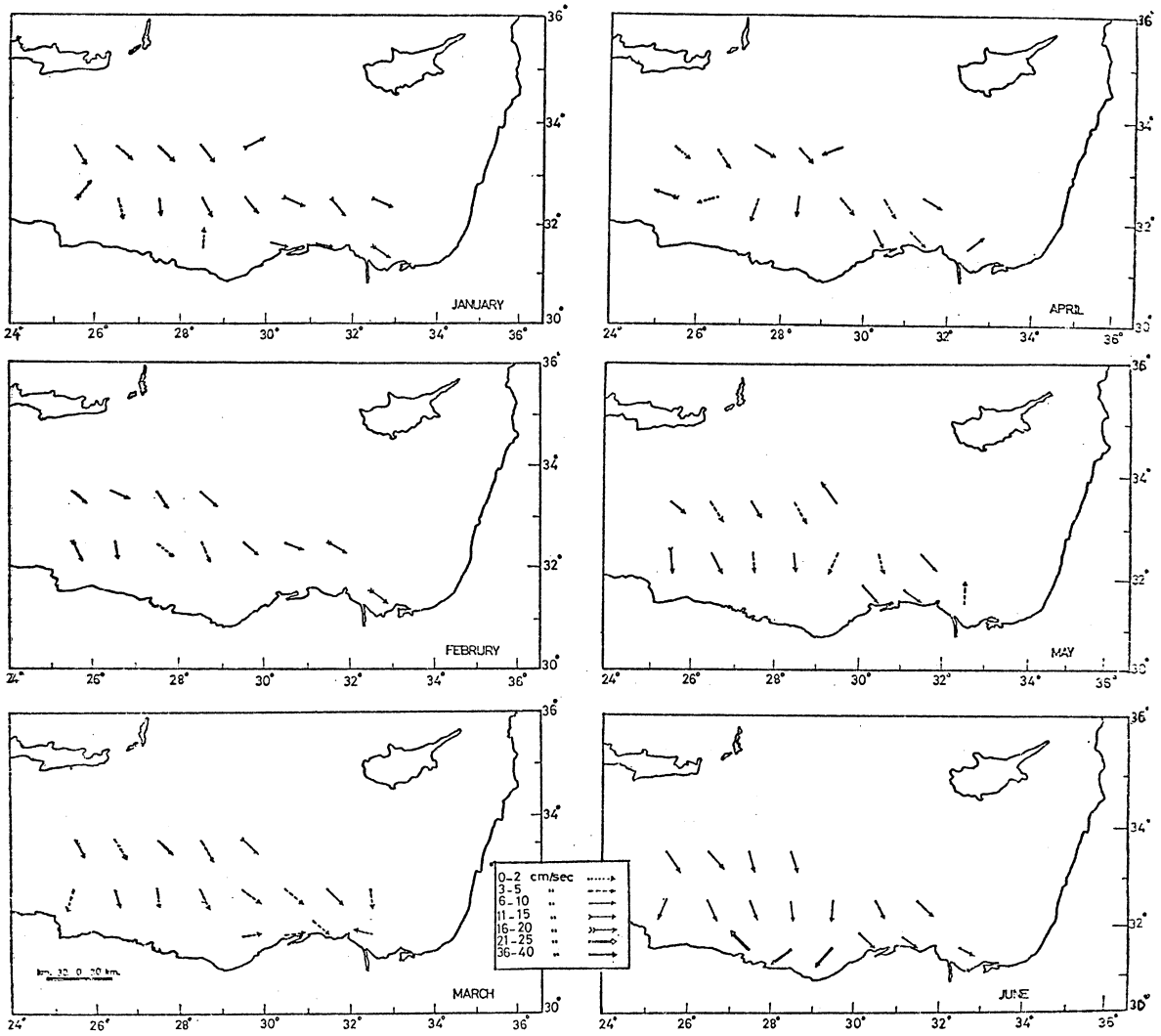

Fig.1: Monthly patterns of the observed surface currents off the Egyptian coast
(a) - Average conditions for the months January - June

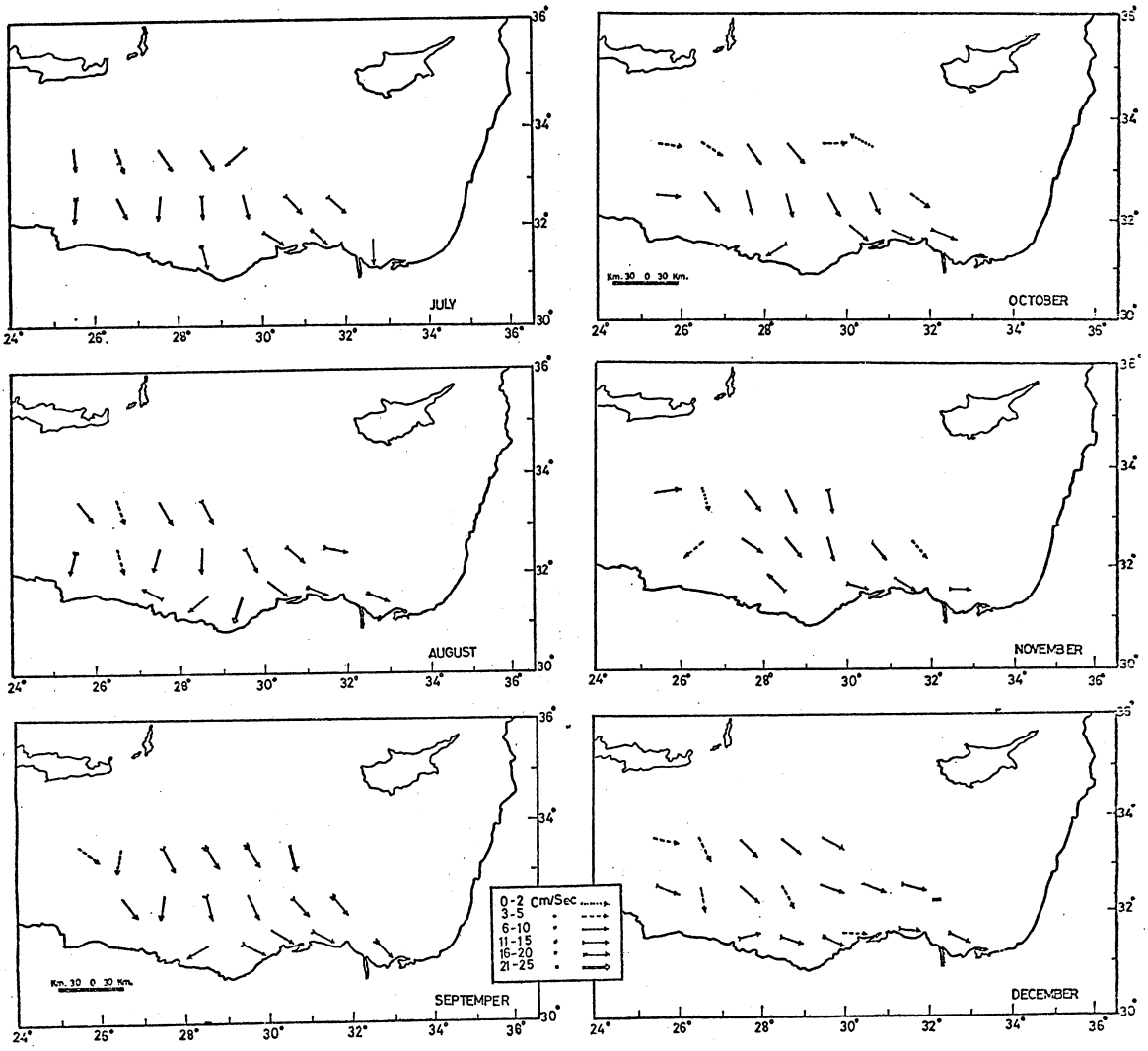

Fig.2: Monthly patterns of the observed surface currents off the Egyptian coast
(b) - Average conditions for the months July - December

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