ON THE ROLE OF WIND IN THE CIRCULATION PATTERN IN THE EASTERN MEDITERRANEAN BASIN

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ABSTRACT

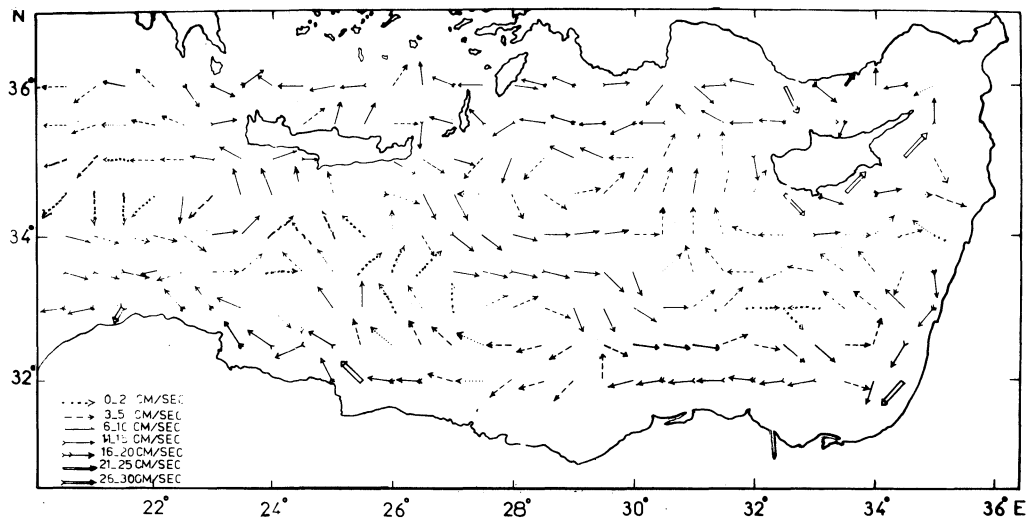
A numerical model of circulation is used to estimate the role of wind in the general circulation pattern. The results showed that the wind has considerable effect on the circulation down to the 300 m depth below which the average current speed reaches values equal to or less than 4% of that at the surface and hence wind is ineffective.

INTRODUCTION

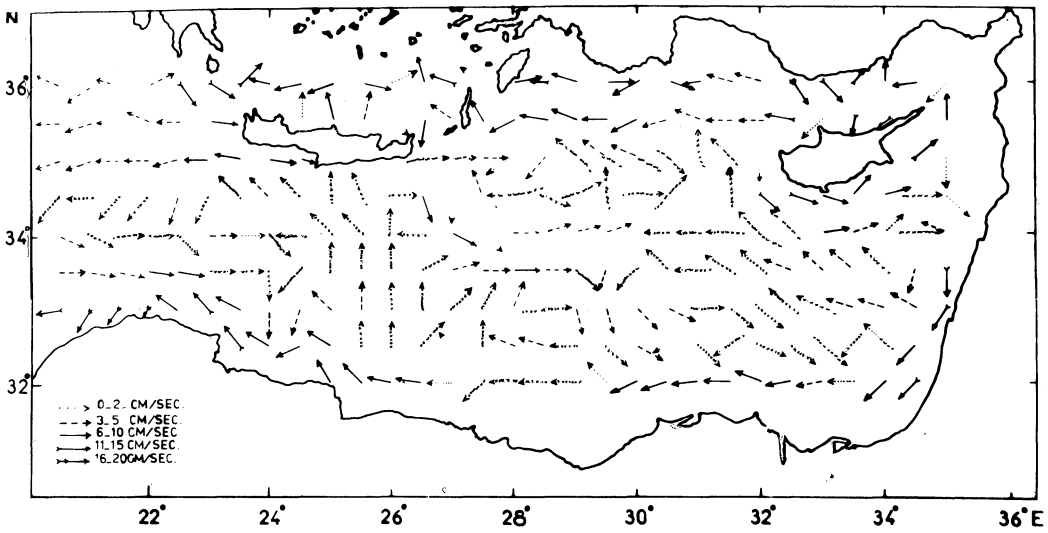
The circulation pattern in the Eastern Mediterranean basin has been mainly based on information gained from the distributions of hydrographic properties and dynamical computations. In a recent study, Gerges (1976) applied the numerical modelling approach to determine the circulation pattern in this basin at several levels, representing the surface, intermdiate and deep layers. The concern of this paper is to investigate the role played by wind, through studying its effect on the circulation and examining to what depth this effect penetrates and to what extent it contributes to the general circulation.

PROCEDURE

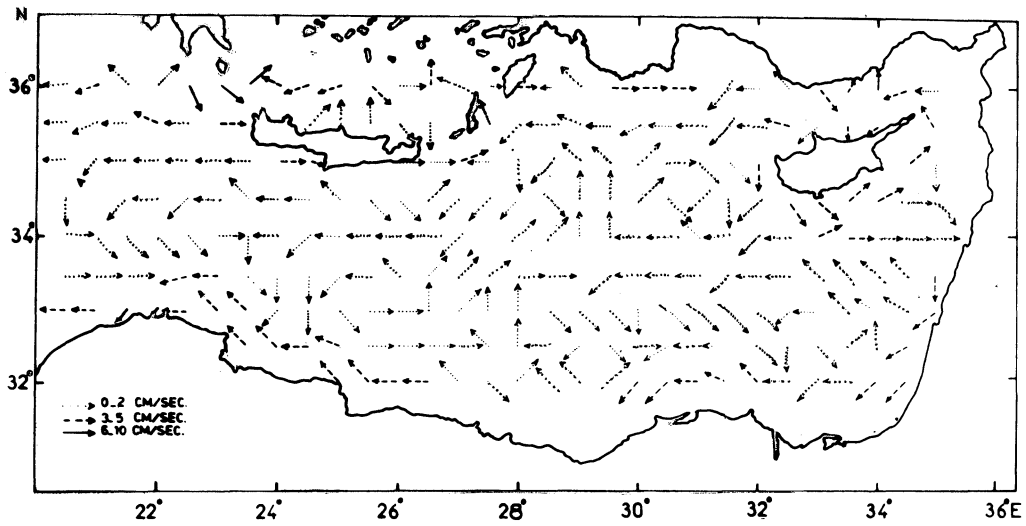
Oceanographic data collected by several Mediterranean expeditions during winter seasons, together with the bottom relief and atmospheric pressure data taken from recent papers and atlases were used to obtain the general pattern of circulation according to the above model. This model uses the observed density and wind fields, and accounts for the sea water baroclinicity, bottom topography, their joint effect and the effect of the Earth's rotation. To estimate the role of winds, its absence was assumed by putting the wind stress equals to zero, and then comparing the results with those previously obtained in the presence of wind.



Current pattern at 50m level, neglecting wind effect



Current pattern at 150m level, neglecting wind effect



Current pattern at 300m level, neglecting wind effect

RESULTS AND CONCLUSIONS

The results showed that wind plays an appreciable role in the surface circulation. The surface current velocity, ranging from 15 to 30cm/sec, considerably decreases in magnitude and varies in direction in the absence of wind.

At the 50 m level, the wind effect could still be felt. However, it begins to weaken. At the 150 m level, speeds and directions of current in both cases, i.e. in the absence and presence of wind, become closer to each other, thus indicating a weaker effect of wind. As we reach the 300 m level, it becomes clear that the wind effect is almost negligible, except in the western part of the basin, where it shows some influence on the circulation, but in a rather limited degree. At the 400 & 500 m levels, a greater similarity has been indicated between the circulation patterns obtained both in the presence and absence of wind. The dominant speed of both patterns is less than 1 cm/sec, except a very few values which exceeded 2 cm/sec off the Libian and Tunisian coasts.

Thus it is concluded that the wind extends its effect down to the 300 m level, particularly in the western part of the basin which is more subjected to strong northwesterly winds prevailing in winter season. Meanwhile, the average current speeds at the 400 m level and deeper, reach values which are equal to or less than 4% of the surface current velocities Therefore, according to Gross (1972), the wind becomes entirely ineffective at the levels below 300 meter all over the basin.

BIBLIOGRAPHY

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