DETERMINATION OF THE LOCATIONS OF SOUTHEASTERN LEVANTINE ANTICYCLONIC EDDIES FROM CTD DATA

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Abstract
The degree of depression in the profile of potential density is proposed as a criterion of the anicyclonality at the cast location. This criterion was calculated for profiles in the historical CTD data set from the Southeastern Mediterranean in order to map the region of transient anticyclonic eddies. Most of the casts with a higher degree of anticyclonic activity are clustered in the region between Cyprus and Haifa. The absence of anticyclonic depression in the potential density profiles outside of an intensive eddy suggest that the so called "Shikmona Gyre area" is not an area of weak anticyclonic circulation, but rather is an area of general cyclonic circulation with the periodic generation of energetic anticyclonic eddies.
Keywords : Levantine Basin, Circulation.

The climatological pattern of the Southeastern Levantine circulation has been the subject of extensive investigation since the first evidence of energetic anticyclonic eddies in this region were discovered in CTD data collected by the Israeli R/V Shikmona in the "Mediterranean Climate" (MC) cruises during 1979-1984 [1, 2]. Prior to this, the commonly accepted picture of a general cyclonic circulation was based on sparse casts (about 50 eastward of 30°E for the classical Ovchinnikov scheme [3]). In an analysis of the CTD data collected by R/V Shikmona during the first two POEM cruises (Oct 1985 and Mar 1986), Brenner [4] determined that among several warm core eddies in the region of study, the most intense eddy was located near 34.2°N, 34.2°E. He referred to this as the Cyprus eddy. Using the same CTD data Oszoy et al, [5] defined a broad area with a relatively high geopotential anomaly and referred to it as Shikmona Gyre. This area appeared to contain three small scale anticyclonic eddies. In summarizing the POEM cruise data and supporting evidence from numerical model simulation, Robinson and Golnaraghi [6] defined the southeastern Levantine as a region with a "system of anticyclonic eddies, among which is the recurrent Shikmona eddy south of Cyprus". Pinardi et al, [7] described the southeastern Levantine circulation as being dominated by an along shore cyclonic circulation with the presence of the Mid-Mediterranean Jet (MMJ) south of Cyprus and the Shikmona gyre area. This description (excluding the MMJ) was corroborated by Hamad et al, [8] based on analysis of remotely sensed sea surface temperature data. Using a unique set of CTD data (1995-2005), Zodiatis at al, [9] demonstrated the persistence of the MMJ south of Cyprus accompanied by a complex structure of anticyclonic eddies south of the jet. To distinguish between anticyclonic eddies located west of and east of 33.5°E, they used the names Cyprus eddy and Shikmona eddy, respectively.

One of the intriguing questions is how to interpret the Shikmona Gyre area: as a region where anticyclonic eddies are generated and migrate or as a relative large area with a slow anticyclonic circulation and periodically generated energetic anticyclonic eddies? Unfortunately the historical CTD data collected in the Southeastern Levantine is too sparse to resolve this question. In order to estimate the presence of anticyclonic circulation at a point where we have only CTD data, we calculate the degree of depression of the vertical profile of potential density in the layer deeper than 250m. We assume that the degree of the depression is proportional inversely to the second derivative from the vertical distribution of the potential density. Depression of the density profile is caused by downwelling resulting from near surface horizontal convergence in an anticyclonic circulation. Fig. 1 shows the locations of casts where depression of the density profile is significant. Most of the anticyclonic eddies are found in the region between Cyprus and Haifa. However stations with depressed profiles are also found southwestward and northwestward of this region. This picture supports the suggestion of Brenner [5] that antyclonic eddies are trapped by topographic effects. Density profiles with a high degree of depression are often adjacent with profiles typical of cyclonic activities (absence or low degree of depression). This suggests that the area between Cyprus and Haifa is not an area of weak anticyclonic circulation, but rather an area of general cyclonic circulation with the periodic generation of energetic anticyclonic eddies. Therefore the "Shikmona eddy generation area" would be a more appropriate name for this area instead of the commonly used "anticyclonic Shikmona Gyre".

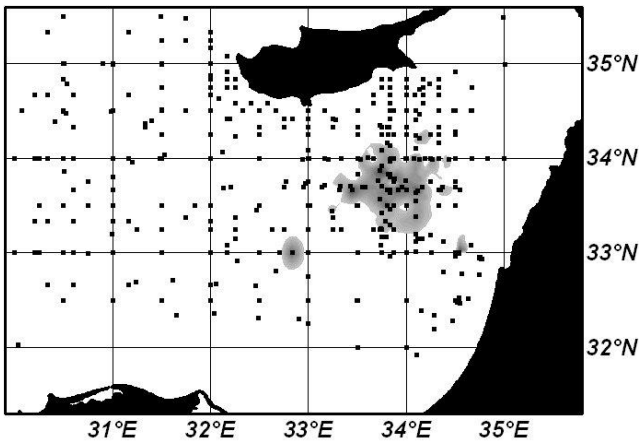

Fig. 1. Locations of casts with significant anticyclonic activity (shadowed) in the South Eastern Mediterranean.

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