THE WINTER CIRCULATION SYSTEM OF THE IZMIR BAY UNDER THE INFLUENCE OF WIND AND THERMOHALINE FORCES

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Abstract
The aim of the study is to examine seasonal circulation pattern of the Izmir Bay under the influence of wind and thermohaline forces. The general water movement characteristics in the Bay are given as a result of analysis of observed current data together with Killworth's general circulation model. The wind from north direction is constant feature. The model is forced using wind data obtained from the Çiğli Meteorological Centre. To set a realistic stratification, measured CTD data is prescribed in the model as initial condition. The wind stress constitutes the main forcing for rotational barotropic motions in the Izmir Bay.

Keywords: circulation pattern, spectra, Izmir Bay

Common oscillations

The current measurements between 1994 and 1998 have been performed by the Institute of Marine Sciences and Technology of Dokuz Eylül University with the R/V *K. Piri Reis*. The locations of current meters are shown in Figure 1. As a result of current and wind spectral analysis the frequencies belong to relevant processes are investigated. The corresponding frequencies can be analysed in four groups. First group has daily period (5 days) related to the large-scale cyclonic motion in the Aegean Sea. The second group is usually affected by sun and moon, includes diurnal and semi-diurnal tide's periods. The most important tides are diurnal-luni solar (K1), diurnal-principal solar (P1), semi-diurnal luni solar (K2) and semi-diurnal principal solar (S2). The third group considers the inertial oscillations and the last group is seiches. But last cannot be resolved by hourly collected data (1).

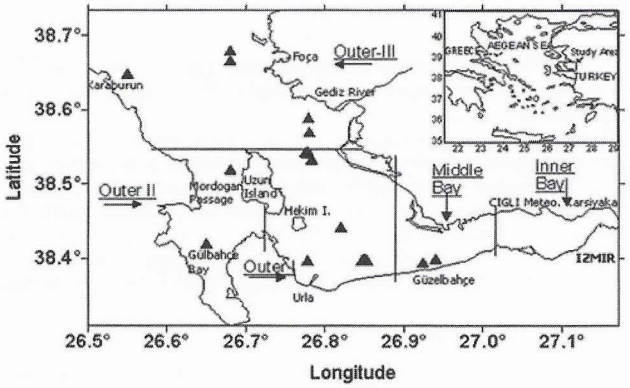

Fig. 1. The location of current meters

Winter current pattern

The circulation system of the Izmir Bay is determined mainly by three factors: the wind, the sea level changes due to the large-scale motion in the Aegean Sea and thermohaline forces. In summer, two-layer stratification occurs in the water column. This two-layer water is destroyed in winter as a result of convective and turbulent mixing. The circulation in the Izmir Bay is not only wind-driven, it is also density-driven especially in summer time, and the circulation due to sea level elevation is not negligible (4).

Model study: The Bay is very dynamic region according to the eddy activities. The generation of eddies are seen in Outer I and Outer III (Fig. 2). The reason of the formation of eddy (Middle Gyre) in Outer I is due to increasing depth to 55 m, so that relative vorticity tends to increase conserving absolute vorticity with an assumption of coriolis does not change in a short distance. The increasing coastal current due to wind-driven circulation enhances the vorticity in eddy generation areas. It is not always the case whole water from Aegean Sea enters Mordoğan Passage and tends to turn back. It causes also an increasing in vorticity in Outer III. The dominating feature of selected circulation pattern is cyclonic in winter and anti-cyclonic in summer. The eddies, that are formed in the entrance of Aegean Sea, in the middle of Bay and in the Inner Bay are very dynamics. The eddy formed in the Outer I propagate with a velocity 0.4 km/day to the North to combine with the Eddies in Outer III. Barotropic current pattern during January 1997 is two cyclonic eddy in the Outer Bay III. Their meridional diameters are about 17 km and 7 km respectively and the shape of eddies is more ellipse-like (5).

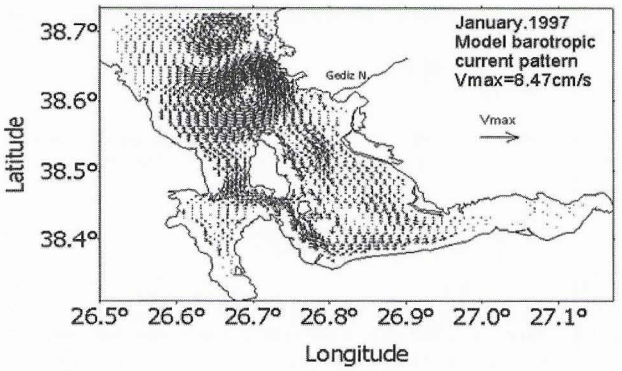

Fig. 2 . January 1997 curent pattern.

Eddies are mostly concentrated in the Outer I and II. The surface current enters the Bay near Foça and separates into two branches. One branch flows to the west and enters to the Mordoğan Passage near the west side of Uzun Island. The second branch flows near east of Uzun Island and combines with first one and together they flow towards Middle Bay. The maximum surface current is nearly 18 cms-1.

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