# BLACK SEA DYNAMICS AND ITS IMPACT ON PLANKTON COMMUNITIES

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**Abstract**
The peculiarities of interactions between the Black Sea basin- and mesoscale dynamics and their dependences on wind forcing and continental slope topography are considered on the base of the ship-borne, drifter, satellite data analysis and laboratory modeling results. It is shown that the dynamical regime of currents considerably affects the cross-basin exchange and the spatial distribution of plankton biomass.
*Keywords : Black Sea, Plankton, Deep Sea Processes.*

The Black Sea is a semi-enclosed basin with complicated ecological conditions, which are a result of its limited water exchange with the adjacent seas and enhanced contamination/eutrophication caused by river discharges, city and tourist resort wastes, oil and other pollution from intensive shipping and oil terminals. Most of the contamination/eutrophication comes from the shore and near-shore regions, and hence the horizontal exchange, which strongly depends on the Black Sea dynamics, should be important for the shelf zone self-purification and nutrient supply into the open basin.

The classical scheme of the Black Sea basin scale circulation includes the Rim current (RC) cyclonically flowing along the continental slope. Broad oceanographic application of satellite remote sensing revealed energetic mesoscale eddy-like structures that produce an effective cross-basin exchange (Fig 1) [1]. Although the satellite images give an idea on the mechanism of the horizontal mixing it is hardly possible to obtain its regular features by using the satellite data only.

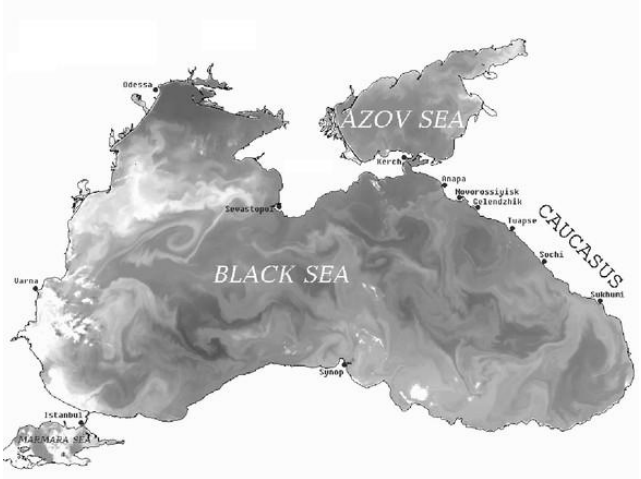


Fig. 1. The Black Sea mesoscale dynamic activity: AVHRR sea surface image (combination of channels 1 and 2) from NOAA-11 (23 June 1993 at 13:10 GMT). Light (dark) shades correspond to high (low) backscattering, consequently.

New quantitative information on basin- and mesoscale circulation and horizontal exchange processes in the Black Sea upper layer was obtained from the international drifter experiment. During 5 years (1999-2003), more than 50 SVP and SVPB Lagrangian satellite tracked drifters were deployed in different parts of the sea. Drifter trajectories indicated the general cyclonic circulation, the presence of RC and the existence of intensive mesoscale eddies (mostly anticyclonic) both over the continental slope and in the deep part of the sea. Using the drifter data an estimate of the horizontal eddy diffusivity was obtained and the timescale of the exchange between the central part and coastal zone of the sea was determined. The latter turned out to be 3-6 months that is nearly the same as a timescale of drifter round-trip in the RC. So it is reasonable to propose that the RC basin-scale advection and cross-basin exchange induced by mesoscale eddies are interrelated [2, 3].

Physical interrelations between the basin -and mesoscale water dynamics, cross-basin exchange and their dependences on wind forcing and bottom topography were studied with the help of field observations and laboratory modelling [4]. It was shown that in the northern-eastern Black Sea where continental slope is very narrow, the topographic control of RC is not strong. Position and stability of RC are governed by wind forcing (Ekman pumping). Under high positive Ekman pumping, RC is a coherent and strong jet located over the continental slope. In that case "shelf-deep sea" exchange is rather weak: coastal and deep waters are separated by the dynamical front. In the opposite case, RC becomes unstable, meandering and breaks up into eddies. Some of the eddies penetrate into the central basin producing strong lateral exchange. It should be pointed out that, due to variability of Ekman pumping, transition from jet-dominating regime of RC to the eddy-dominating regime occurs several times a year. In the north-western Black Sea with wide continental slope, both the RC and the mesoscale eddies should be topographically controlled.

In case of narrow shelf, the RC regime strongly affects the distribution of plankton species. Intense RC restricts cross-slope exchange and causes the uneven plankton distribution. The weakening RC is accompanied by intense cross-slope transport and causes more even plankton distribution [5]. Eddy-induced cross-slope transport affects the abundance and composition of benthos species (by removing the larva from shelf to deep sea).

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