

MESO-SCALE DYNAMICS OF THE BLACK SEA AND EXCHANGES WITH THE MEDITERRANEAN

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Abstract

The Black Sea Circulation is dominated by a coherent current system along its periphery, i.e. the 'rim' current, and meso-scale eddies and meandering motions superposed onto this basic pattern. The influence of buoyancy input into the northwestern shelf by major rivers, among which the Danube is the largest, contributes to the instabilities of the rim current, which transports the river inputs along the periphery of the western Black Sea. Another mechanism generating intense meandering is the interaction with the abrupt topography of the Sakarya canyon along the southwestern shelf area near the Bosphorus. Strong cross-shelf exchanges driven by these mechanisms redistribute the lateral fluxes originating from the major rivers and straits which contribute significantly to the budget of water, nutrients, organic and inorganic particulates and pollutants. A synthesis of the scales and signatures of these circulation features is made, based on oceanographic surveys and satellite data.

The two-layer flows through the Bosphorus determine the fluxes transported to the Black Sea by the 'Mediterranean effluent', and those exported out into the Marmara Sea. Estimates of the fluxes for a number of important properties are made, based on long-term measurements in the region.

Investigations of the spreading of the Mediterranean effluent into the Black Sea have shown a very particular pattern of boundary mixing. The Mediterranean water first spreads on the shelf and becomes diluted by entraining the overlying Cold Intermediate Water, then descends the continental slope, where it generates a pattern of intrusions and secondary circulations up to a depth of 500m, aided by the double diffusive ambient environment and the temperature-salinity anomalies of the sinking slope water. This in turn sets up a larger scale vertical circulation contributing to the interior mixing. The cross-shelf exchanges determine the domain of influence of the intrusions. The filaments of anomalous water thus spread horizontally into the interior carrying the fluxes various properties with them.