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Contribution of mesoscale eddies to Black Sea ventilation

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The shoaling of the Black Sea oxycline is one of the most urgent environmental issues in the Black Sea. The permanent oxycline derives directly from the Black Sea permanent stratification and has shoaled alarmingly in the last decades, due to a shifting balance between oxygen consumption and ventilation processes (Capet et al. 2016). The understanding of this balance is thus of the utmost importance and requires to quantify 1) the export of nutrients and organic materials from the shelf regions to the open sea and 2) the ventilation processes. These two processes being influenced by mesoscale features, it is critical to understand the role of the semi-permanent mesoscale structures in horizontal (center/periphery) and vertical (diapycnal and isopycnal) exchanges. A useful insight can be obtained by merging observations from satellite altimeter and in situ profilers (ARGO). In such composite analyses, eddies are first automatically identified and tracked from altimeter data (Mason et al. 2014, py-eddy-tracker). Vertical ARGO profiles are then expressed in terms of their position relative to eddy centers and radii. Derived statistics indicate how consistently mesoscale eddies alter the vertical structure, and provide a deeper understanding of the associated horizontal and vertical fluxes. However, this data-based approach is limited in the Black Sea due to the lower quality of gridded altimetric products in the vicinity of the coast, where semi-permanent mesoscale structures prevail. To complement the difficult analysis of this sparse dataset, a compositing methodology. is also applied to model outputs from the 5km GHER-BHAMBI Black Sea implementation (CMEMS BS-MFC). Characteristic biogeochemical anomalies associated with eddies in the model are analyzed per se, and compared to the observation-based analysis.

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