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Long-term regularities and disturbances of oxygen regime in the NW Black Sea coastal waters

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The paper presents temporal, seasonal and inter-annual variations of Dissolved Oxygen (DO) regime in the Romanian Black Sea coastal waters (Constanta area) based on measurements and samples collected daily, during 1959-2010, from a fixed near-shore station (sub-surface layer - bottom depth 1.5 m) and monthly/seasonally, during 1964-1980/1981-2010, from five stations (water column sampling with standard depths within 0-50 m) located on the transect East-Constanta (50 km length, bottom depths 16 m – 54 m), respectively.
The climatic factors controlling seawater thermal regime, discharge fluctuations of the Danube River and water masses mixing as well as biological processes are mainly responsible for DO temporal variability in the Romanian coastal waters. Seasonally, DO showed the highest concentrations in winter (maximum monthly mean - 490.9 μM in February 2007), strongly linked to low seawater temperature and intense mixing processes leading to well-oxygenated waters in the cold season. The lowest DO concentrations were measured in the warm season (minimum monthly mean - 186.4 μM in August 1998), when higher seawater thermal regime and oxygen consumption for the organic matter decomposition contribute to decreased values.
In terms of inter-annual variability, the highest winter DO concentrations (throughout the water column) were measured in cold and windy winters (maximum of 436.2 μM in 2003). Summer DO variation showed different patterns for the upper layers and bottom layers, respectively. In the surface layer, higher values (maximum - 387.2 μM in 1999) were measured in the years with larger summer discharges of the Danube River, which favor more intense photosynthetic processes due to increased nutrient stocks. In the bottom layers, DO showed lower values in the intense eutrophication period (1975 – 1988), when the seasonal cycle of primary production highlighted more pronounced summer maxima. Summers with higher seawater thermal regime showed lower DO concentrations in the bottom layers (minimum - 138.6 μM in 1986) due to stronger water stratification and increased intensities of oxidative decomposition of newly formed organic matter. The strength of these processes is responsible for the occurrence of hypoxic events in the coastal waters, but these phenomena are rather sporadic and are not a permanent feature of the Romanian coastal waters.
The authors present a series of graphs illustrating long-term aspects concerning the oxygen regime at the Romanian coast of the Black Sea.