

Decrease of the Black Sea Oxygen Inventory through the second half of the XXth century

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Abstract

We investigated the dynamics of the oxygen inventory and penetration depth in the Black Sea over the period 1955-2013 using CTD and ARGO profiles.

Several authors (e.g. Codispoti et al., 1991; Kononov and Murray, 2001; Stanev et al., 2013) have proposed that the upper interface of the suboxic layer has shoaled on a density scale during the last decades in answer to eutrophication. Those studies are based on the assumption that oxygen vertical properties are sufficiently stable, spatially and seasonally, when expressed on a density scale to permit representative interannual statistics.

We used the Data Interpolating Variational Analysis (DIVA) software and in particular the de-trending algorithm (Capet et al. 2014) to explicitly evaluate the spatial, seasonal and interannual variabilities of the total Oxygen vertical content and penetration depth (in depth and density scales).

The most striking result is the strong and quasi-motonomous decrease of the Black Sea total oxygen inventory which, in 2013, only amounts to 70% of what it was in 1955. The study also confirms a shoaling of the $[O_2]=20$ mmol/m³ iso-surface, on the order of 8m (0.06 kg/m³) per decades.

Profiles obtained from two Argo float (2010-2012) confirmed the present status of the properties obtained from CTD cast, and were used to assess the role of the Cold Intermediate Layer in ventilating the upper part of the Black Sea open basin. It effectively appears that the important dense water formation in the period 1985-1995 refrained the upper-mentioned trends and that the lower formation in 1995-2010 has contributed to their more recent increases.