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Recent evolution of the Black Sea Cold Intermediate Layer

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Within a depth range of 50-180m, the Black Sea presents a Cold Intermediate Layer (CIL) characterized by temperatures smaller than 8.35°C and density larger than 1014 kg/m3. This specific feature arise as the dense cold waters formed at surface in winter accumulate on top of the permanent halocline that separates the active oxic layer from the stagnant anoxic deep water mass. These cold waters can be formed west of the Crimean peninsula, in the northern part of the central basin, and in the convective zone located between the Rim current and the shelf (Stanev et al, 2003, Ivanov et al, 1997). Several studies have shown that the interannual variations of the total CIL volume can be large (several thousand km3, i.e. 0.5% of the total Black Sea water mass) in response to variability of atmospheric forcings. Capet et al. (2014) investigated the long term dynamics of the CIL and highlighted the integrative nature of its interannual variability as a response to atmospheric regimes.

Here, we explore the CIL formation dynamics and its variability for the period 1992-2015, using ARGO profiler data available for the last decade, as well as the coupled GHER hydrodynamic model (Capet et al, 2012, Vandenbulcke et al, 2010, 2016) and BAMHBI (BiogeochemicAl Model for Hypoxic and Benthic Influenced areas) model, with a horizontal resolution of 5 km. The BAMHBI biogeochemical model has been extensively validated for the period 1980-2008, and is presently used as the biogeochemical component of the CMEMS Black Sea operational forecasting system.

The coupled models are used to depict the role of the CIL dynamics in the Black Sea biogechemical cyclings, and to discuss the corresponding consequences of the severe decrease in CIL formation during recent years.