The use of CMEMS Black Sea Physical Reanalysis (1993-2019) to understand better the Black Sea variability

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The recently upgraded CMEMS product Black Sea Physical Reanalysis (BLKSEA_MULTIYEAR_PHY_007_004) covers the period 1993-2019 presenting a base for reliable long-term estimates on different aspects of the Black Sea physical processes. The data archive provides monthly and daily fields for the Black Sea basin including 3D variables (temperature, salinity, zonal and meridional velocity components) and 2D variables (mixed layer depth, bottom temperature and sea surface height).

The good spatial and temporal resolution of the reanalysis gives possibility to evaluate the trend and variability of the subsurface temperature and salinity, as well as the general circulation changes. In the last two decades significant tendency for warming is observed at the surface and in deeper layers, reaching down ~100 m depth. This trend is associated with a slight positive salinity trend seen down to ~200 m depth, which is present almost in the entire Black Sea except for the north-western shelf close to the Danube and Dnestr river delta. Both temperature and salinity show strong interannual variability.

The calculated Ocean Heat Content (OHC) in the Black Sea basin over the last ~30 year period suggests that the Black Sea water had experienced a general heating tendency after 2013. The increase of OHC is mostly due to the layer 0-200 m and the deeper layers are rather conservative in time. Nevertheless, the cold winter conditions in 2006, 2012 and 2017 led to significant surface water cooling and replenishment of the Cold Intermediate Layer.

The variation in the main dynamic feature of the basin, the Black Sea Rim current, is studied using the reanalysis data. It shows that the surface current speed varies within ~30% in the period 1993-2019 with a slight positive tendency. The main factor which triggers the inter-annual variability of the Rim current is found to be the atmospheric forcing. Comparison with the surface wind curl from the ERA5 reanalysis data shows significant correlation, predominantly positive (cyclonic) curl for both sea and atmosphere circulation and similar positive trend of the
wind/current speed. This proves that the Black Sea Rim Current could be considered a Sverdrup balanced flow and thus strongly related to the regional air circulation.