Altimeter and Argo float data assimilation in the Black Sea

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We analyse the thermo-haline characteristics in the Black Sea during the period 2002-2009 derived from numerical model simulations assimilating different observation data with the aim to improve the model skills. The Nucleus of European Modelling of the Ocean (NEMO) framework is used. In the experiment OI-1 we assimilate satellite altimetry and AVHRR data. In the experiment OI-2 we add also in-situ measurements from ARGO floats. Data assimilation uses the SESAM code and an optimal interpolation approach based on the static covariance matrix derived from the preliminary free model run, which converters the observations into basin temperature and salinity fields. Main attention in the analysis of simulations is been paid to the dominating characteristics of physical fields at seasonal and inter-annual time scales. Empirical orthogonal function (EOF) analysis of steric heights from simulations and their consistence with the ones from satellite altimetry is used to analyse the general characteristics in the thermo-haline signals. Results indicate that the free model run reproduces reasonably well the seasonal variability of Rim Current and the cold intermediate water mass formation. The assimilation of remote sensing observations only (OI-1) improves significantly the dynamics of steric heights, in particular as seen in the analysis of higher degree EOF-modes. However, in this experiment the simulation of profiles needs an improvement. This improvement is ensured by the assimilation of ARGO profiles in OI-2. However, because in the Black Sea ARGO measurements are sparse the benefit of their assimilation has to be considered carefully and is done by an objective analysis on model skills in the entire basin.