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A 30-year hindcast of the interconnected Eastern Mediterranean – Black Sea system: A first step towards climate projections for the Aegean Sea

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Long-term simulations of the circulation and hydrological conditions in regions adjacent to Straits connecting two oceanic basins appear to be highly sensitive to the simulated exchanges. This is especially crucial for climate studies, where the variability of the exchanges may exceed recorded or parameterized values; in such studies, a more suitable approach might be the extension of the numerical domain of the simulation to include both oceanic basins as well as the interconnecting Straits. In this study, the Eastern Mediterranean – Black Sea system is simulated for the historical period (1985-2015) using realistic boundary conditions (lateral, atmospheric and hydrological), with a hydrodynamic fully three-dimensional ocean modeling system (ROMS). The domain is comprised of the whole Mediterranean Sea east of Sardinia, the Sea of Marmara and the Black Sea. A variable cell-size curvilinear grid is used, permitting the high resolution simulation of the exchange in the Turkish Straits, at affordable numerical costs for the whole domain. Atmospheric forcing is provided by the ERA-interim reanalysis dataset, lateral boundary conditions at the western boundary by the Mediterranean Forecasting System (MFS), while inflow of major rivers is given by the HYPE hydrological model results. The simulation is validated in terms of realistic representation of the general circulation, water-mass properties, and volume exchanges between the two seas, while the variability of the above is assessed for the 30-year hindcast. Comparison of the results with published observational and modeling studies demonstrates that the 30-year integration without data assimilation exhibits a minimal drift, thus providing the confidence required for using the current configuration as a tool for future projections, useful in assessing the impact of various climate scenarios on the system, for similar time scales.