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An adjusted one year sea surface heat and water budget for the Northwestern Mediterranean basin

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The problem of heat and salt budget closure is an important subject in operational and research oceanography. The closure depends crucially on surface fluxes, as they are one of the most important processes in terms of the evolution of the heat and salt content in the oceanic top layers. However, in this problem, two points have to be considered. First, surface fluxes are affected by a variety of errors: those associated with the algorithms used for computing the turbulent fluxes, those due to the data used as input of bulk algorithms and the errors associated with the time and space resolution of the fluxes themselves. The second problem is that no surface flux dataset exists, that can be used as the truth, or as a reference, i.e. that can be used for closing observed heat and water budgets at various time and space scales.

Here we address the question of adjusting surface heat and water fluxes so that they are in agreement with the evolution of the thermal and salt contents deduced from the extended dataset collected during the HyMex campaigns. These experiments were conducted in the North-western Mediterranean basin in 2012 and 2013. The method is based: (1) on the one-dimensional column modelling of the experimental area, by solving specific temperature and salinity equations and (2) on the optimization of adjustable coefficients with a genetic algorithm. The surface forcings, calculated from a mix of satellite retrievals, in-situ data, numerical weather prediction model observables and a bulk algorithm are also adjusted with the genetic algorithm. Finally, the adjusted fluxes allows to simulate the domain average sea surface temperature and salinity with errors less than 0.2 percent (or 0.03°C) and 0.08 percent (or 0.03 psu) respectively over one year. The adjusted fluxes are finally compared with various NWP models over the North-western Mediterranean basin and also locally with fluxes estimated at a mooring site (LION buoy).