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A numerical study of the influence of vertical and horizontal dynamics on biogeochemical fluxes in the Mediterranean Sea

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One-dimensional numerical models are largely adopted to study biogeochemical fluxes in the sea. The major lack of these models is related to the absence of lateral dynamics. The introduction of horizontal fluxes can thus improve the accuracy of the numerical results. In this work we estimate the effects of horizontal advection and diffusion on the mediterranean pelagic ecosystem. In the framework of MFSTEP project we set up a 3D discretization of such a community dynamics by inserting a 0D multi-nutrient carbon-based biogeochemical flux model (BFM) into the optimized massively parallelized 1/8 degree OPA 8.1 Tracer model. The tracer model is coupled offline with the companion OGCM model OPA 8, driven by a "perpetual year" forcing. Key aspects of the model are the potential for limitation by macronutrients (nitrogen, phosphate and silicate), adjustable (i.e. non-redfilian) C:N:P:Si ratio into zooplankton and phytoplankton compartments, chlorophyll to carbon variable dependency. The forcing fields of the Tracer model are: 3D velocity, vertical eddy diffusivity coefficient, salinity, temperature, solar short wave radiation, and wind stress. The Mediterranean Sea has been divided in sub basins, with quasi homogeneous physical and biological characteristics. For each sub basins as well as for east and west sub basins, results of 0D, 1D and 3D simulations are compared, using statistical analysis, in order to evaluate temporal and vertical evolution of the key parameters. Variables adopted as comparison parameters are concentrations of principal functional compartments, aggregated values for trophic levels and principal rates as net primary production and bacterial production.