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Application of ROMS-AGRIF over Levantine and Cyprus Seas

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ROMS-AGRIF (Regional Ocean Model System, Adaptative Mesh Refinement In Fortran) is a free surface numerical ocean model that solves the primitive equation with the Boussinesq approximation with respect to hydrostatic vertical momentum balance. The model uses terrain-following vertical coordinates that allow differential stretching, within orthogonal, curvilinear, spherical horizontal coordinates. Equations are solved with short time steps for barotropic dynamic (ssh and 2D momentum) and a much larger time steps for baroclinic dynamic (T,S, 3D momentum) in a split explicit scheme. It uses rotated tensors to reduce diapycnal mixing and improved calculation of horizontal pressure gradient, following surface and bottom KPP turbulent closure model, thus obtaining high advection scheme. It uses adaptive mixed radiations/nudging open boundary conditions and it uses parallelization by two-dimensional subdomain partitioning, providing shared (OpenMP, as in our case) and distributed (MPI) parallelization. Also, it provides dynamic nesting capability with the AGRIF (Adaptive Grid Refinement in Fortran) library. It is an open source Fortran code coupled to several models including biogeochemistry, waves, sediments, bio-optical and sea ice. It offers great flexibility for configuration and is widely used by the scientific community for a diverse range of applications.

ROMS-AGRIF version 3.1.1,(2014), has been applied on Eastern Mediterranean and, specifically, for first time over the Levantine and Cyprus Seas, covering the area that is defined by the geographical coordinates, 30.05º E to 36.25º E longitude and 30.99º N to 36.96º N latitude. The model's horizontal resolution is approximately 5.5km x 4.6km (122 XI x 142 ETA cell points) with an internal nested grid of 1.8km over the area defined by longitude 33.03 E to 34.06 E and latitude 33.68 N to 34.44 N (62 XI x 56 ETA cell points), at 30 vertical, terrain following, s-levels The model is using initial and boundary conditions from Marine Copernicus Portal data and surface fluxes from NOAA Global Forecast System. The grid has been created based on EMODNET Bathymetry portal data (tile 241). All data used are free open source.

The model is running in operational prognostic mode, producing results every six hours, for a period of ten days, with daily averages included. Comparisons of the results with the CYCOFOS system (Cyprus Coastal Ocean Forecasting and Observing System) and with ARGOS float profiles shown compliance and very high accuracy.