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Performance Improvements of the CYCOFOS Flow Model

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The CYCOFOS-Cyprus Coastal Ocean Forecasting and Observing System has been operational since early 2002, providing daily sea current, temperature, salinity and sea level forecasting data for the next 4 and 10 days to end-users in the Levantine Basin, necessary for operational application in marine safety, particularly concerning oil spills and floating objects predictions. CYCOFOS flow model, similar to most of the coastal and sub-regional operational hydrodynamic forecasting systems of the MONGOOS-Mediterranean Oceanographic Network for Global Ocean Observing System is based on the POM-Princeton Ocean Model. CYCOFOS is nested with the MyOcean Mediterranean regional forecasting data and with SKIRON and ECMWF for surface forcing. The increasing demand for higher and higher resolution data to meet coastal and offshore downstream applications motivated the parallelization of the CYCOFOS POM model. This development was carried out in the frame of the IPcycofos project, funded by the Cyprus Research Promotion Foundation. The parallel processing provides a viable solution to satisfy these demands without sacrificing accuracy or omitting any physical phenomena. Prior to IPcycofos project, there are been several attempts to parallelise the POM, as for example the MP-POM. The existing parallel code models rely on the use of specific outdated hardware architectures and associated software. The objective of the IPcycofos project is to produce an operational parallel version of the CYCOFOS POM code that can replicate the results of the serial version of the POM code used in CYCOFOS. The parallelization of the CYCOFOS POM model use Message Passing Interface-MPI, implemented on commodity computing clusters running open source software and not depending on any specialized vendor hardware. The parallel CYCOFOS POM code constructed in a modular fashion, allowing a fast re-locatable downscaled implementation. The MPI takes advantage of the Cartesian nature of the POM mesh, and use the built-in functionality of MPI routines to split the mesh, using a weighting scheme, along longitude and latitude among the processors. Each server processor work on the model based on domain decomposition techniques. The new parallel CYCOFOS POM code has been benchmarked against the serial POM version of CYCOFOS for speed, accuracy, and resolution and the results are more than satisfactory. With a higher resolution CYCOFOS Levantine model domain the forecasts need much less time than the serial CYCOFOS POM coarser version, both with identical accuracy.