Geophysical Research Abstracts
Vol. 14, EGU2012-13144-1, 2012
EGU General Assembly 2012

On Improving the Operational Performance of the Cyprus Coastal Ocean Forecasting System

H. Radhakrishnan (1), I. Moulitsas (2), D. Hayes (3), G. Zodiatis (3), and G. Georgiou (3)

(1) EXA High Performance Computing Ltd., Nicosia, Cyprus (hari@exahpc.com), (2) The Cyprus Institute, Nicosia, Cyprus, (3) Oceanography Center, University of Cyprus, Nicosia, Cyprus

Modeling oceans is computationally expensive. Rising demands for speedier and higher resolution forecasts, better estimations of prediction uncertainty, and need for additional modules further increase the costs of computation. Parallel processing provides a viable solution to satisfy these demands without sacrificing accuracy or omitting any physical phenomena. Our objective is to develop and implement a parallel version of Cyprus Coastal Ocean Forecasting and Observing System (CYCOFOS) hydrodynamic model for the Eastern Mediterranean Levantine Sea using Message Passing Interface (MPI) that runs on commodity computing clusters running open source software. The parallel software is constructed in a modular fashion to make it easy to integrate end-user applications in the future. Parallelizing CYCOFOS also enables us to run multiple simulations using different parameters, and initial and boundary conditions to improve the accuracy of the model forecasts, and reduce uncertainty.

The Cyprus Coastal Ocean Forecasting and Observing System (CYCOFOS) was developed within the broad frame of EuroGOOS (European GOOS) and MedGOOS (Mediterranean GOOS), to provide operational oceanographic forecast and monitoring on local and sub-regional scales in the Eastern Mediterranean Basin. The system has been operational since early 2002, consists of several forecasting, observing, and end-user modules, and has been enriched and improved in recent years. The system provides daily forecasting data to end-users, necessary for operational application in marine safety, such as the Mediterranean oil spill and trajectory modeling system. Like many coastal and sub-regional operational hydrodynamic forecasting systems in the Mediterranean, CYCOFOS is based on the Princeton Ocean Model (POM).

There have been a number of attempts to parallelize the Princeton Ocean Model, on which the CYCOFOS is based, such as MP-POM. However, existing parallel code models rely on the use of specific outdated hardware architectures and associated software. Additionally, all reported works seem to be one-off attempts with no further development, the emphasis being given to the high performance computing aspect rather than to accurate ocean forecasting and end-user applications. The goal of producing a distributed memory parallel version of POM based on the Message Passing Interface (MPI) paradigm is done in three stages producing three versions of the code.

In the first version, we take advantage of the Cartesian nature of the POM mesh, and use the built-in functionality of MPI routines to split the mesh uniformly along longitude and latitude among the processors. This version is the least efficient version because the processors whose meshes contain a lot of land regions will have a lower computational load. Therefore the overall computational load balance is poor and significant portion of the time is spent idling. The objective of this version is to produce a parallel version of the code that can replicate the results of the serial version of the POM code used in CYCOFOS for validation and verification purposes

Results from the first parallel version of CYCOFOS will be presented during the conference, and speedup will be discussed. We will also present our parallelization strategies for the second and third versions which will improve the load balancing and speedup by using a weighted distribution of the grids among the processors.