OCEAN FORECASTING IN THE EASTERN MEDITERRANEAN, THE ALERMO SYSTEM

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Abstract
The ALERMO ocean forecasting system was implemented and developed in the framework of the Mediterranean Forecasting System and provides five days of ocean circulation forecasting in the Eastern Mediterranean Sea on a weekly basis. New features and innovative coupling techniques have been incorporated in the forecasting system. The system reliably simulates the evolution of the main circulation features in the domain compared with available observations. Extensive validation and sensitivity experiments are carried out to investigate the forecasting skill as well as the effects of different initialisation and coupling procedures.
Keywords : Aegean Sea, Levantine Basin, Models.

Introduction
During the last decades progress in several scientific and technical aspects of physical oceanography enabled the evolution of ocean forecasting activities for operational needs. In the Mediterranean Sea such operational activities in different countries were integrated in the framework of research projects (e.g. Mediterranean Forecasting System - MFS) or operational networks (e.g. Mediterranean Operational Oceanography Network - MOON). In the present work the ALERMO (Aegean Levantine Eddy Resolving Model) ocean forecasting system implemented in the framework of MFS is presented. MFS demonstrated the feasibility of reliable near real time 5-days forecasts at regional/shelf scale in the Mediterranean Sea, through a network of 15 models at various scales, related to the MFS observational network through assimilation. The network performs five-day forecasts on a daily basis as well as additional experiments for optimisation of the implementation and coupling procedures.

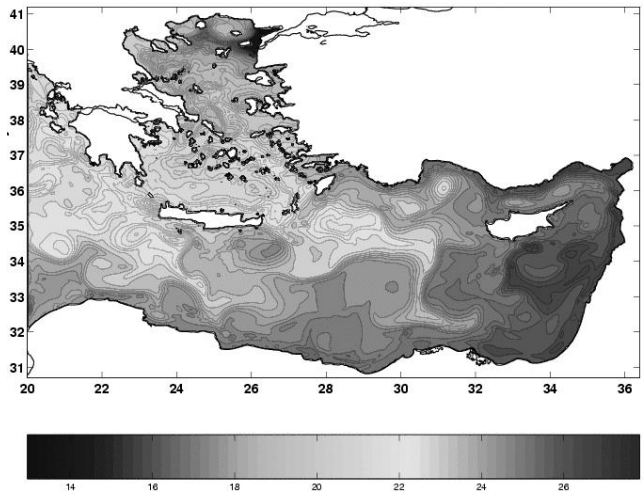

Fig. 1. ALERMO domain and sea surface temperature forecast field

Modelling System
The ALERMO model is based on the Princeton Ocean Model [1], covering the geographical area 20°E - 36.4°E, 30.7°N - 41.2°N and has one open boundary at 20° E (Fig. 1). The computational grid has a horizontal resolution of 1/30°and 25 sigma levels in vertical with a logarithmic distribution near the sea surface. The Dardanelles exchange is treated as an open boundary and a real freshwater flux boundary condition is applied at the surface. The one-way nesting with the Mediterranean OGCM is applied along the western boundary. The coupling between the ALERMO and the SKIRON/Eta atmospheric model with 1°/10 resolution [2] is designed in such a way to allow one-way feedback ocean-atmosphere mechanisms to take place. The ALERMO model is initialized from the Mediterranean OGCM using the Variational Initialization (VI) method [3]. The initialization including the tangent linear of the POM model were successfully implemented and configured in ALERMO (Fig. 2). The 5-day forecast fields are made available to the public on the web (http://www.oc.phys.uoa.gr) and are provided to 5 shelf models, nested in the ALERMO system.

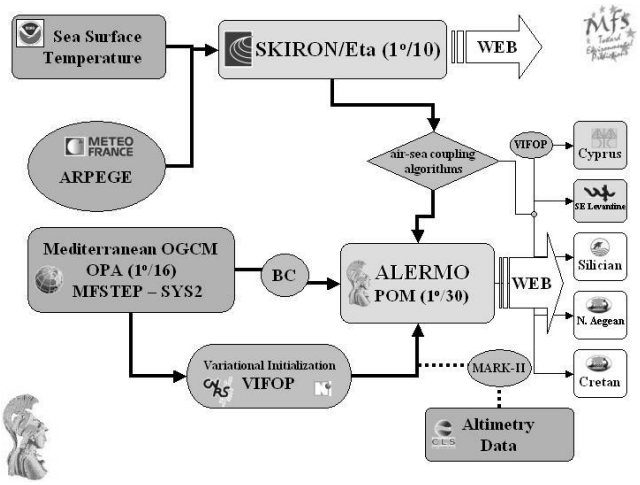

Fig. 2. The ALERMO operational system flowchart

Results
From the beginning of September 2004 onward the MFS-ALERMO system provides a 5-days forecast (on a weekly basis in the initial phase and later on a daily basis). ALERMO reliably simulates the evolution of the main circulation features in the domain such as the Mersa-Matruh anticyclone, the Asia Minor Current, the Ierapetra anticyclone and the Rhodes cyclonic circulation. Results also put in evidence a large number of fine circulation features and vortices in the Aegean and Levantine basins in agreement with satellite SST data. For the first 2-3 forecast days, results of both Mediterranean OGCM and ALERMO are almost identical in the interior of the domain, with the higher-resolution ALERMO model producing more fine-structure flows in the coastal/shelf areas and near islands. In the last 1-2 forecasting days one may observe significant changes in the coastal areas such as a flow reversal in the ALERMO model near the Levantine coasts. Additional experiments with very high-resolution forcing (5 km), different initialisation procedures, and introduction of assimilation in ALERMO reveal interesting aspects of the forecasting activities. A thorough validation of the system is carried out in order to quantify the system's reliability and define tuning adjustments.

References

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