MEDITERRANEAN ECOSYSTEM MODELLING: WHERE ARE WE GOING TO?

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Abstract
In recent years many Mediterranean ecosystem models have been published, but they were basically local of process-oriented. Now the Mediterranean modelling community is moving towards more challenging goals that both science and society are asking for. The new frontiers for ecosystem modelling set by operational oceanography include short term forecast and long term simulations. An overview of state-of -the-art and future perspectives on these fields is presented in the light of ongoing projects and strategic guidelines for marine research.
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Mediterranean Sea is an ideal basin to implement (and to challenge) pelagic ecosystem models because of its physiography, the presence of key oceanic processes, the variety of habitats and living communities. In the past, a number of articles on Mediterranean ecosystem models have been published but they used largely one-dimensional, sub-regional or process- oriented models. Now the Mediterranean community seems ready to respond to the request of environmental information for policy makers, the monitoring and prediction of environmental and climate changes.

In operational oceanography, GMES (Global Monitoring for Environment and Security), a partnership of the European Commission and the European Space Agency, asks for the demonstration of short term forecast of marine ecosystems to monitoring the environment, preventing and managing natural or industrial catastrophes. EU-funded Integrated Projects MFS (Mediterranean Forecasting System) and now MERSEA (http://www.mersea.eu.org/) and ECOOP develop and coordinate a sustainable pan-European system that include the prediction of biogeochemical and ecosystem parameters for some European regional seas including the Mediterranean. This philosophy include a nesting strategy in order to downscale the resolution and biological detail in selected coastal areas where the major practical applications are present. In this context, a demonstration of short term forecast is going to be produced using an innovative off-line coupling between INGV OPA 16° resolution operational forecasting system for Med Sea (http://www.bo.ingv.it/mfs/) and OGS/OPA transport module embedding the Biogeochemical Flux Model (http://www.bo.ingv.it/bfm/) [1]. This approach exploits the benefits of state-of-the-art dynamical prognosis including extensive data assimilation up-scaled to lower horizontal spatial resolution (1/16° to 1/8°) to keep off-line dynamics files and computational load at affordable level for the forecast. The OGS/OPA transport model does not include at the moment any direct data assimilation techniques already applied in experimental way in some Mediterranean simulations [2, 3]. Instead, the spatial estimates for the diffusive absorption coefficient obtained from SeaWiFS 490nm band is going to be implemented.

Further developments in data assimilation for biological variables are expected in the near future and will be the basis for a better integration and exploitation of the information coming from satellite sensors in the visible band.

Since large part of biogeochemical modules presently are run in data-free conditions, they have the potential to be applied also in a long term integration for hindcasting and for scenario analyses under different forcing and anthropic pressure. SESAME, an EU FP VI co-financed project started in November 2006, has as general scientific objective to assess and predict changes in Mediterranean ecosystem through extensive usage of mathematical modelling in order to provide ecosystem key variables for the assessment of climatic impact on key goods and services provided by the Mediterranean. The proposed numerical design includes again decadal hindcasts and scenarios for the whole Mediterranean using similar numerical tools as those used for the short term forecasts, or set up during MFS in a nesting structure. IPCC scenario A1B will be used for testing the biogeochemical cycles modifications with full 3D biogeochemical models with different resolution, physical modules and domains. The improvement in model complexity and parametrization will be beneficial also for the short term forecast applications.

Regarding the assessment of the predicting capabilities, even the most advanced biogeochemical forcasting systems have often low skill score. Ecosystem models are still in their infancy and their uncertainties are higher than physical variables and care must be taken not to release products prematurely, before full confidence can be stated.

References

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