THE MEDITERRANEAN SEA ECOSYSTEM DYNAMICS: HINDCAST AND SCENARIO SIMULATIONS

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Abstract
High resolution (1/16 degree) simulations of the interannually varying Mediterranean sea ecosystem dynamics are presented and discussed. The modelling system used is constituted by the on-line coupling of the BFM (Biogeochemical flux model) and NEMO (Nucleus for European Modelling of the Ocean). Hindcast for the period (1996-2000) were performed using two different sets of forcing functions: the ERA40 and the results of the ENSEMBLE atmospheric model coupling with the IPCC scenario of Co2 emission A1B. The main aim is to compare the influence that the use of different forcing functions might have on governing the ecosystem dynamics.
Keywords: Models, Circulation Models

Introduction

In the framewok of the EU FP6 Project SESAME (Southern European Seas: Assessing and Modelling Ecosystem changes) project, we performed a set of hindcast and scenario numerical simulations of the coupled ecosystem dynamics of the Mediterranean Sea. The atmospheric forcing functions used for the 1970-2000 hindcast simulations are derived from the ECMWF reanalyses (ERA40), while for the scenario (2070-2100) simulations the forcing functions are computed from atmospheric data originating from the numerical silulation of the global atmosphere carried out under the A1B IPCC scenario of greenhouse gas emission. The aim of the work is to study the impact of "green hous effect" related global change on the Mediterranean Sea ecosystem . The simulation performed for the periods 1970-2000 (hindcast), 2070-2100 (scenarios predictions).

Model

The used modelling system is based on the on-line coupling of a biogeochemical and a general circulation model.

The circulation model is NEMO (Nucleus for European Modelling of the Ocean)-OPA(Ocean PArallelise) version 9.0 [1] primitive equation model implemented in the Mediterranean Sea with an horizontal resolution of 1/16 degree (approsimatevely 7 km) and a vertical resolutionof 72 unevenly spaced vertical z-level.

The ecological model used in ths work is the BFM (Biogeochemical Flux Model) [2-3]. This model is an evolution of ERSEM (European regional sea ecosystem model) [4]. It is a generalized biogeochemistry model based on a biomass-based continuum description of lower trophic levels in the marine environment.

The initial conditions for nutrients and oxygen derived form SEADATANET project (http://www.seadatanet.org) merged with World Ocean Atlas climatology in the Atlantic box. In other hand, the initial conditions for biology are homogeneous guessstimates with vertically-distribuited analytical profiles.

Numerical simulations have been carried out oh a high performance parallel computer.

Results and conclusions

We focused on the temporal evolution of chemical and biological variables. In particular, we compared the monthly averaged numerical results of sea surface Chlorophill-a concentration (Fig.1) derived by simulation forced by ERA40 and satellite data.

The numerical results (Fig.1) show an overall tendency to overstimate phytoplancton biomass. The model is able to reproduce the interannual variability of Chlorophyll surface data. In particular, the relatively high march biomass in the Gulf of Lions and in the Sicily channel detected by the satellite are captured by the model, but with a positive bias particularly strong in the Sicily channel.

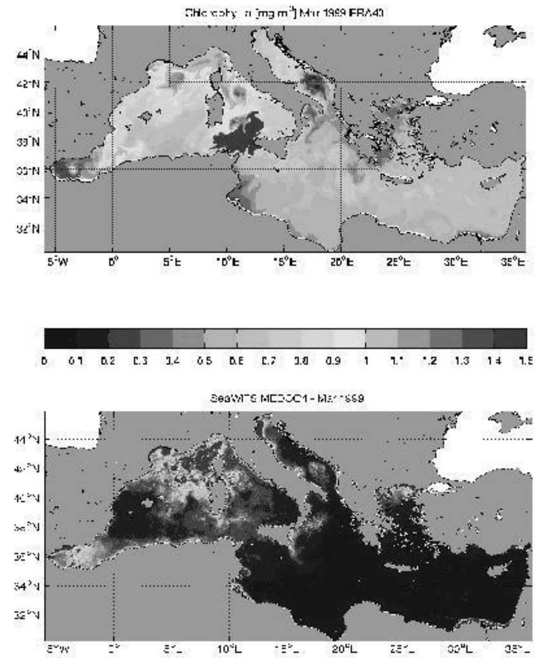

Fig. 1. Chlorophyll-a monthly mean concentration simulated by the model forced by ERA40 (up) and provided by SeaWifs (down) for March 1999

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