SIMULATING THE INTERANNUAL VARIABILITY OF THE ADRIATIC SEA ECOSYSTEM DYNAMICS

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Abstract
The Adriatic Sea ecosystem dynamics has been simulated, under high frequency, interannually varying, surface forcing, with a coupled physical/biogeochemical modelling system composed by the Princeton Ocean Model (POM) and the Biogeochemical Fluxes Model (BFM). The high frequency forcing for the modelling system is from operational atmospheric circulation analyses. The preliminary simulations results relative to both the general circulation and the biogeochemical processes are assessed by comparing them with available and remotely sensed data. Particular emphasis is put on the analysis of the biogeochemical processes variability induced by the strongly inter-annually varying circulation dynamics (current systems, dense water formation etc.) and by the variability in the Po river freshwater and nutrient forcing.
Keywords: Models, Coastal Models, Adriatic Sea

Introduction
The Adriatic Sea ecosystem is characterised by a strong spatial and temporal variability ([1] and [2]) due to the atmospheric forcing functions, the circulation patterns, the fresh water river runoff that strongly affects spatial and temporal variability and distribution of biogeochemical properties in the northern Adriatic Sea [3].

The objective of this research is to simulate with a three-dimensional coupled numerical model the Adriatic Sea ecosystem dynamics under high resolution and high frequency, interannually varying, surface forcing conditions; to analyse numerical results in terms of Nutrients, Chlorophyll, Primary and Bacterial production variability.

Model
The three-dimensional ecosystem numerical model used is a coupled hydrodynamic/ biogeochemical model.
The circulation model is the Princeton Ocean Model (POM), a three-dimensional, primitive equation, time-dependent, sigma-coordinate, free surface, estuarine and coastal ocean circulation model [4].

The ecological model used in this research is the Biogeochemical Flux Model (BFM) [5]. The model describes physiological and population processes of lower trophic levels in the marine environment. Biota is described by means of three main functional groups: producers, decomposers and consumers, each one defined by internal constituents: Carbon, Nitrogen, Phosphorous, Oxigen and Silicon (in the case of diatoms).

The model has been implemented in the Adriatic Sea basin with a grid resolution of about 2.5 km in horizontal direction and 27 sigma vertical levels with a logarithmic distribution near the surface and the bottom; the minimum depth resolved is 10 m. The model is free surface with time step splitting: the two-dimensional external mode has a 5 sec. time step, while the three-dimensional internal mode has a 500 sec. time step.

Results and conclusions
Simulation results derived from a fully three-dimensional, coupled physical-biogeochemical model implemented in the Adriatic Sea are analysed including Nutrients, Chlorophyll, Primary and Bacterial production. In particular, the monthly averaged numerical results of sea surface Chlorophyll-a concentration are compared with satellite remote sensing data derived from the MERSEA dataset.

The numerical results (Fig. 1) qualitatively agree with the main ecosystem dynamics of the Adriatic Sea. In particular the model is able to represent the high Chlorophyll-a concentration in the northern and western sides of the Adriatic Sea and its decrease towards southern and deeper areas. The seasonal Chlorophyll variability is also qualitatively modelled in comparison with SeaWifs data.

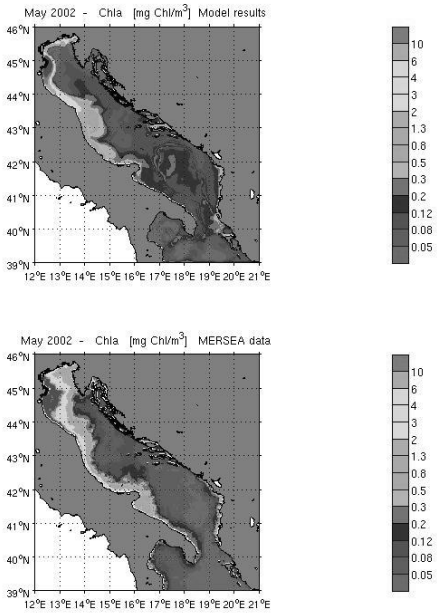

Fig. 1. Chlorophyll-a monthly mean concentration simulated by the model (up) and provided by MERSEA dataset (down) for May 2002.

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