Nitrogen budget in the Eastern Mediterrenean Sea: results from a coupled 3D hydrodynamic-biological model

Renzo MOSETTI, Guido CRISPI and Alessandro CRISE

Osservatorio Geofisico Sperimentale, TRIESTE (**Italia**)

The principal goal of the POEM 2 project is the interaction of the bio-geochemical cycles with the physical processes in the Mediterranean Sea. For this purpose a model was implemented, (CRISE *et al.*, 1992). Coupling the previously developed hydrodynamics (MALANOTTE-RIZZOLI and BERGAMASCO, 1989; PINARDI and NAVARRA, 1992) with a trophic model. In particular, the aim of this work is the discussion of the results of a numerical experiment devoted to the simulation of a simplified conservative nitrogen cycle. For this simulation, the Eastern Mediterranean is a well suited testbed because of the lack of significant nutrient sources and the Gibraltar effects have little influence on the eastern basins. Our model encompasses the whole Mediterranean and is based on a Bryan and Cox primitive equation eddy resolving moclel with a 1/4 degree spatial resolution and 16 levels in the vertical coordinate. This model is forced by monthly Hellermann wind stresses and is initialized by the Levitus climatological T-S data.

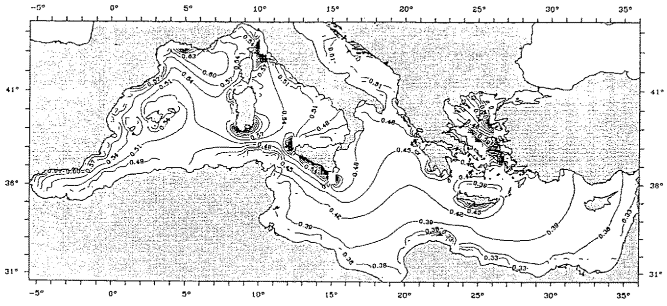

Fig . 1.- Nutrient distribution (*mg at N/m*3) at 50 meter depth in April

The biological model takes into account non-passive advection-diffusion of nitrogen, phytoplankcton and detritus on the same spatial grid of the hydrodynamic part, giving a good horizontal resolution. The considered limiting factors for phytoplancton growth are nitrogen concentration, downward irradiance and temperature. Climatic data arc used to initialize the biochemical fields; the daily irradiance and photoperiod are used as forcing terms for the biochemical model whereas the temperature and the advection evolve according to the hydrodynamic model.

The numerical results show a low nutrient concentration in the upper layer with an increasing concentration through the depth. The minimum is found in the Eastern Mediterranean while higher values appear in convergence areas, in good agreement with the known phenomenology. A snapshot of the model regarding nutrients is shown in fig. 1. An evaluation of nitrogen annual fluxes for Sicily Channel is estimated and comparisons with the figures given by BETHOUX (1981) are given.

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An Application of 'AQUAMOD' Trophic Model to the Marine Ecosystem along the Emilia-Romagna Coastal Region in the Adriatic Sea

Renzo MOSETTI, Mario LAGONEGRO*, Vincenzo ZUCCARELLO* and Enrico FEOLI*

Osservatorio Geofisico Sperimentale, TRIESTE (**Italia**)
*Dipartimento di Biologia dell'Universita' degli Studi di TRIESTE (**Italia**)

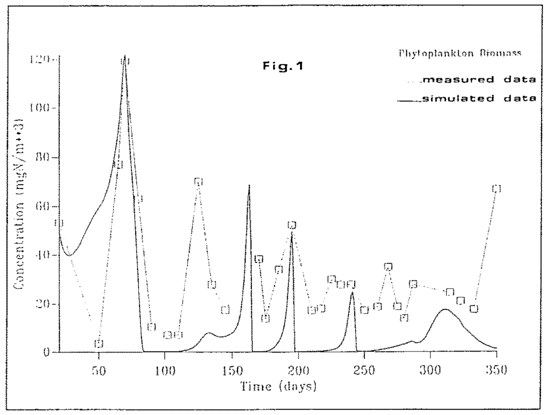
The trophic model 'AQUAMOD' (HULL and LAGONEGRO, 1988; LAGONEGRO *et al.*, 1991) has been applied for the first time to a coastal marine ecosystem. This model is able to simulate the dynamics of micro and macro-algae, macrophytes and zooplankton, giving also the fluxes of nutrients, oxygen, dissolved and particulate dead matter and sediments. The phytoplankton growth is limited by nutrient's concentrations, temperature and light.

By means of the existing data collected in the coastal sea of the Emilia Romagna Region, three groups of phytospecies (winter, spring-autumn and summer groups) have been taken into account in the model's equations. Two zooplankton species have also been introduced into the model: the first for describing the winter grazing, the second for the summer one.

The nutrient's concentrations and water temperature have been assigned through the measured data.

The model simulates the time evolution of the phytoplankton species and the zooplankton ones. The results have been compared with the measured values of chlorophyll *a*. Good correlations have been obtained between measured and simulated data.

In Fig. 1 the results of the simulation concerning the data collected at a station near Cattolica are reported.



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