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Simulating the interannual variability of the Adriatic Sea ecosystem

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The Adriatic Sea ecosystem is characterised by a strong spatial and temporal variability due to the atmospheric forcing functions, the circulation patterns, the fresh water river runoff that strongly affect spatial and temporal variability and distribution of biogeochemical properties in the northern Adriatic Sea.
The objectives of this research are: to perform numerical simulations of the Adriatic Sea ecosystem dynamics with a three-dimensional coupled physical/biogeochemical modelling system; to carry out a long numerical experiment (starting year is 1980) 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. Particular emphasis is put on the analysis of the biogeochemical processes variability induced by the strongly interannually varying circulation dynamics (current systems, dense water formation etc.) and by the variability in the Po river freshwater and nutrient forcing.
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.
The ecological model used in this research is the Biogeochemical Flux Model (BFM) that 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, Oxygen and Silicon (in the case of diatoms).
The model has been implemented in the Adriatic Sea basin with a grid resolution of about 2 kms in horizontal direction and 27 sigma vertical levels.
The high frequency forcing for the modelling system is from operational atmospheric circulation analyses. Observed daily Po river runoff and monthly averages derived from an hydrological model (data from SESAME project) for all the other Adriatic rivers are used to force the model. River nutrient inputs are derived by a global model calibrated by using measured data (from SESAME project).
The analysis of the long time serie numerical simulation resulting from the modelling system implemented in the Adriatic Sea shows that the numerical results agree with the main physical (salinity, temperature and velocity fields) and biogeochemical dynamics of the Adriatic Sea. In particular, the model represents the spatial variability of the chlorophyll concentrations (with higher values in the North-West coastal area that decrease in the Southern and deeper areas) and the seasonal and interannual temporal variability.