Geophysical Research Abstracts
Vol. 17, EGU2015-3017-1, 2015
EGU General Assembly 2015

Study of the plankton ecosystem variability using a coupled hydrodynamics biogeochemical modelling in the Mediterranean Sea

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The Mediterranean Sea presents a wide variety of trophic regimes since the large and intense spring bloom of the North-Western Mediterranean Sea (NWMS) that follows winter convection to the extreme oligotrophic regions of the South-eastern basin. The Mediterranean Sea displays a strong time variability revealing its high sensitivity to climate and anthropic pressures. In this context, it is crucial to develop tools allowing to understand the evolution of the Mediterranean hydrology and marine ecosystem as a response to external forcing. Numerical coupled hydrodynamic and biogeochemical modelling carefully calibrated in the different regions of the basin is the only tool that can answer this question. However, this important step of calibration is particularly difficult because of the lack of coherent sets of data describing the seasonal evolution of the main parameters characterizing the physical and biogeochemical environment in the different sub-basins.
The chlorophyll satellite data from 4km MODIS products, a multiple in situ data from MerMEX MOOSE and DEWEX cruises and Bio-Argo floats from NAOS project are believed to be an opportunity to strongly improve the realism of ecosystem models.
The model is a 3D coupled simulation using NemoMed12 for hydrodynamics and ECO 3MS for biogeochemistry and covers the whole Mediterranean Sea and runs at 1/12°. The relevant variables mentioned are phytoplankton, organic and inorganic matters faced to water masses dynamics, over ten years since summer 2003.
After a short validation, we will expose two topics:
First, through this coupling we quantify the nutrients fluxes across the Mediterranean straits over the years. For example, we found an annual net average around 150 Giga moles NO_3 per year at Gibraltar, where we expect low annual fluctuations. In contrast, the Strait of Sicily shows greater annual variability going from 70 to 92 Giga moles NO_3 per year. All the fluxes are resumed in a detailed diagram of the transport for organic matters and the nutrients.
Second, we described for each basin the particularities with evoking the main dynamics and biogeochemical aspects affecting primary production and export of particulate carbon outside the photic zone.