IMPACT OF HYDRODYNAMIC CHANGES ON MEDITERRANEAN BIOGEOCHEMICAL BUDGETS (WP1 OF THE MERMEX PROJECT)

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Abstract
The objectives of the MERMEX project focus on the understanding of the ecosystems response to likely changes in physical, chemical and socio-economical forcing induced by global change and by growing anthropogenic pressure. The objectives of MERMEX workpackage 1 are (i) to assess the budget of nutrients and of some contaminants, (ii) to understand their past and future evolution, and (iii) to understand the specific stoichiometry of inorganic and organic matter in the Mediterranean Sea.
Keywords: Geochemical Cycles, Nutrients, Western Mediterranean

The questions addressed by the workpackage 1 of MERMEX concern the evolution of biogenic elements and contaminants in the Mediterranean in relation with specific characteristics:
- a marked limitation of primary production by phosphorus,
- budgets of nitrogen and silica showing a deficit but based on non synoptic and sparse data,
- an increasing trend for phosphate and nitrate concentrations in deep water mainly in the western basin,
- an increase of anthropogenic input,
- a recent evolution of the stoichiometry of these imputs.

The strategy chosen to deal with this question is double: first, to establish budgets of nutrients and second, to understand their past and future evolution. This "budget" approach is complexified by the contrasted functioning of the different regions of the Mediterranean, from mesotrophy to ultra oligotrophy. It was then decided to divide the Med Sea in group of regions characterized by similar trophic regimes and to study for each regime a representative region of the group. The approach then consists to do a budget of standing crops of C, N, P in their mineral / organic, dissolved/particulate forms and to characterize their primary fluxes. These informations will then be used to calibrate and validate numerical models which are the only way to integrate the complex interactions between hydrodynamical, and bio-geochemical processes. Following the classification of [1], four typical trophic regimes have been identified: - the regions marked by a bloom in late winter-early spring months, - the "intermittently blooming"zones with erratic regimes alterning intense biomass accumulation and oligotrophic conditions, - the oligotrophic regions with higher and quite constant biomasses in fall-winter and lower and uniform values in late spring-summer, - the coastal regions characterized by a high biomass in winter and a more reduced biomass in spring.

In a first time, we want to implement our strategy on the northwestern Mediterranean representative of the first trophic regime cited above. This region is characterized by a pronounced spring bloom associated to upward transport of intermediate or deep water rich in nutrients. The HYMEREX experiment at the heart of our strategy will be based on three cruises in fall 2012, spring 2013 and fall 2013. These field cruises will be carried out in collaboration with the Hymex program, to have a synoptic view of the meteorological and hydrodynamical conditions in the whole area. Our aim is to reduce the uncertainties on the air-sea fluxes and on the volume and characteristics of dense water formed during winter each year, including the impact on the stocks, composition and quality of organic and mineral matter. For each of these cruises, an array of 280 stations will be visited in less than 35 days (figure 1) at which stocks of nutrients, organic matter, contaminants, biogenic fluxes (production mineralization) will be measured as well as temperature and salinity and meteorological fluxes. Biodiversity will also be considered. The modelling will be initialized from the first array. The boundary conditions will be constrained as often as possible by regular glider lines, and information from autonomous profilers and mooring lines. Specific experiments concerning key biological fluxes (hyperbaric bacterial production, grazing, …) not in accordance with a high frequency sampling strategy will be carried out in the same time on a second ship devoted to processes studies. Besides this experiment that should allow to improve our hydrodynamic and biogeochemical models, a long-term monitoring of the biogenic elements will be done by the MOOSE project with time series at fixed points, mooring lines, ARGO profilers and gliders equipped with bio sensors allowing to efficiently sample the water column. Finally, we hope to establish dialogue and collaboration with our colleagues of the different countries of the Mediterranean to have similar actions in other typical regions.

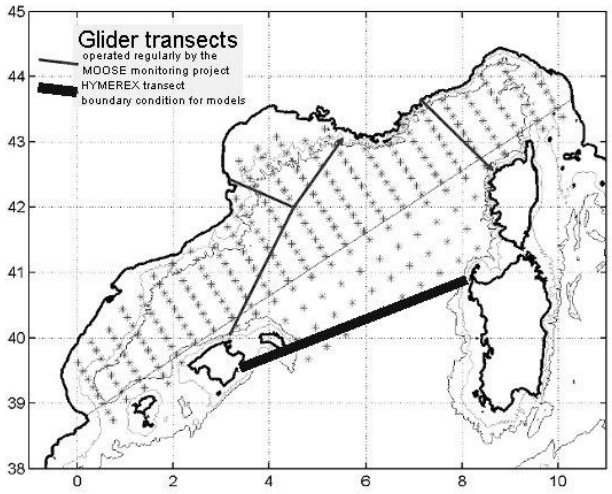

Fig. 1. Scheme of the HYMEREX cruises. The crosses correspond to CTD stations, black lines to gliders transects

References
1 - 1- D'Ortenzio, F. and Ribera d'Alcalà, M., 2009. On the trophic regimes of the Mediterranean Sea: a satellite analysis. *Biogeosciences*, 6 : 139-148.