Impact of changes in rivers inputs during the last decades on the biogeochemistry of the eastern Mediterranean basin

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ABSTRACT

The biogeochemistry of the Mediterranean Sea (MS) is strongly linked to the input of nutrients from external sources, such as the Gibraltar strait which has long been considered as the major source. Recent studies have shown that other sources may play a significant role, such as rivers and runoffs which substantially changed over the last decades. The consequences of these variations on the MS biogeochemistry remain poorly investigated. This study aims at filling this gap through a modelling study. One of the main result is that PO4 concentrations in the surface layer have decreased in the last decades, especially in the eastern basin (EMB), resulting in higher dissolved organic carbon concentrations. This study also provides a new potential explanation for the shift between the top of the nitracline and the phosphacline in the EMB.

CONTEXT AND OBJECTIVES

This work is part of the **LaSeR-Med** project **funded by the OT-MED** labex. The **mains objectives of this work** are :

→ To address the **large-scale and long-term influence of river inputs** on the biogeochemistry of the MS over the last decades.
→ To **investigate the impact of climate change** on the MS biogeochemistry and planktonic trophic webs (in progress)**.**

The modelling tools

The hydrodynamic model NEMO-MED12

(Nucleus for European Modelling of the Ocean for the Med sea [6])

→ Horizontal resolution 1/12°

→ Vertical resolution 75 sigma levels

→ Eddy-permitting model

→ From 1980 to 2012

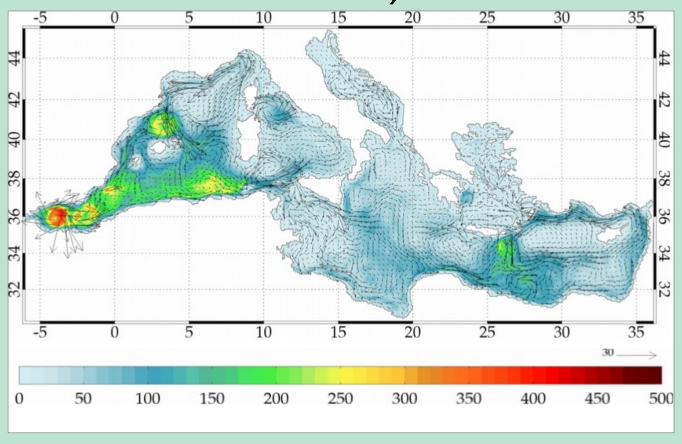


Figure 1 : Mean eddy kinetic energy at 40m depth over the period 1992–2013 [1]

The biogeochemical model Eco3M-Med

(Ecological Mechanistic and Modular Modelling for Med sea. [2][7])

→ Based on **mechanistic formulations**

→ 6 main planktonic functional types

→ **Flexible stoichiometry**

→ Includes the Carbonate cycle (new) [3]

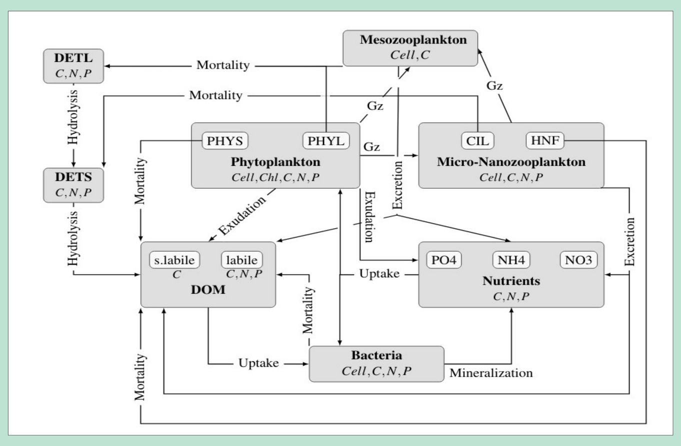
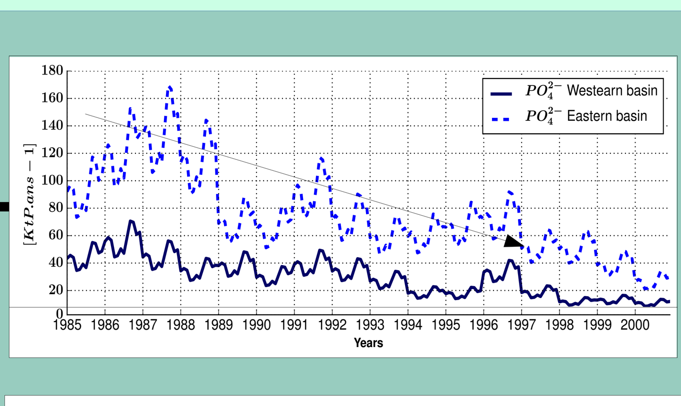


Figure 2 : Conceptual model used in Eco3M-MED[8]

The hindcast simulation : 1985 to 2010



• **PO4 decrease in rivers inputs**

Figure 4: Nutrients inputs from rivers and runoff [4] used in the model for the eastern basin (dotted line) and for the western basin (plain line).

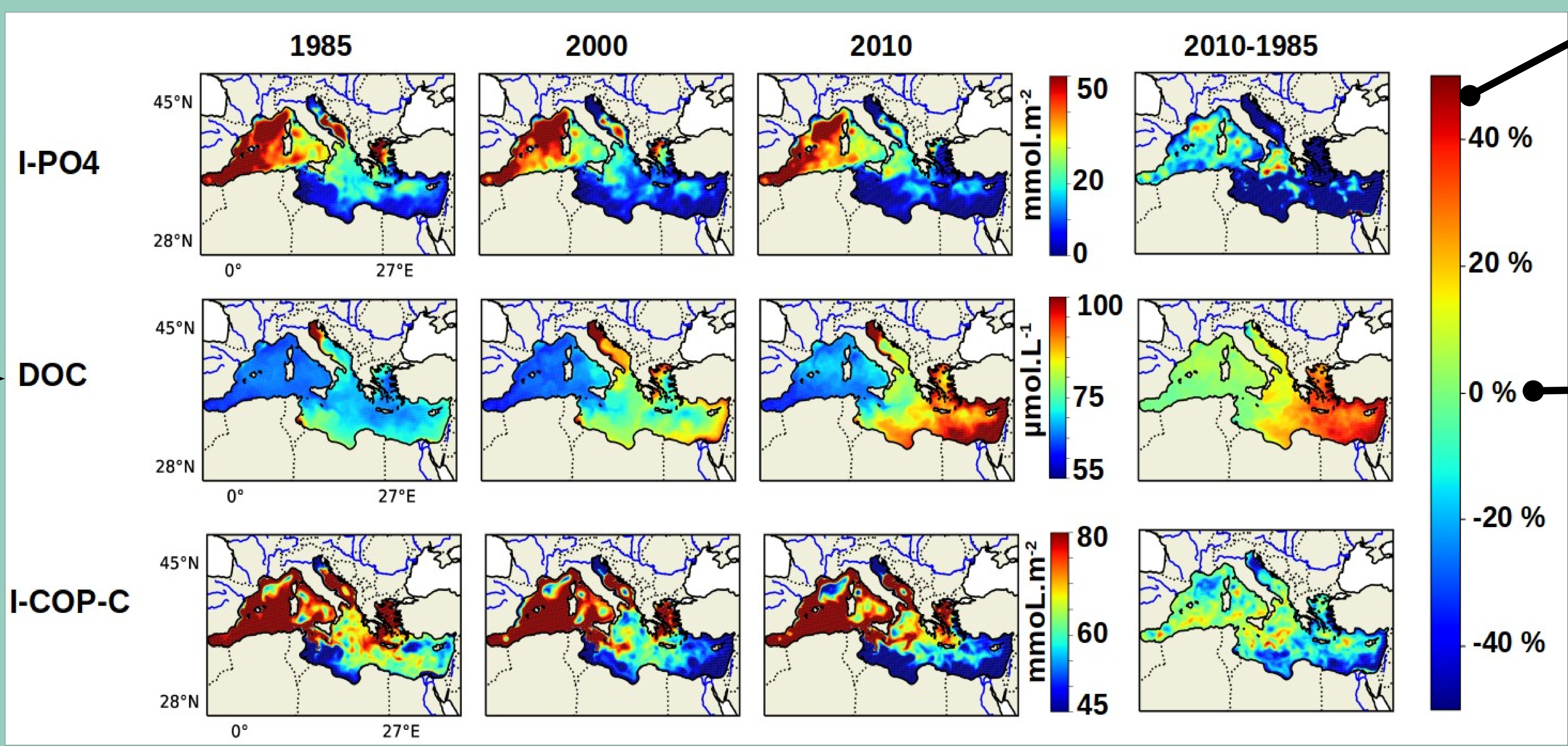


Figure 5: Patterns of change at basin scale between 1985 and 2010 of: (top) the 0-150 m integrated PO4 concentration(I-PO4), (middle) the surface DOC concentration, (bottom) the carbon biomass of copepods (I-COP-C) integrated between 0 and 150 m. The last column shows the difference between 1985 and 2010[8].

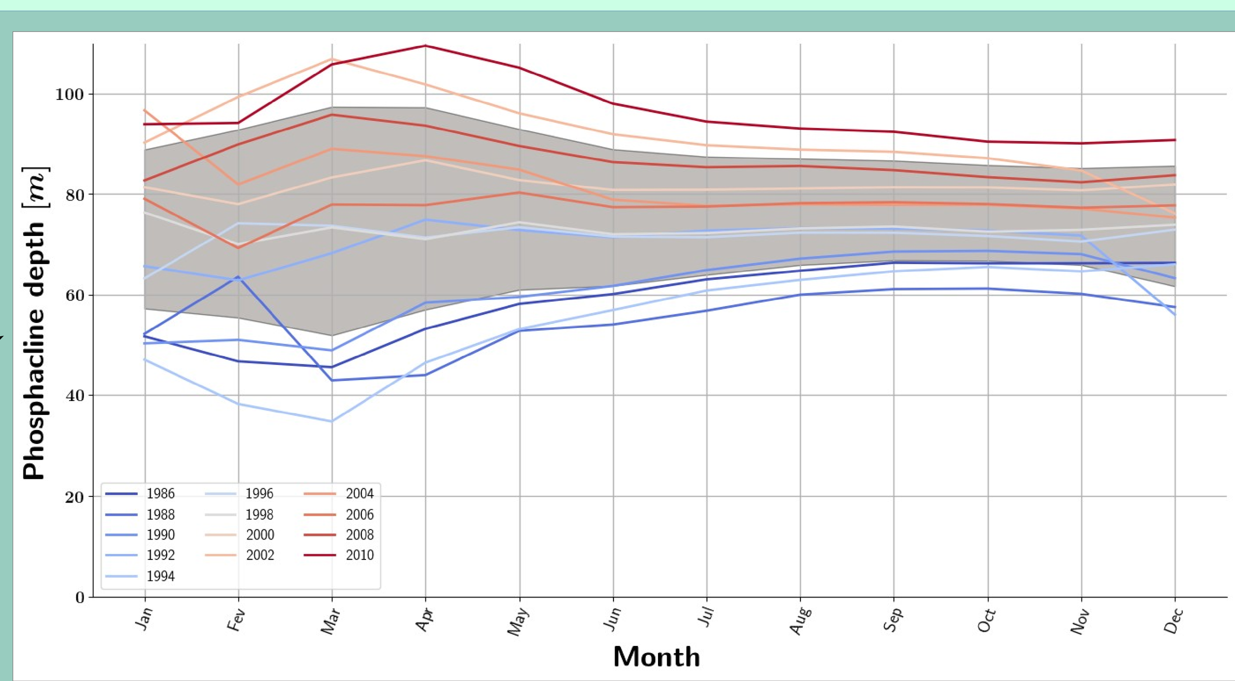


Figure 6: Patterns of changes concerning the depths of the top of the phosphacline in the eastern basin.

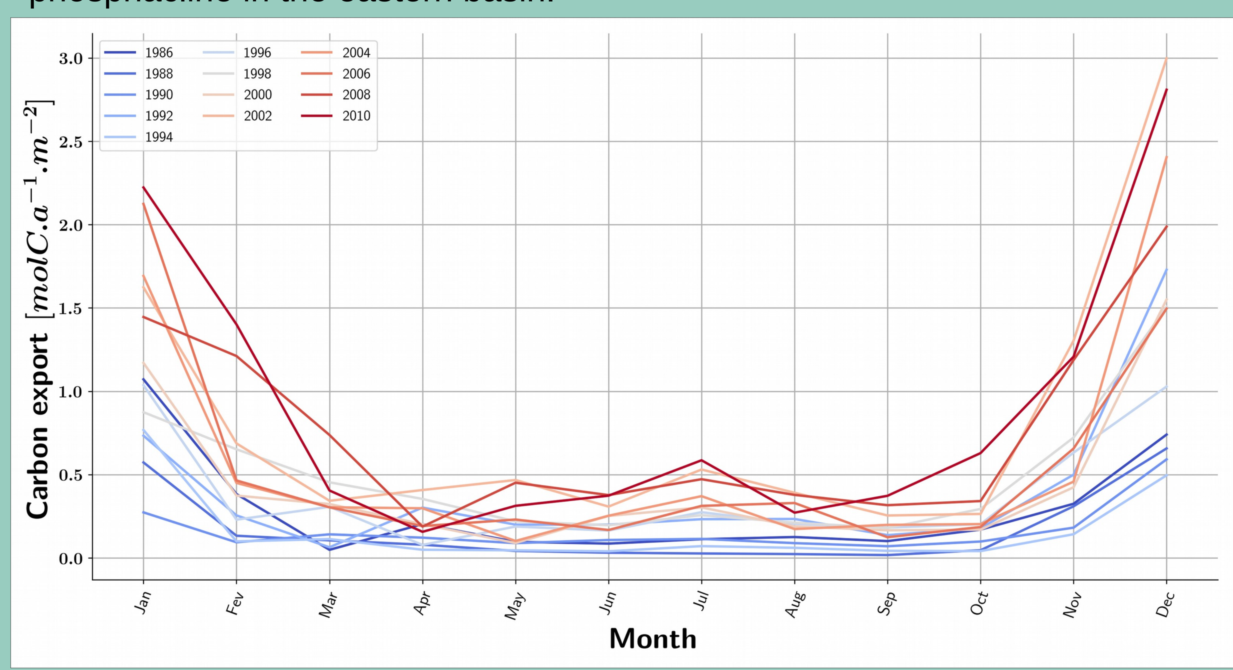
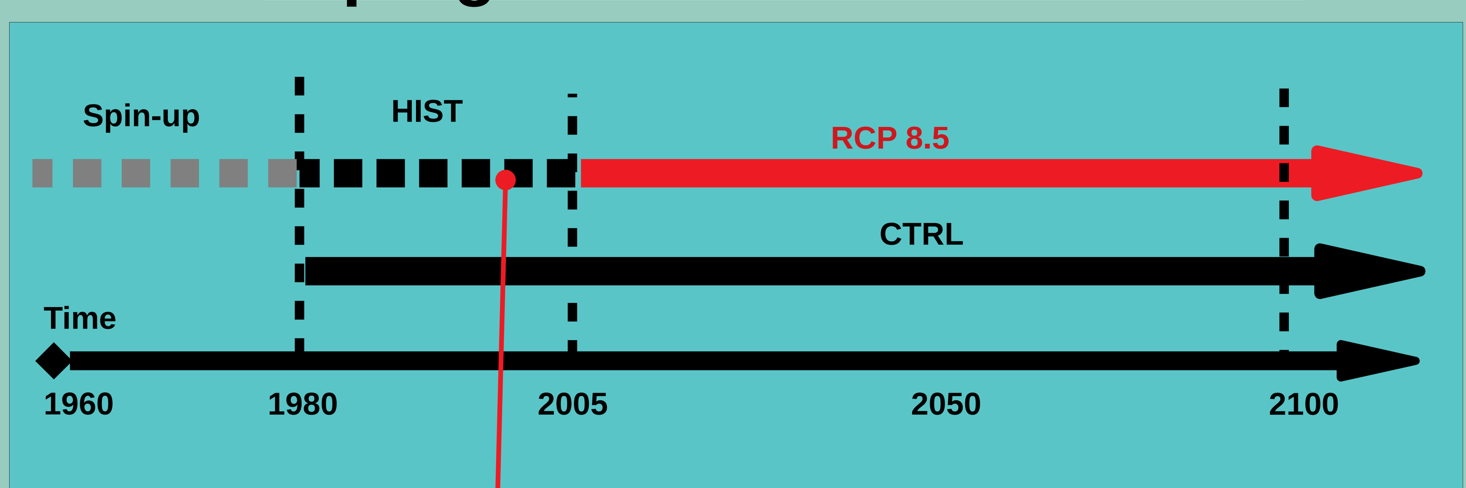


Figure 7: Patterns of change in the DOC export for the eastern basin.

In progress : RCP 8.5 scenarios



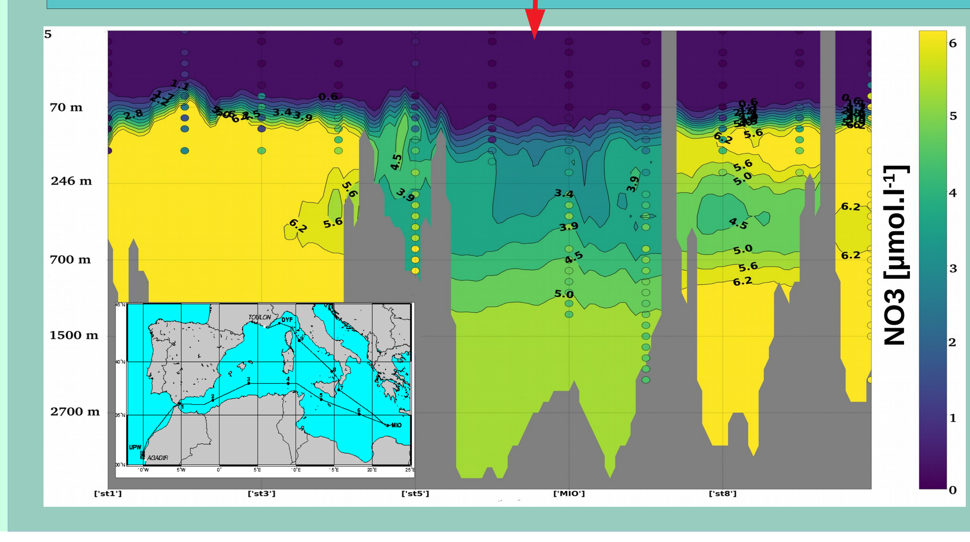


Figure 9: Transect of PROSOPE cruise (1999), the base map show model results and the colored points show the data.

CONCLUSIONS

During 1985-2010, we observe with the model:

→ A **lowering of PO4** availability in the **eastern basin.**
→ A **rise in DOC** concentration in the surface layer of the **eastern basin.**
→ A **increase in DOC export** in the **eastern bassin.**
→ **Copepods biomass decreases** in the **eastern basin.**

Overall, this study emphasizes the fact that the **biogeochemistry of the two basins** of the MS **did not exhibit the same response to the variation of rivers inputs.**

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