How will climate change affect the planktonic food web and the biogeochemistry of the Mediterranean Sea according to the RCP 8.5 scenario?

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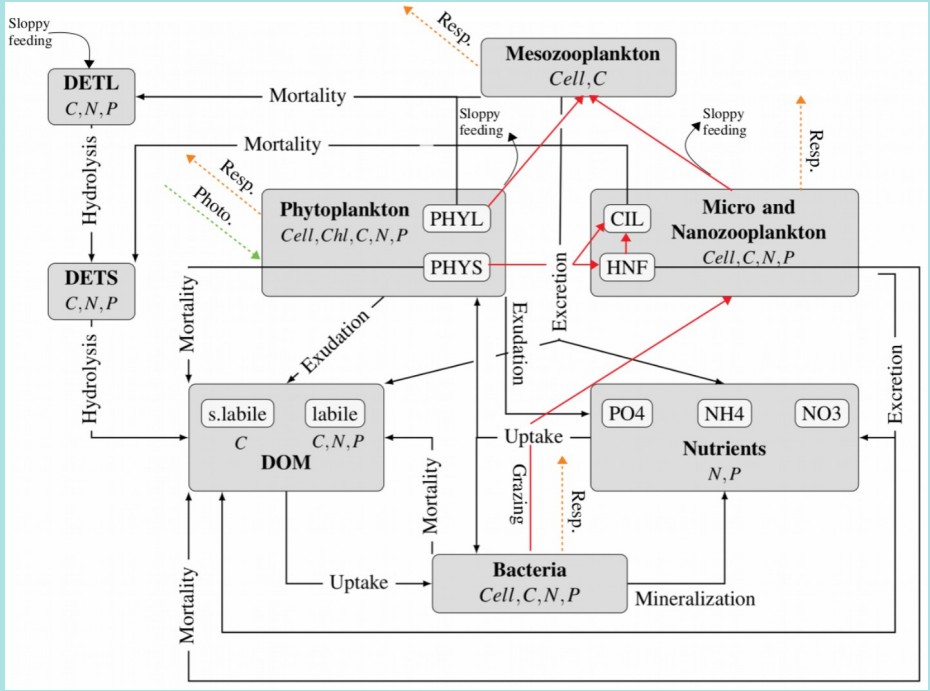
The biogeochemical model Eco3M-Med

- 37 state variables including 6 Plankton Functional Types (PFT)

- PFT represented in terms of C, N, P concentrations (except MZOO) and cell abundance

- Mathematical formulations based as far as possible on mechanistic considerations

- Kinetics of biogeochemical processes regulated by intracellular ratios (ratio between two intracellular elements) and intracellular quotas (amount of a given element per cell)



See Baklouti et al., PinO (2006b), Alekseenko et al., Ocean Dynamics (2014), Guyennon et al., Biogeosciences (2015), Pagès et al., PinO (2019), Baklouti et al., in prep.

The physical model and the physical scenario

- « Two-ways » coupled atmospheric-ocean general circulation model (AOGCM) using the CNRM-RCSM4/NEMO-MED8 configuration
- Ocean resolution : 1/8°, 43 vertical levels (cell height ranging from 6 to 200 m)
- The RCP 8.5 IPCC scenario performed with this AOGCM is described in Darmaraki et al. (2019)
- This scenario has been used as a physical forcing for the biogeochemical model Eco3M-Med

Main assumptions for the biogeochemical scenario

- Nutrients inputs by river and runoff are kept constant (monthly values of year 2000 are applied from 2000 to 2100)

- At the Gibraltar Strait (GS), the boundary concentrations of nutrients are kept constant

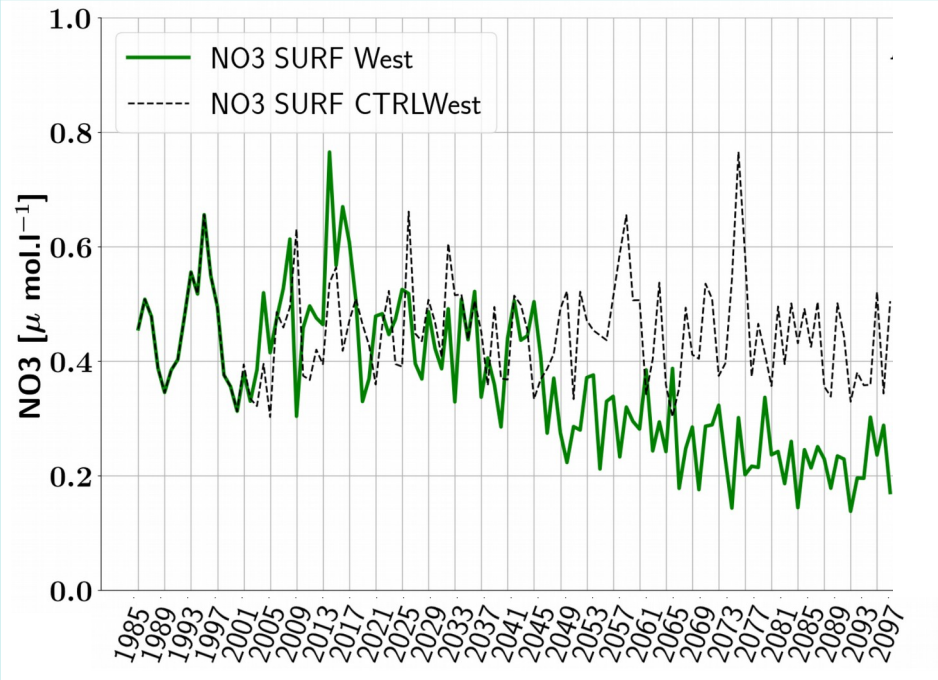
- For the control run, nutrients input by rivers and the GS are also kept constant and the physical dynamics is given by years randomly selected into the historical period (1985-2005)

Main results (I)

- The physical RCP scenario (Darmaraki, 2019) predicts a significant reduction of the Mixed layer depth (MLD), especially in the NW Med

- NO3 and PO4 surface concentrations will strongly decrase, mostly in the W MED (~ - 45 % for NO3 and - 37 % for PO4)

- Deepening of both the top of the nitracline and phosphacline, but slightly more pronounced for the nitracline



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Main results (II)

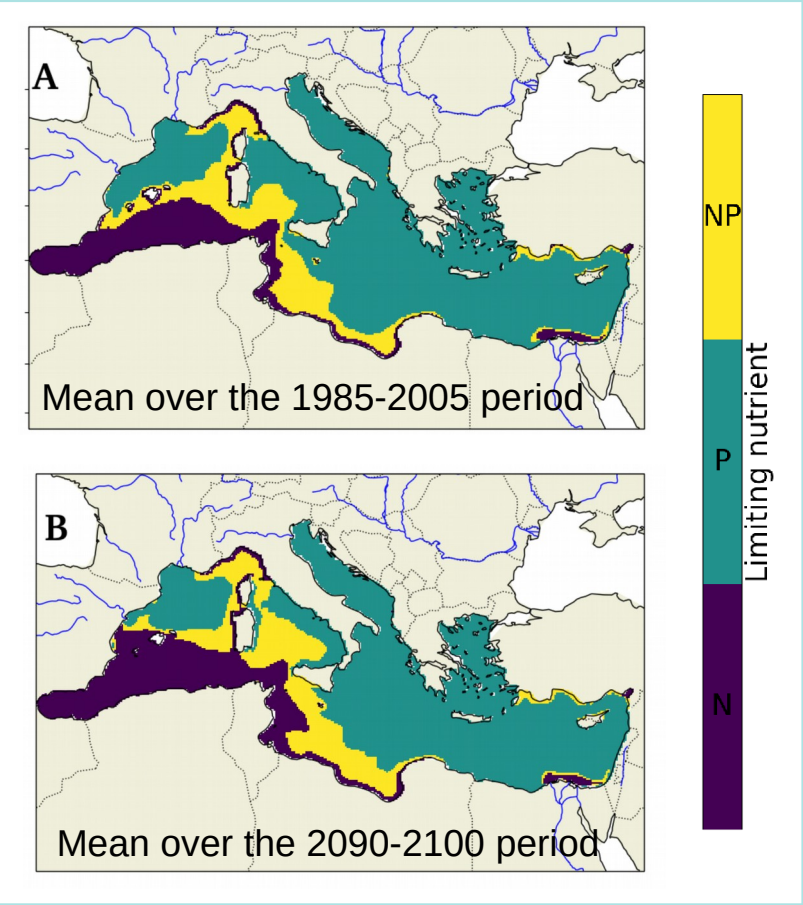
Under a RCP8.5 scenarios and constant nutrients river inputs, the model also predicts :

- a 12 % decrease in net primary production in the WMED

- a 19 % decrease in carbon export at 1000 m

- a change in the structure of the planktonic food web, in favor of small organisms

- organisms should be more and more N-limited (see the figure on the right for the PFT of « small phytoplankton »)



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