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MODELING OF PCB TROPHIC TRANSFER IN THE GULF OF LIONS; MARS3D/ECO3M COUPLED MODEL APPLICATION

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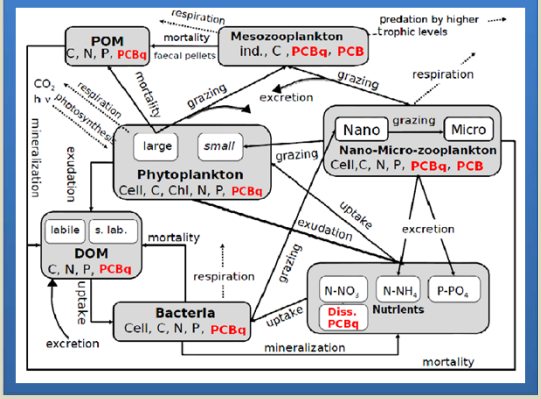
Introduction

The focus is given to the dispersion of PCBs in the Gulf of Lions (GoL) and of their transfer to zooplankton *via* biogeochemical processes. We estimate PCB congener budgets and fluxes into the GoL. We consider different processes: sorption, mortality, excretion, grazing, mineralization, volatilization, degradation, sedimentation.

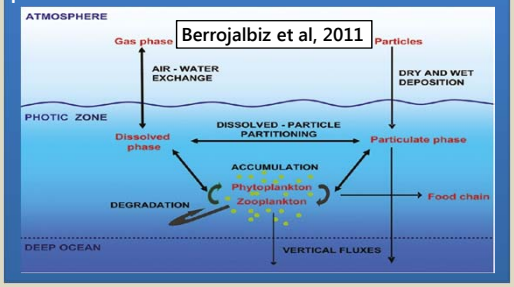
Coupled model MARS3D/Eco3M

The coupled model contains **49 states variables (variable stoichiometry) in addition to the hydrodynamics.**
PCBq - sorbed, PCB - assimilated.



Basic hypotheses for PCB transport

- The PCB fluxes along the trophic chain are related to carbon fluxes;
- Two uptake pathways of PCBs by plankton: passive sorption and assimilation (by grazing); Process of passive sorption tends towards an equilibrium governed by partition processes.



Model forcings:

hydrodynamical

- Initial and open boundary conditions: from the MFS 1/16° regional model.
- Meteorological forcing: from the high-resolution (3 km) non-hydrostatic mesoscale atmospheric model MM5 .
- Rhone River: from time series of SIE river discharges (French national database).

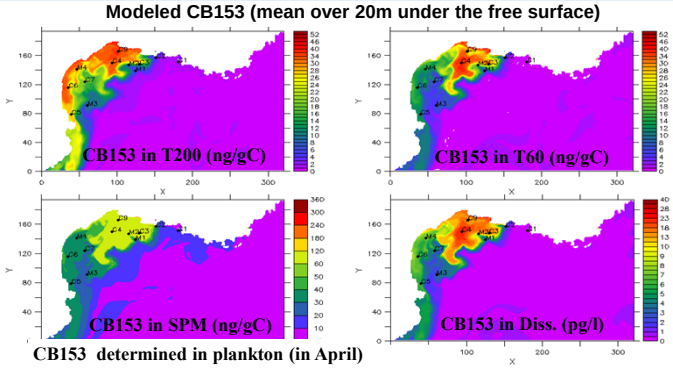
biogeochemical

- The initial and boundary conditions were derived from the MEDATLAS database.
- Rhone River nutrient inputs from time series of SIE database.

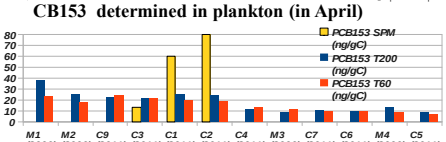
transport of PCBs

- Rhone River inputs: mean values of PCB issued from ARCMED project measurements;
- Atmospheric inputs (dry and wet deposition) (Castro-Jimenez et al, 2008, 2012);
- Initial and boundary PCB distribution assessed using COSTAS project *in-situ* data.

Modeled CB153 (mean over 20m under the free surface)

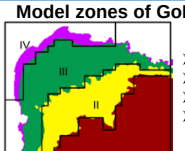


CB153 determined in plankton (in April)



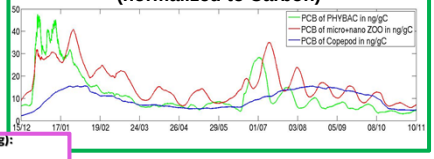
- **T60 : 60µm<X<200µm (phytoplankton+ microzooplankton);**
- **T200: 200µm<X<500µm (mesozooplankton).**

Model zones of GoL with different depth:

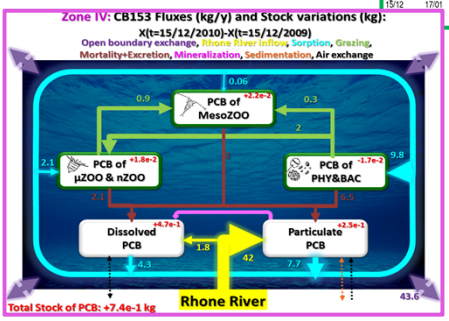


- **I: 2000m<H**
- **II: 600m<H<2000m**
- **III: 50m<H<600m**
- **IV: H<50m**

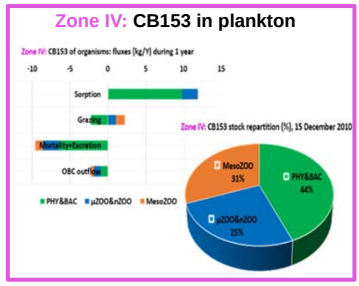
Zone III: Evolution of CB153 in plankton (normalized to Carbon)



Zone IV: CB153 Fluxes (kg/y) and Stock variations (kg):



Zone IV: CB153 in plankton



Conclusions

- Considering simplified assumptions and forcings, modeled concentrations of CB153 (ng/gC) in the different plankton size classes remain within same order of magnitude of the limited field dataset of CB153 in plankton in the GoL.
- The Rhone loads play an important role in the contamination of the GoL by PCBs. The CB153 entering the food web represents only a small fraction of total CB153 present in the water column.
- The CB153 sorption by the smaller organisms (bacteria and phytoplankton) is the dominant uptake process at this lower trophic level, while contaminant uptake by meso-zooplankton is mostly by feeding of contaminated prey and only slightly by the sorption processes.