POC and DOC **DYNAMICS** in the southern Baltic Sea – model and experimental verification.

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POC and DOC

- POC - Particulate Organic Carbon
  - Measure of particulate organic matter (POM) in the marine environment
  - Sum of phytoplankton, zooplankton, bacteria and dead organic matter concentrations
- DOC - Dissolved organic carbon
  - Measure of dissolved organic matter
  - Viruses, macromolecules, small molecules etc.

POC and DOC are important components in sea-water

- Play key role in many natural processes occuring in marine enviroment

(vertical downwards transport of chemical substances: C, N, P, heavy metals, O_2 depletion, etc.)

- Are responsible for many chemical and physical properties

(sea water-color, light-availability etc.)

AIMS:

- **Aim - To create POC and DOC model**

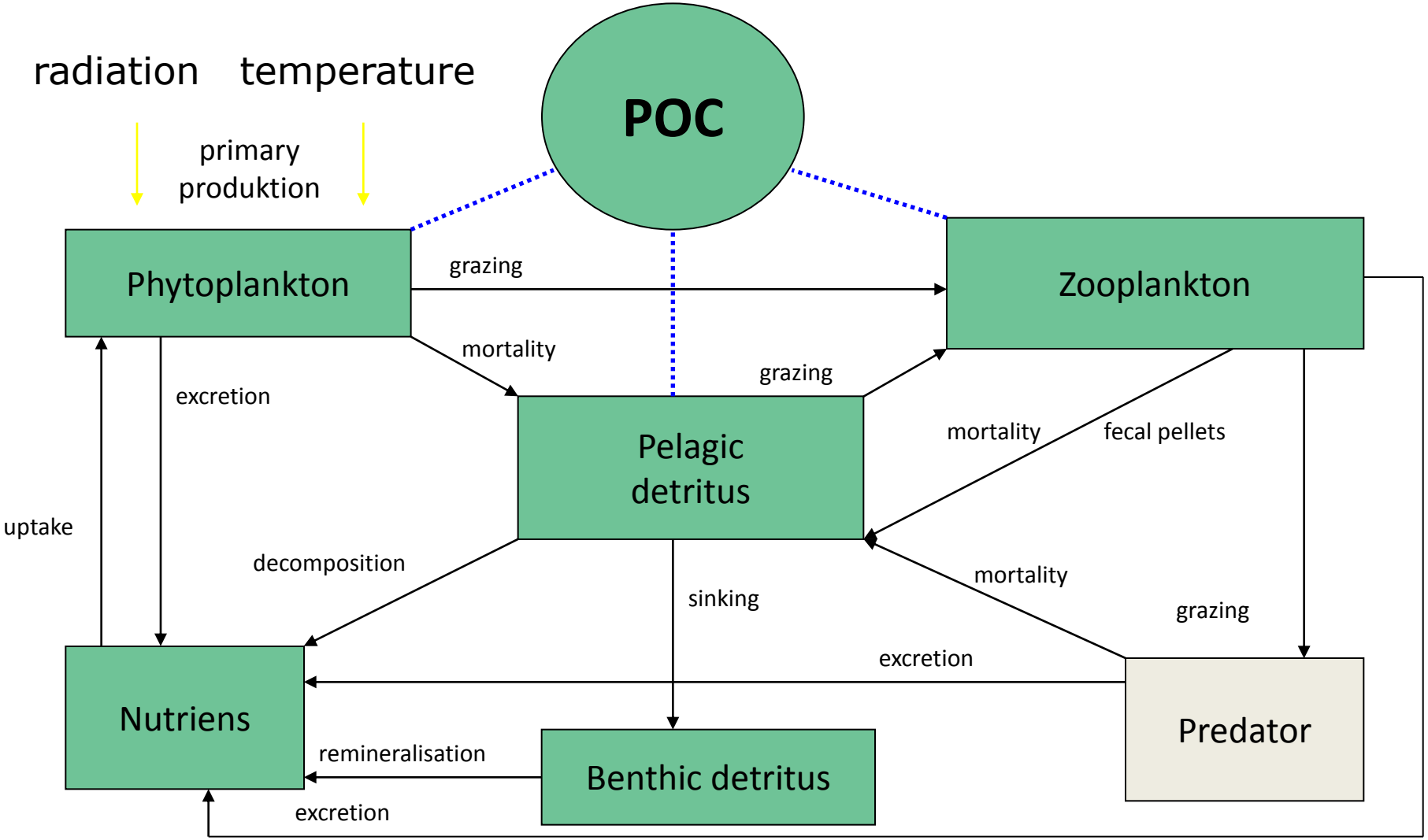
- investigates the seasonal, annual dynamic and long term changes of both components concentrations in the southern Baltic Sea
- enables simulation of POC and DOC distribution in water column
- model verification by experimental data (parametrization improvment)

Location of

	POC [mgC/l]			DOC [mgC/l]		
Deep/Month	*Gdansk*	*Gotland*	*Bornholm*	*Gdansk*	*Gotland*	*Bornholm*
January		surface - 0,15 w. column - 0,09			surface - 3,22 w. column - 2,78	
February				surface - 3,93		
March	surface - 0,28 w. column - 0,15	surface - 0,17 w. column - 0,13		surface - 3,38 w. column - 3,59	surface - 3,47 w. column - 3,08	
April	surface - 1,27 w. column - 0,52	surface - 1,23 w. column - 0,56	surface - 0,71 w. column - 0,41	surface - 4,46 w. column - 4,14	surface - 3,43 w. column - 3,35	surface - 3,88 w. column - 3,87
May	surface - 1,17			surface - 5,35		
June / July	surface - 0,88 w. column - 0,41	surface - 0,72 w. column - 0,38	surface - 0,54 w. column - 0,29	surface - 4,98 w. column - 4,21	surface - 3,87 w. column - 3,52	surface - 4,01 w. column - 3,56
August						
September	surface - 0,30			surface - 4,00		
October	surface - 0,22 w. column - 0,15	surface - 0,34 w. column - 0,21	surface - 0,17 w. column - 0,14	surface - 3,89 w. column - 3,72	surface - 3,34 w. column - 3,21	surface - 3,65 w. column - 3,59
November						
December						

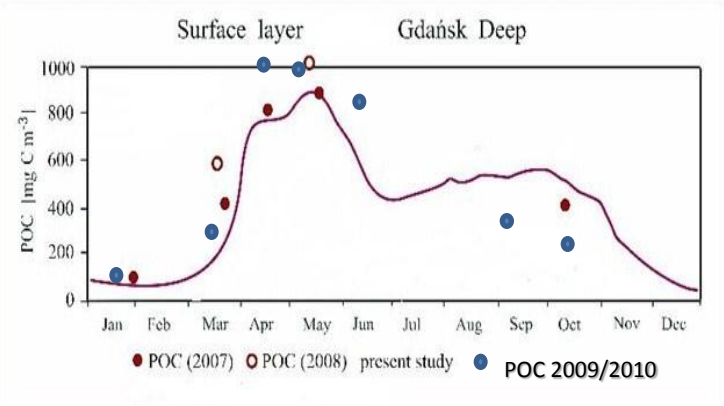
POC Model

$$\frac{\partial POC(z,t)}{\partial t} = \frac{\partial Phyt(z,t)}{\partial t} + \frac{\partial Zoop(z,t)}{\partial t} + \frac{\partial DetrP(z,t)}{\partial t}$$

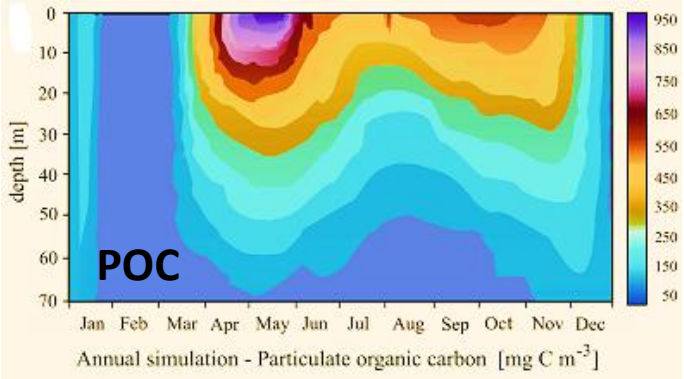


RESULTS

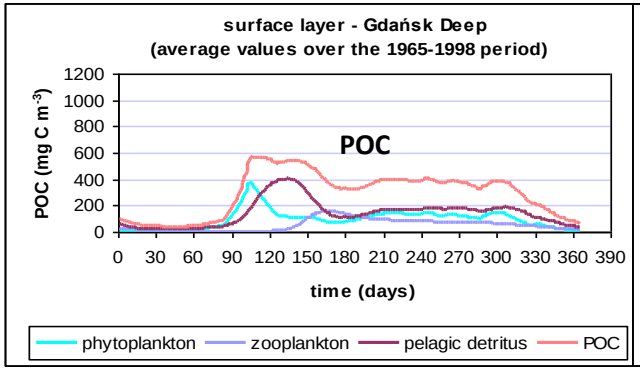
Modelled vs experimantal results →

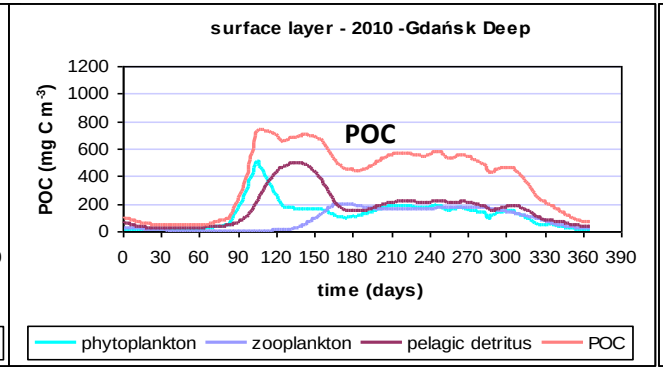


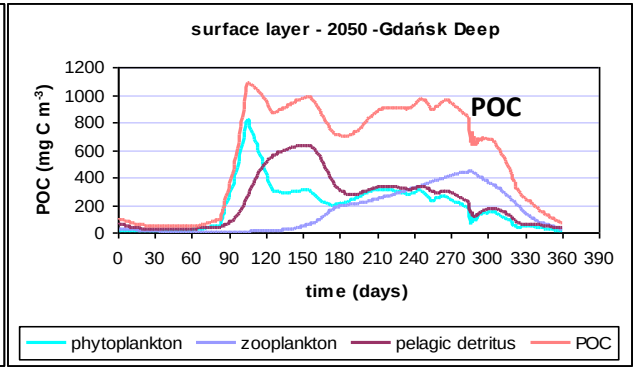
Dynamic of POC concentration in water column (Gdansk Deep) →



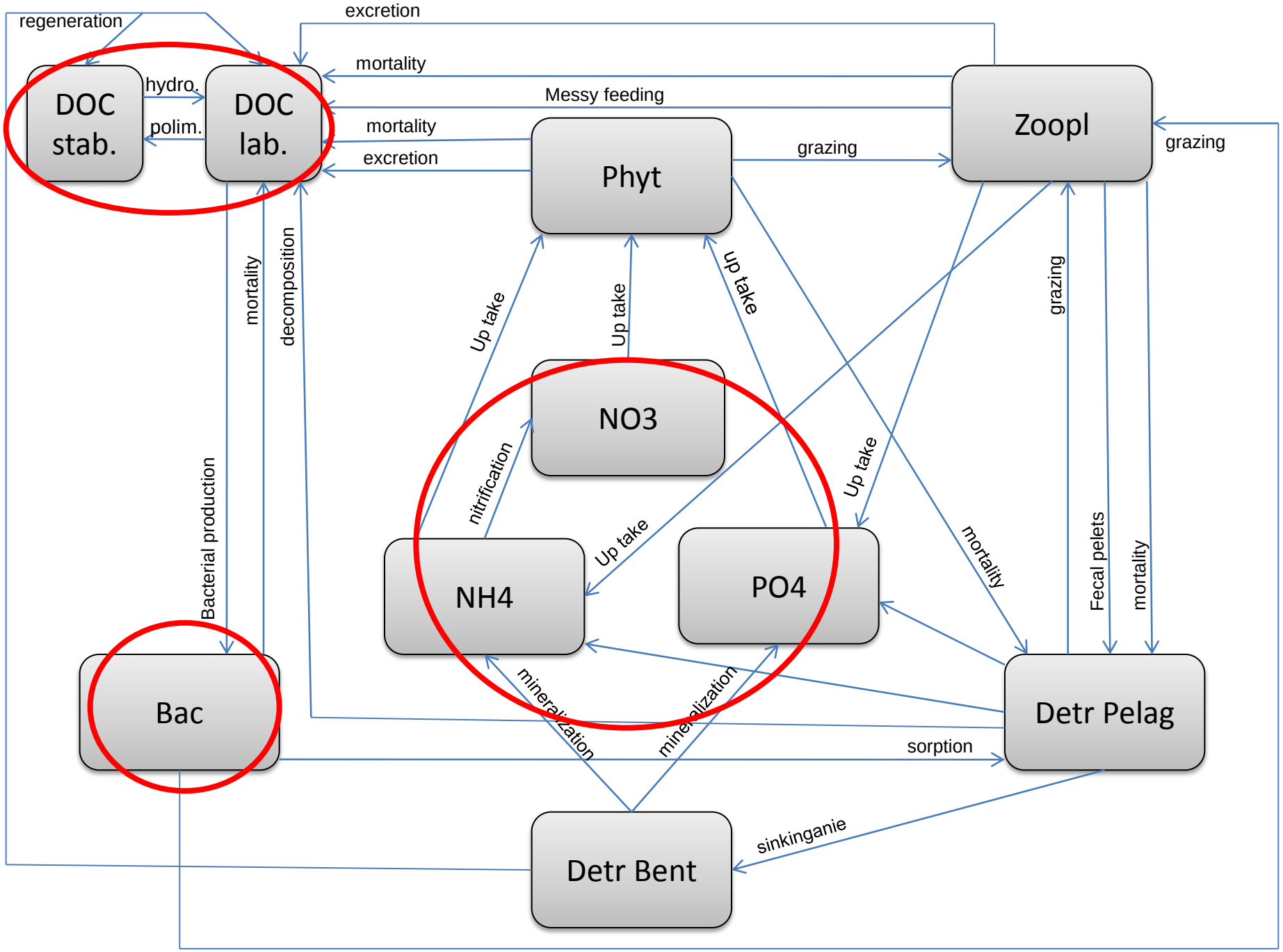
Simulated annual cycles for POC in the surface layer







COMBINED POC and DOC model


regeneration
excretion
mortality
Messy feeding
DOC stab.
hydro.
polim.
DOC lab.
mortality
excretion
Phyt
grazing
Zoopl
grazing
mortality
decomposition
Up take
Up take
up take
grazing
NO3
nitrification
Up take
Up take
Bacterial production
NH4
PO4
mortality
Fecal pelets
mortality
Bac
mineralization
mineralization
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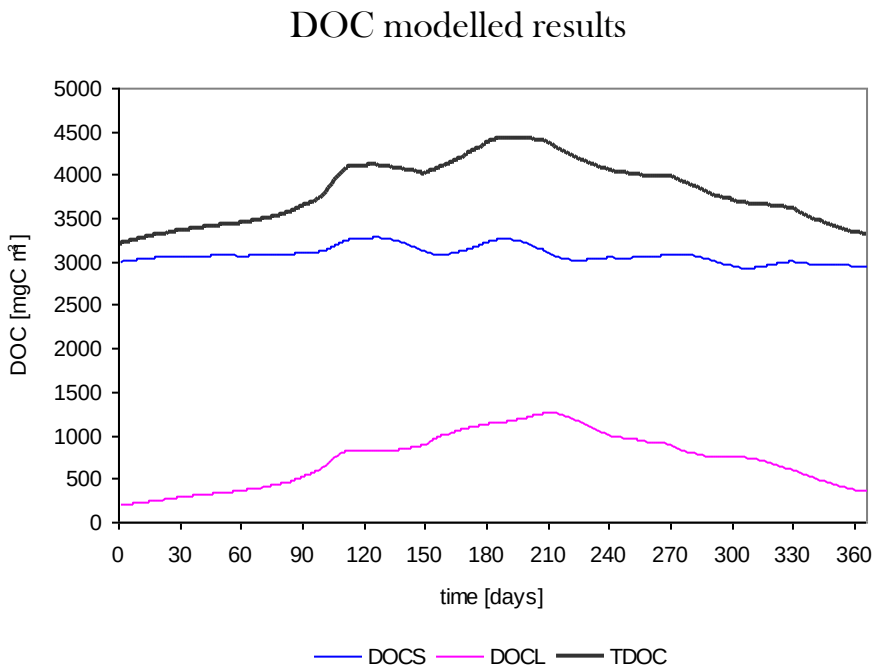
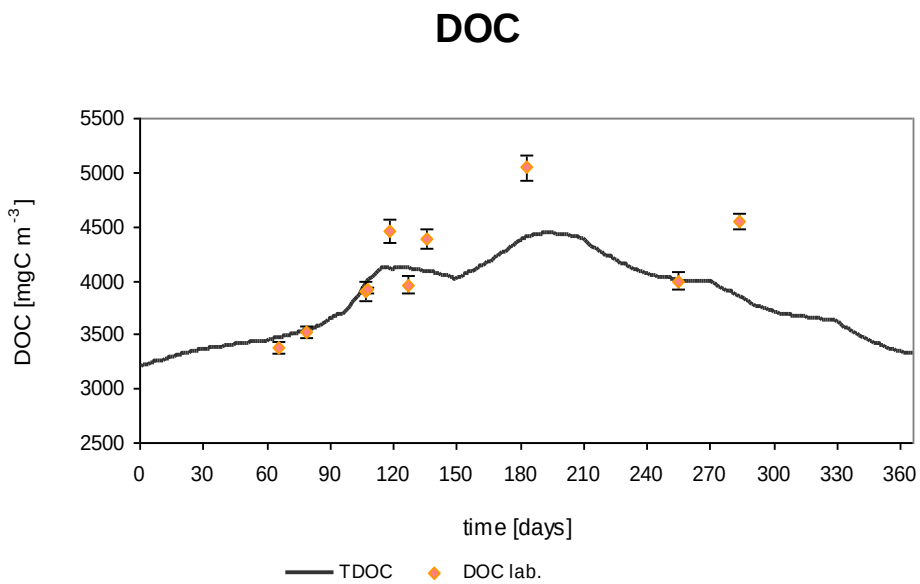
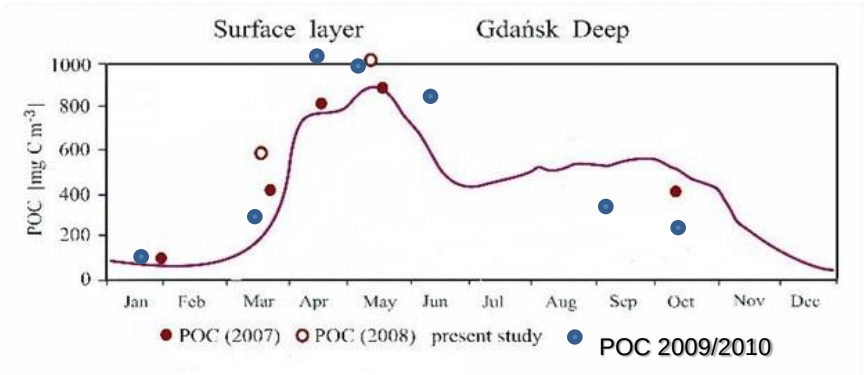
DOC - modelled vs. experimental results







Quantification of factors affecting DOC distribution

Coefficient	DOC pool
α_1	Refractory DOC
β_1	Phytoplankton activity
γ_1	Zooplankton
λ_1	Terrestrial dilution
α_2	Refractory DOC
β_2	Phytoplankton sinking
γ_2	Zooplankton
λ_2	North Sea

$$\mathrm{DOC_M} = \alpha_1 + \beta_1 C_\mathrm{a} + \gamma_1 C_\mathrm{f} + \lambda_1 S$$

$$\mathrm{DOC_M} = \alpha_2 + \beta_2 C_\mathrm{a} + \gamma_2 C_\mathrm{f} + \lambda_2 S$$

$\mathrm{DOC_M}$ – modelled DOC concentration [mg/l]
C_a – observed active chlorophyll *a* concentration [mg/m^3]
C_f – observed phaeopigment concentration [mg/m^3]
S – salinity
α_1, α_2, β_1, β_2, γ_1, γ_2, λ_1, λ_2 – coefficients

Plans for future

- Continuation POC/DOC model verification and parametrization
- Continuation of labile/stabile DOC experiment
- Quantification of factors influencing DOC distribution in my study areas
- Write PhD thesis

Thank you