ECOSMO and ECOSMO_E2E: Perspectives and Integration Challenges

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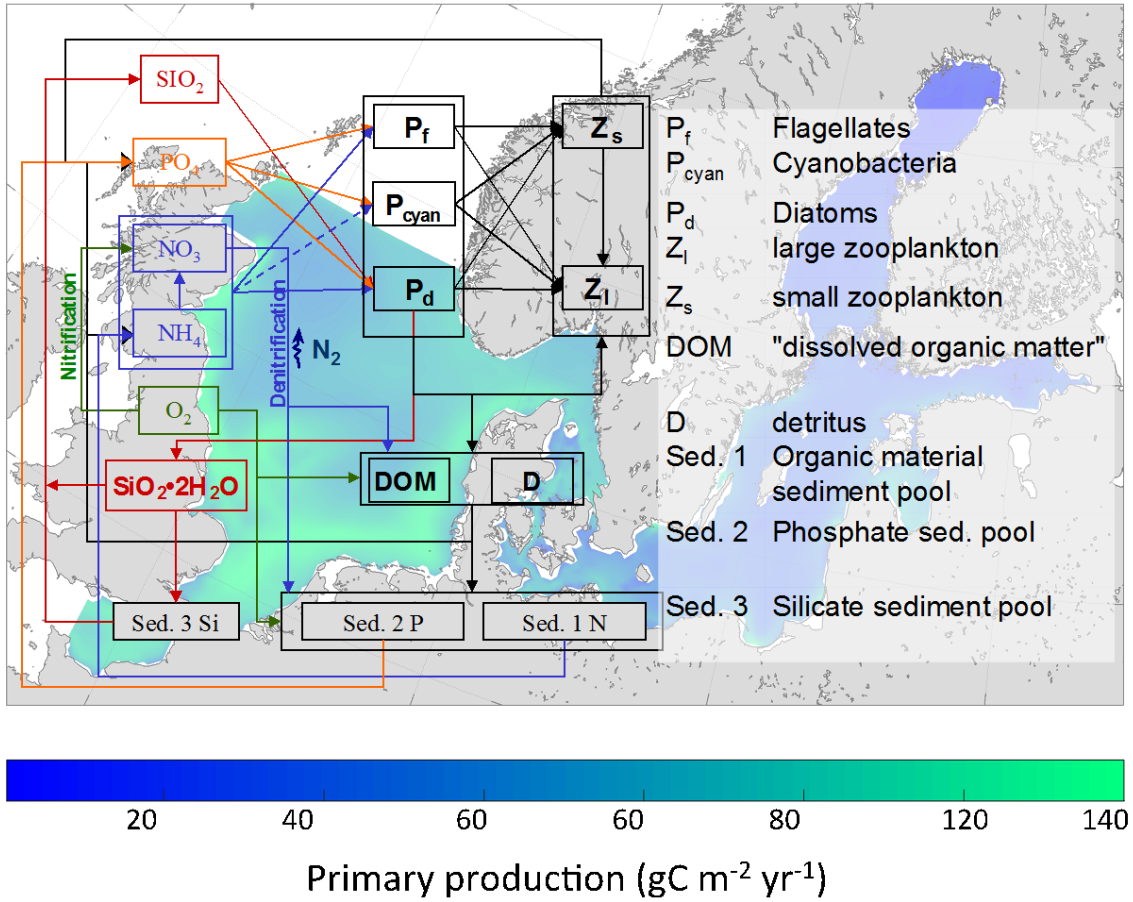
ECOSMO II (Daewel & Schrum 2013)



(Graphik: Ute Daewel/ Hereon)

NPZD model

functional groups

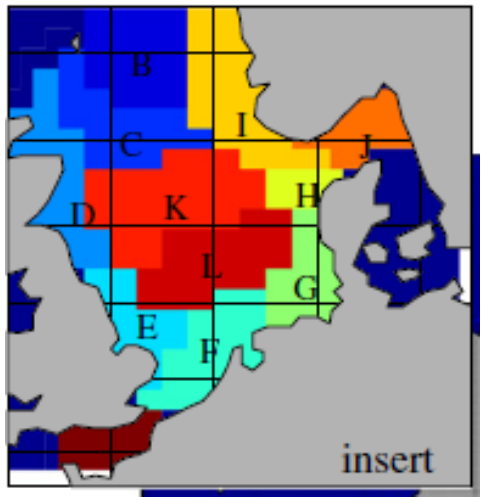
for all 16 variables:

$$\frac{\partial C}{\partial t} = -\vec{u}\,\vec{\nabla} C + \mu\,\nabla^2 C + Q_{bio}$$

Michaelis-Menten-Kinetics

$$v_0 = \frac{v_{max}\,[S]}{K_m + [S]}$$

ECOSMO II (Daewel & Schrum 2013)



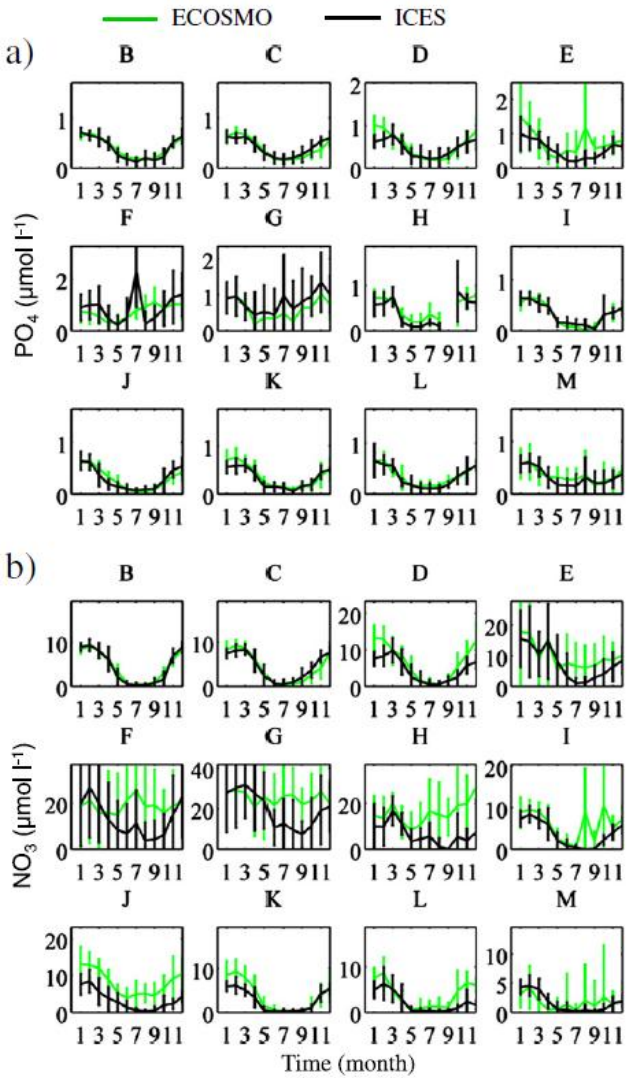
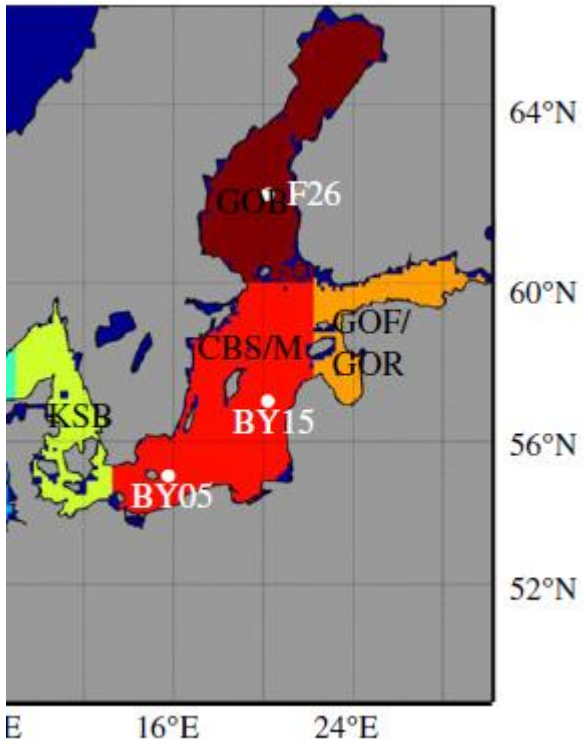


Fig. 6. Validation of seasonal cycle of surface nutrients (model versus ICES data) in different areas of the North Sea (area separation according to Fig. 3) and the central Baltic Sea (M) (phosphate (a); nitrate (b)).

1948-2008 hindcast

ECOSMO II (Daewel & Schrum 2013)

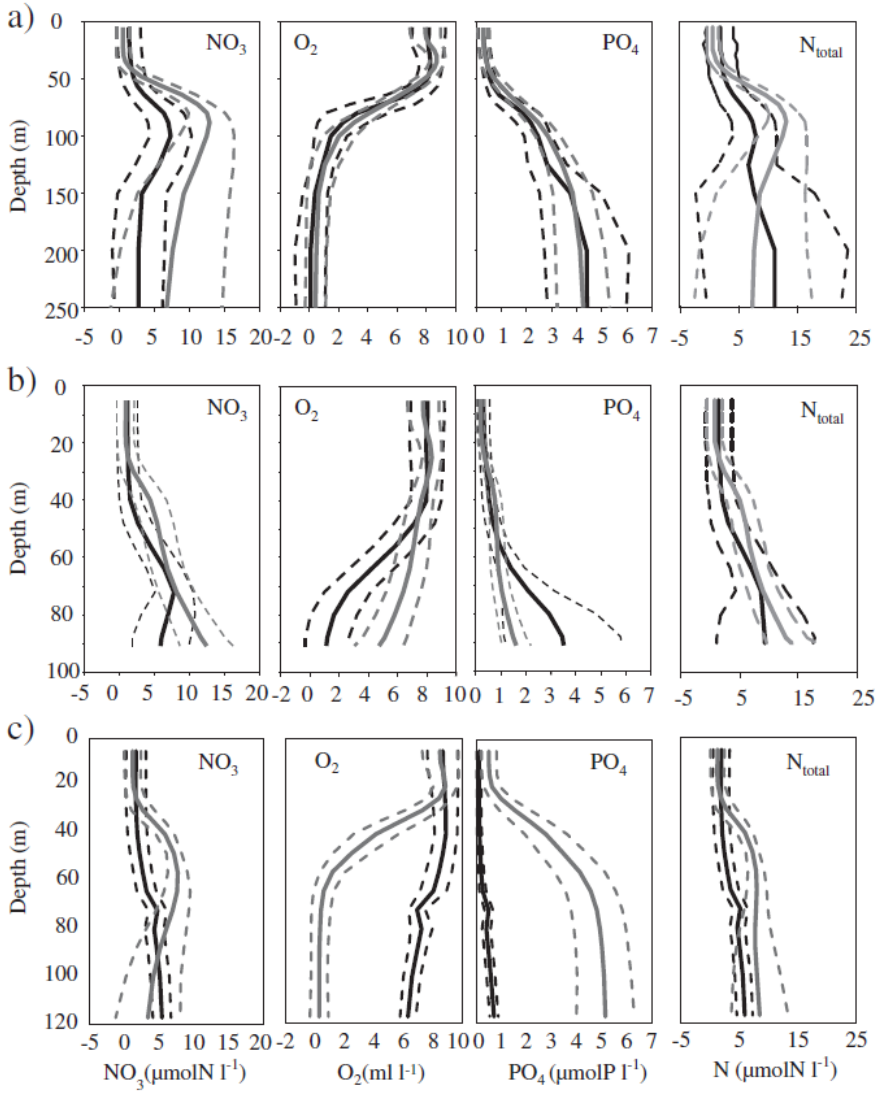


1948-2008 hindcast

BY15

BY05

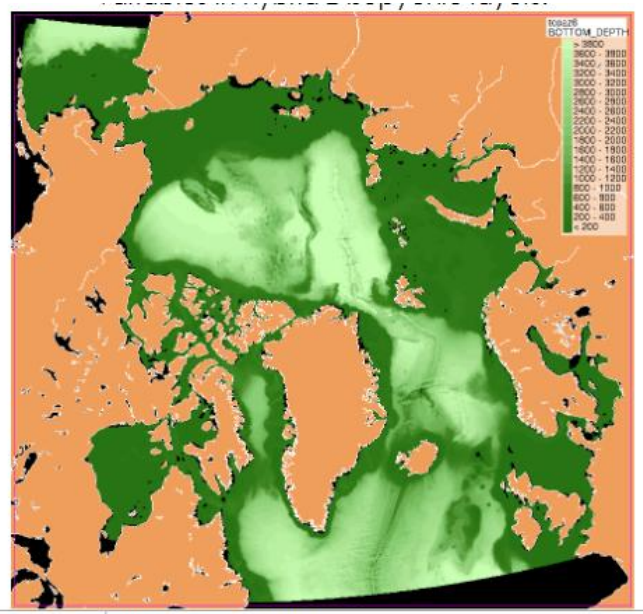
F26



black: HELCOM data
gray: modelled

full line: mean
dashed: standard deviation

ECOSMO II (Daewel & Schrum 2013)

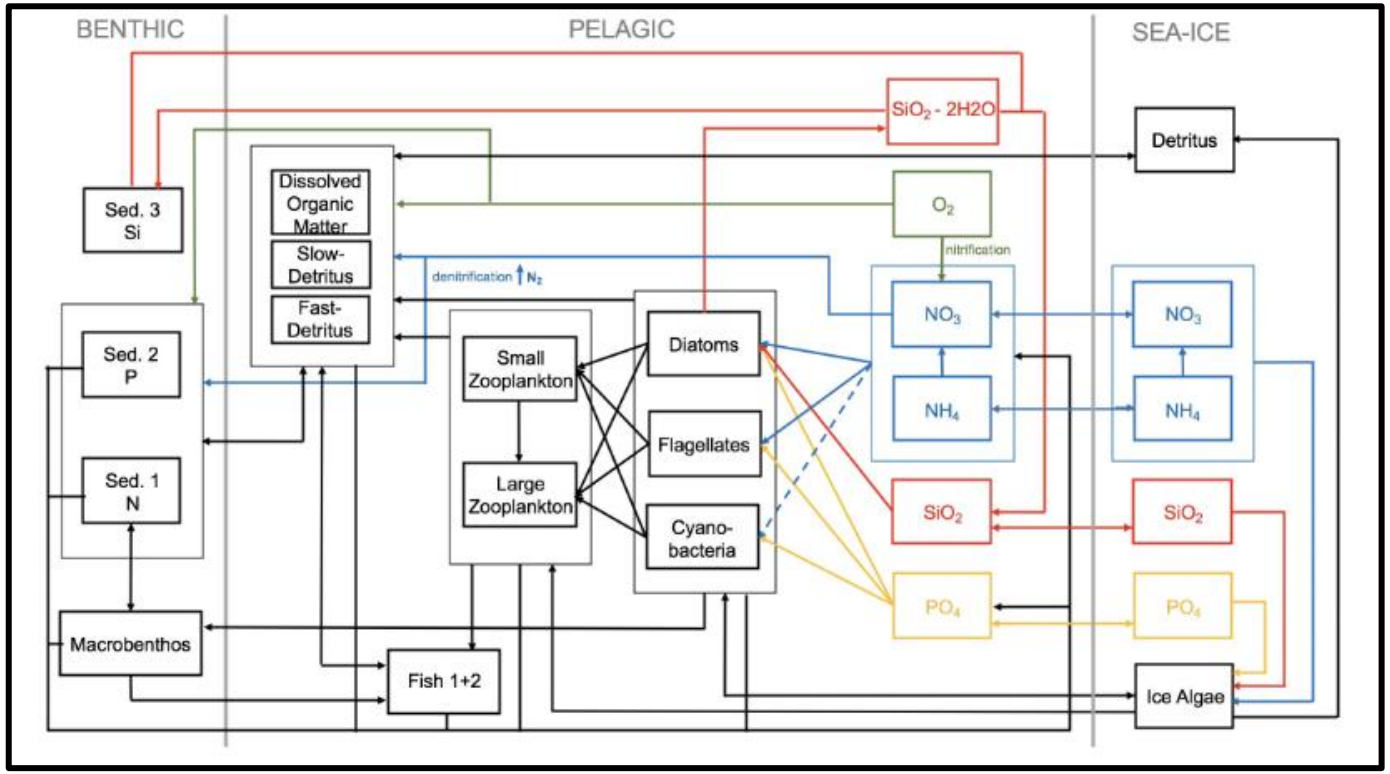


Vertical grid	50 hybrid layers
System Name	TOPAZ5-ECOSMO
Model version	HYCOM v2.2.98 (ocean) CICE 5.1 (sea ice) ECOSMO II (bgc)
Horizontal output Resolution	6. 25 km
Vertical output Resolution	40 Z levels
Interpolation method	Horizontally: bilinear, vertically: linear
Coupling	ESMF and FABM
Sea Ice Model	CICE v5.1 with 5 ice thickness categories
Bathymetry	GEBCO14

ECOSMO II(CHL) (Yumruktepe et al, 2022)

Weekly assimilation of satellite Chl-a
10 days forecast and analysis
ECMWF atmosphere forcing
PISCES bgc-boundary conditions
operated by NERSC

ECOSMO E2E (Daewel et al. 2019)

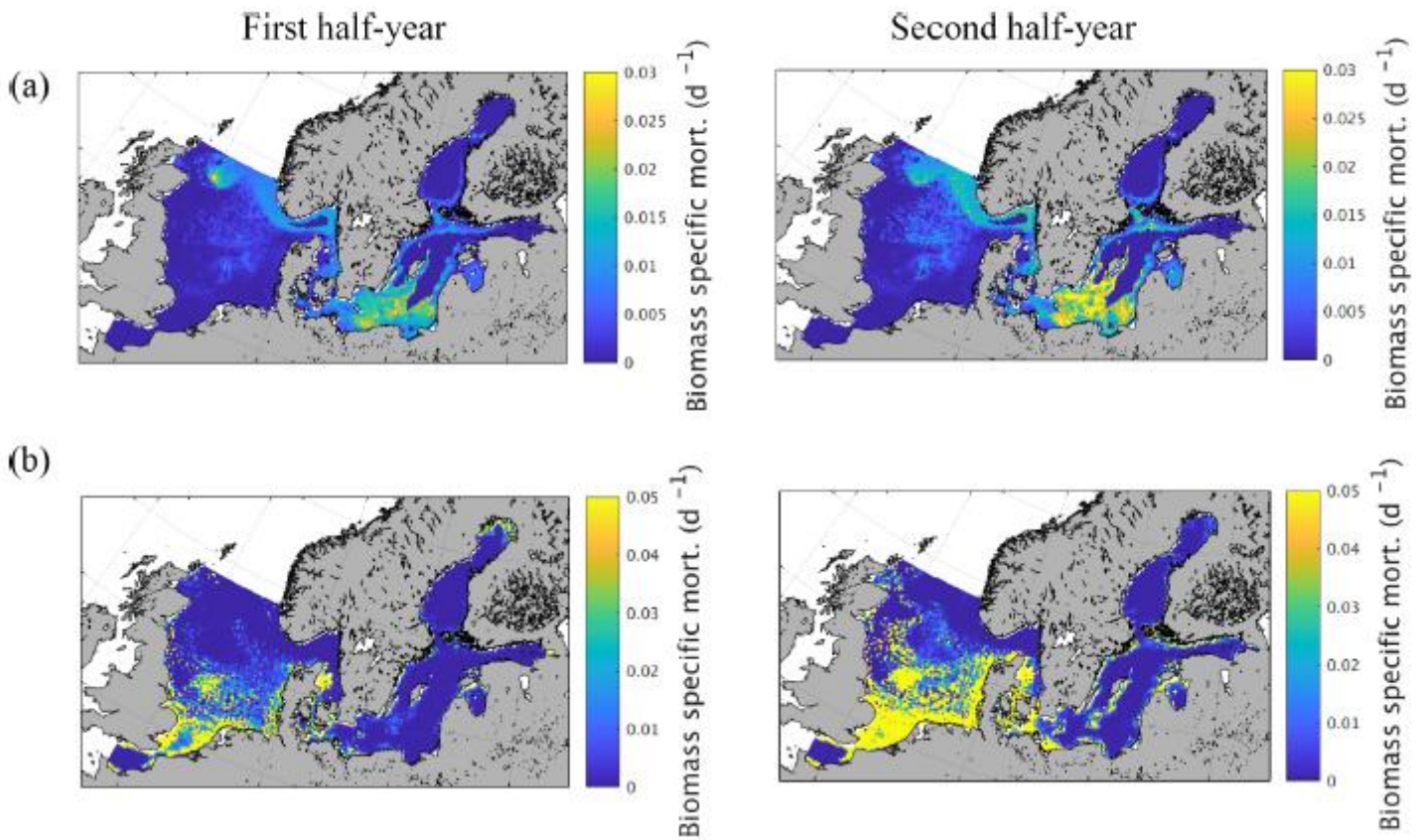


Schematic of ECOSMO-E2E. (*from Benkort et al. (2020)*)

ECOSMO E2E (Daewel et al. 2019)

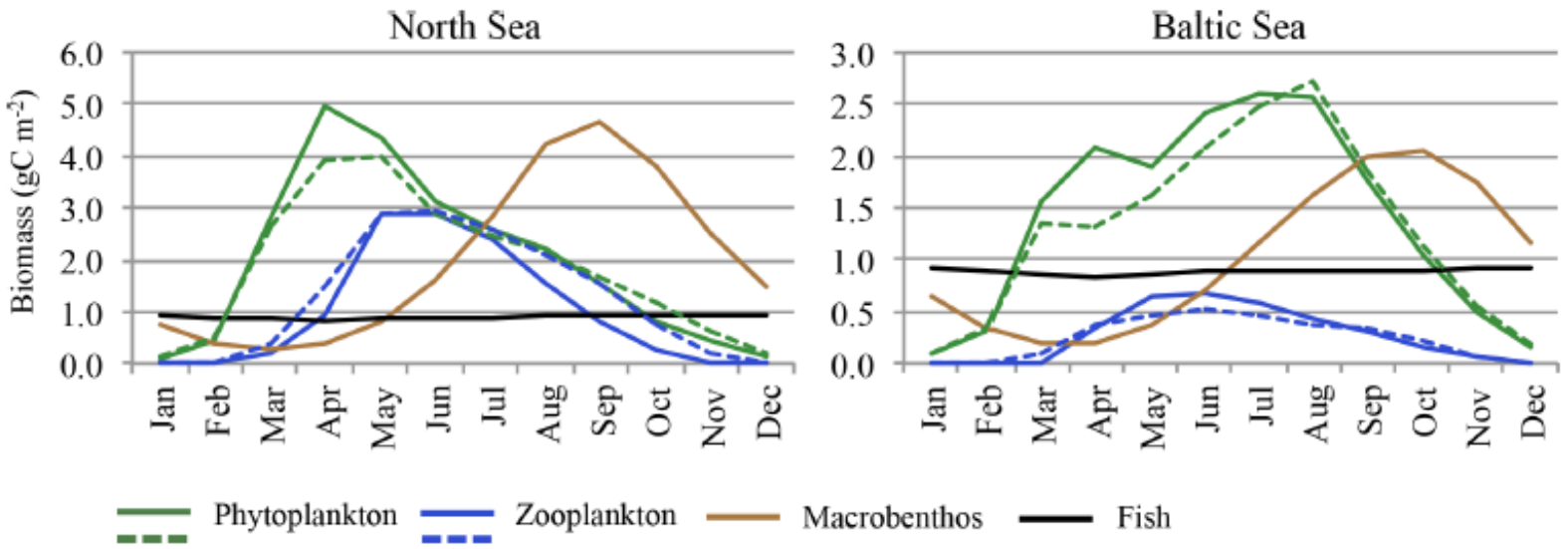
fish predation

macrobenthos predation



mortality of zooplankton

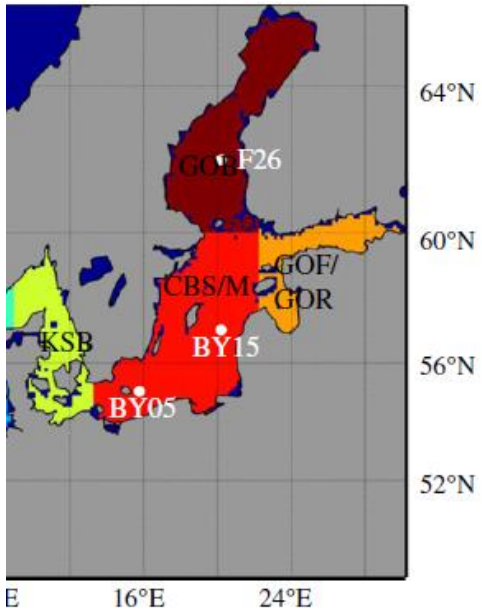
ECOSMO E2E (Daewel et al. 2019)

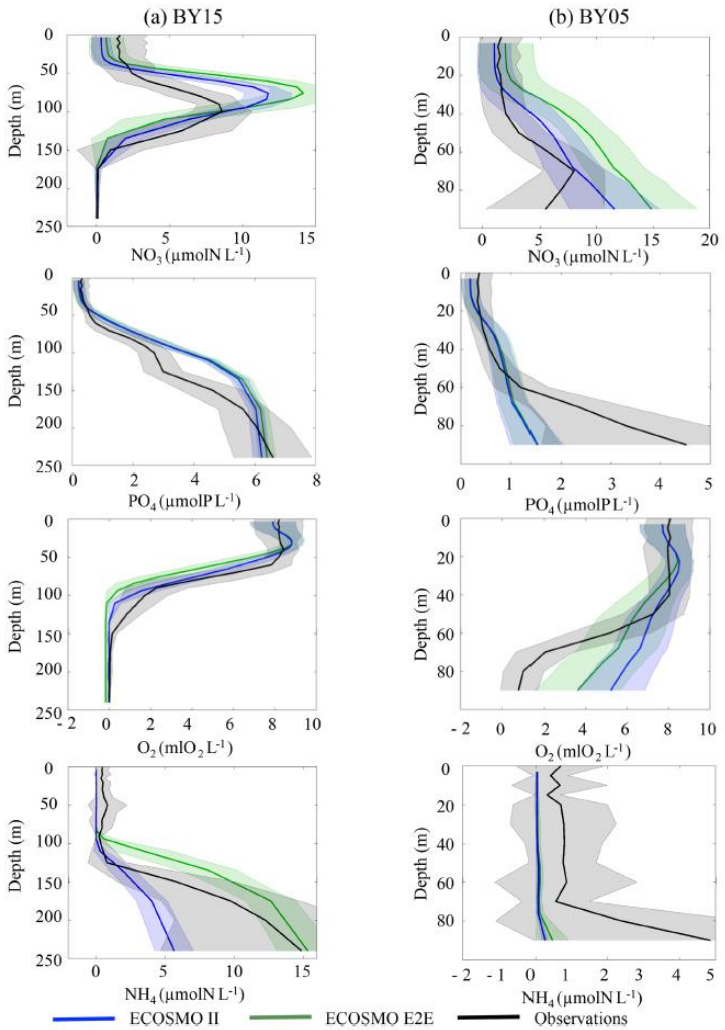


solid: ECOSMO E2E
dashed: ECOSMO II

1980-1989 monthly means

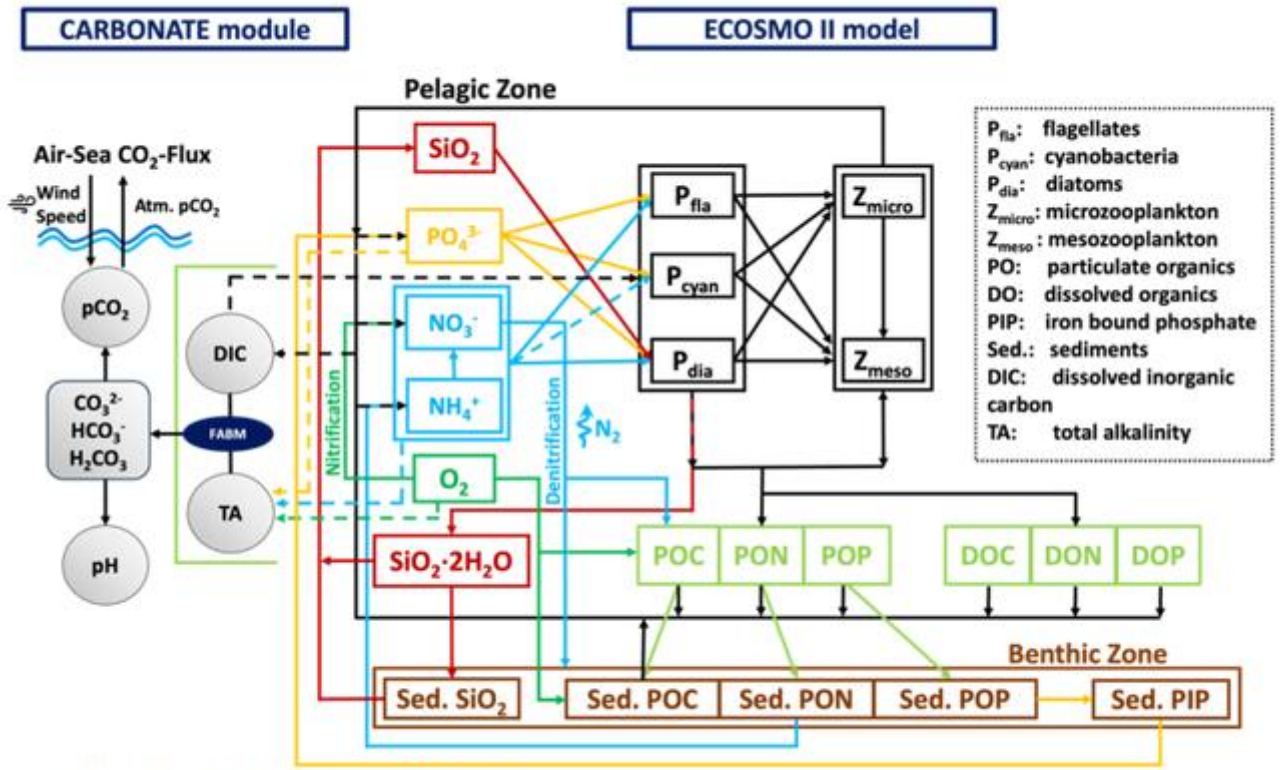
ECOSMO E2E (Daewel et al. 2019)





comparison with HELCOM data 1980-1989

ECOSMO-CO2 (Kossack et al. 2024)



Graphik: Kubilay Timur Demir/ Hereon

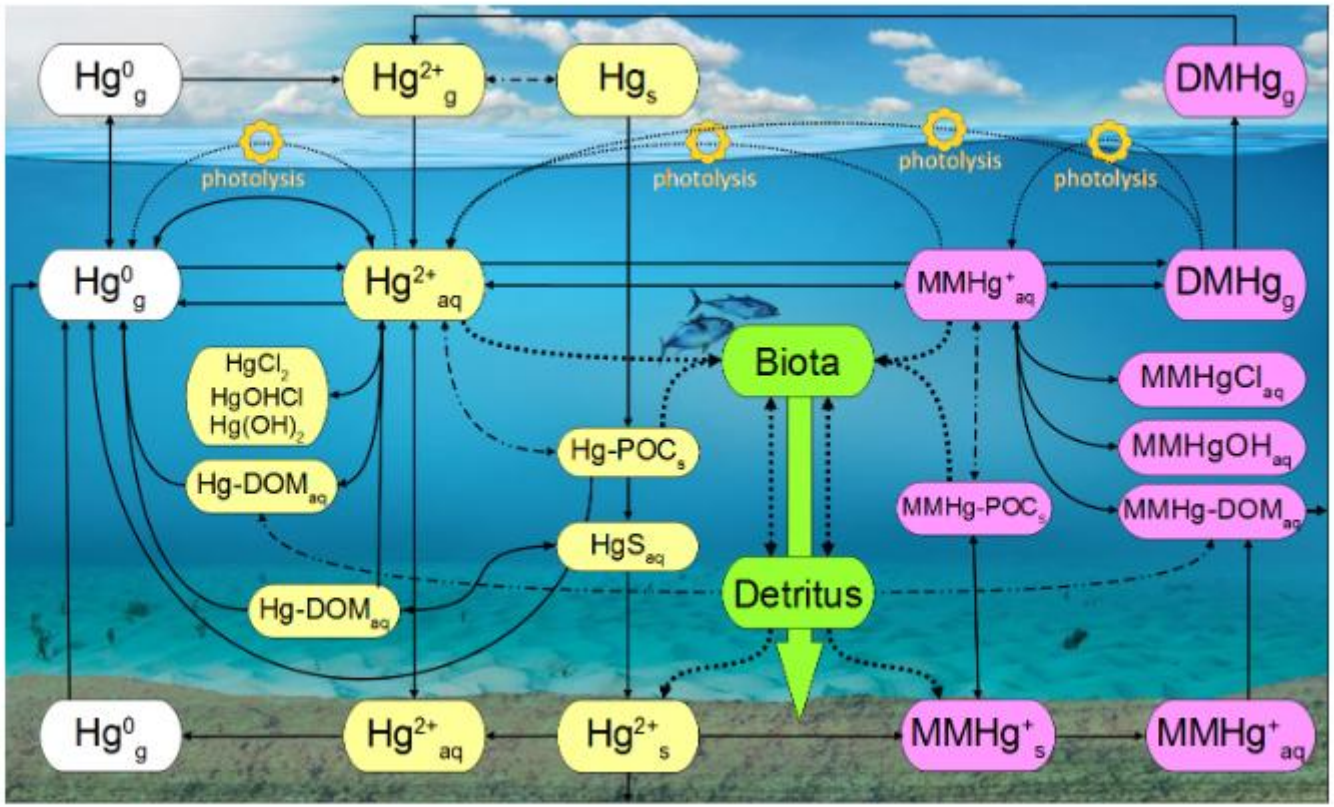
carbonate module (Blackford und Gilbert, 2007)

variable C:N:P stoichiometry (Demir et al. 2024)

ECOSMO-ICE (Benkort et al. 2020)

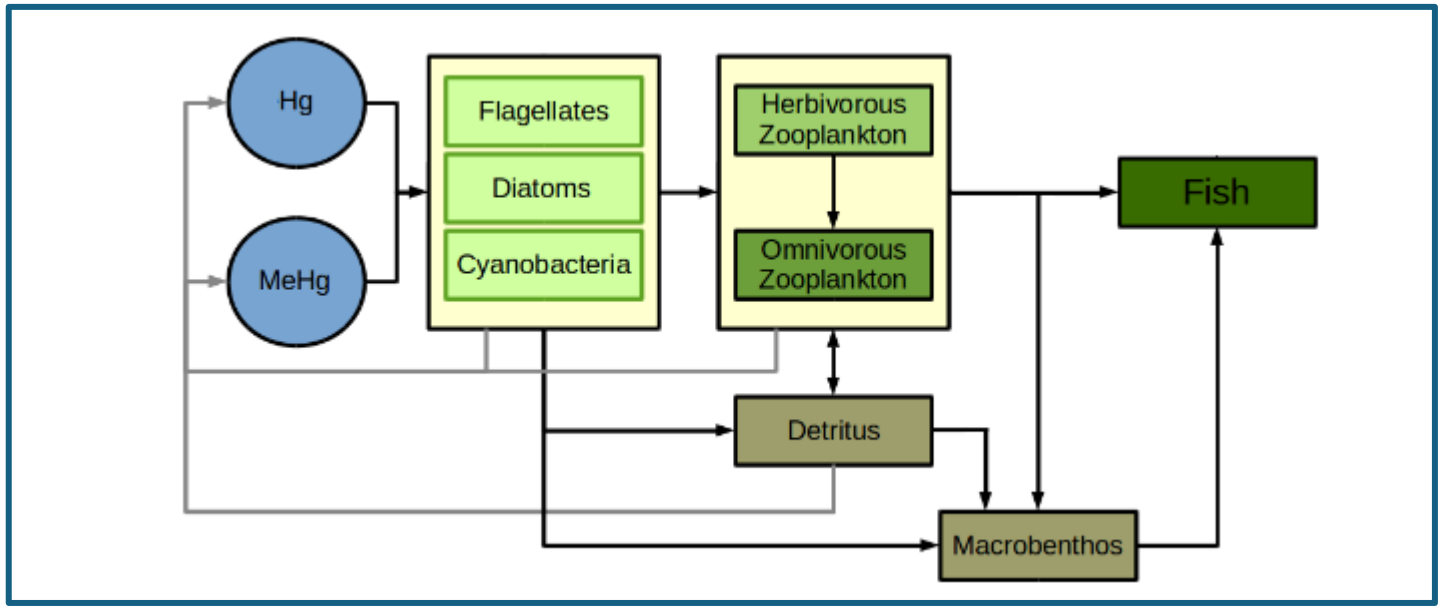
ECOSMO-IBM (Daewel et al. 2008)

MERCY2.0 – ECOSMO_E2E (Bieser et al. 2023)



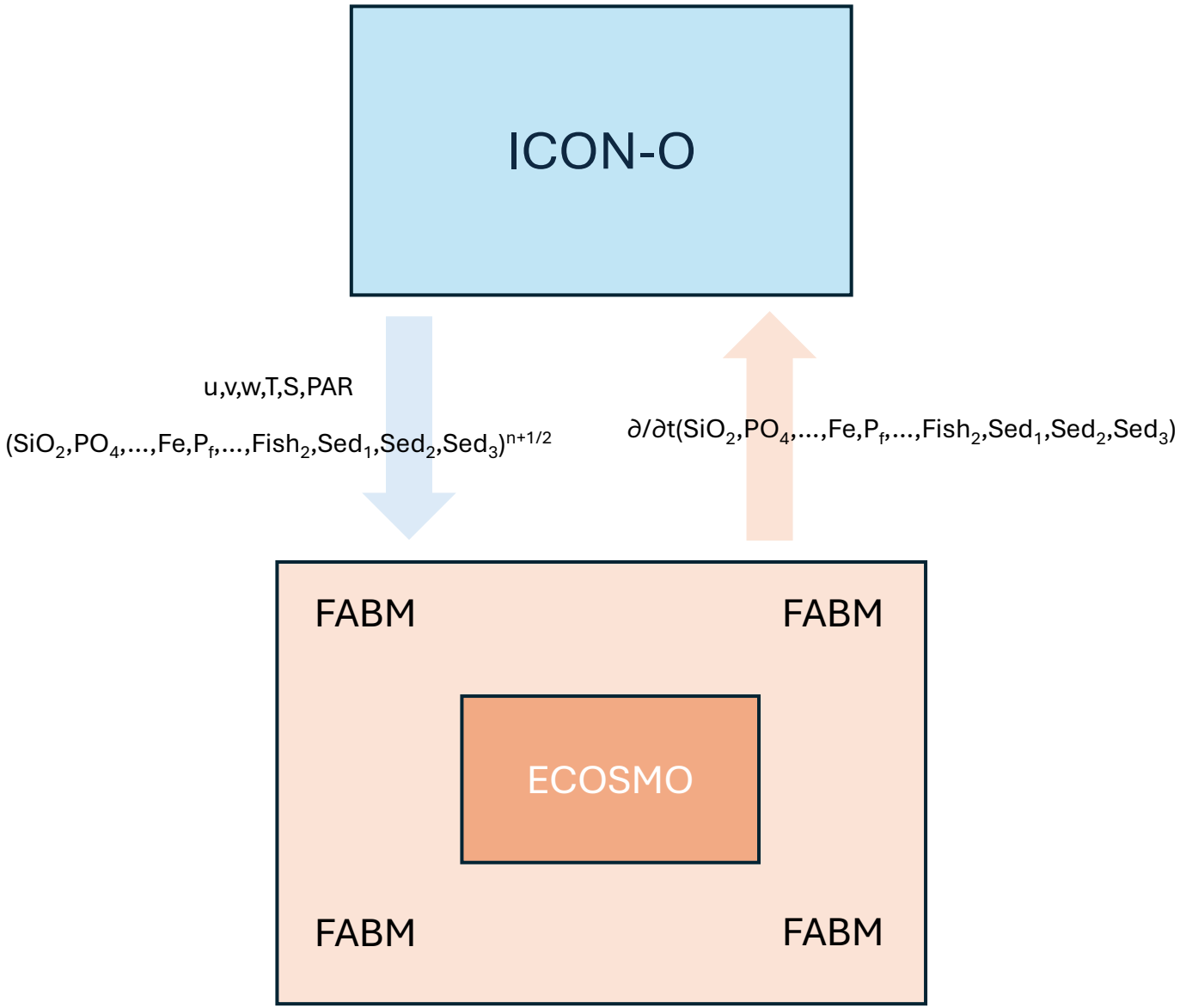
from Bieser et al. 2023

MERCY2.0 – ECOSMO_E2E

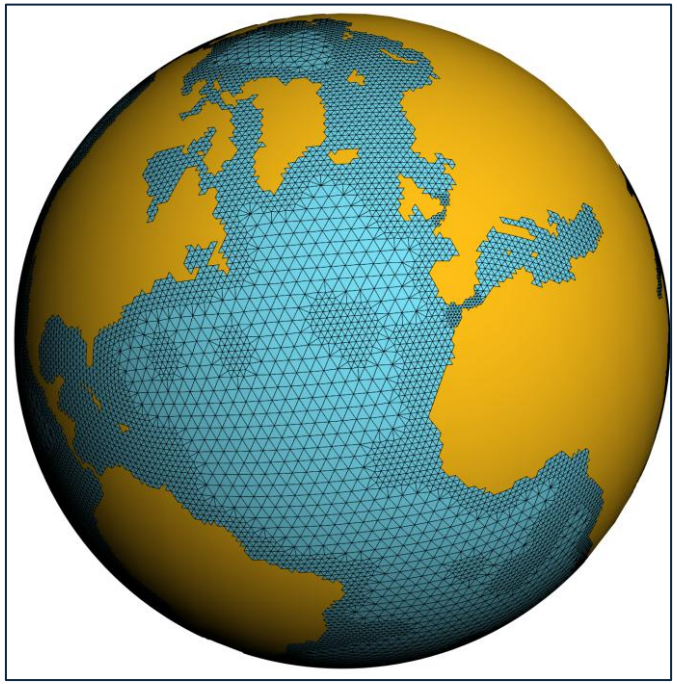


from Bieser et al. 2023

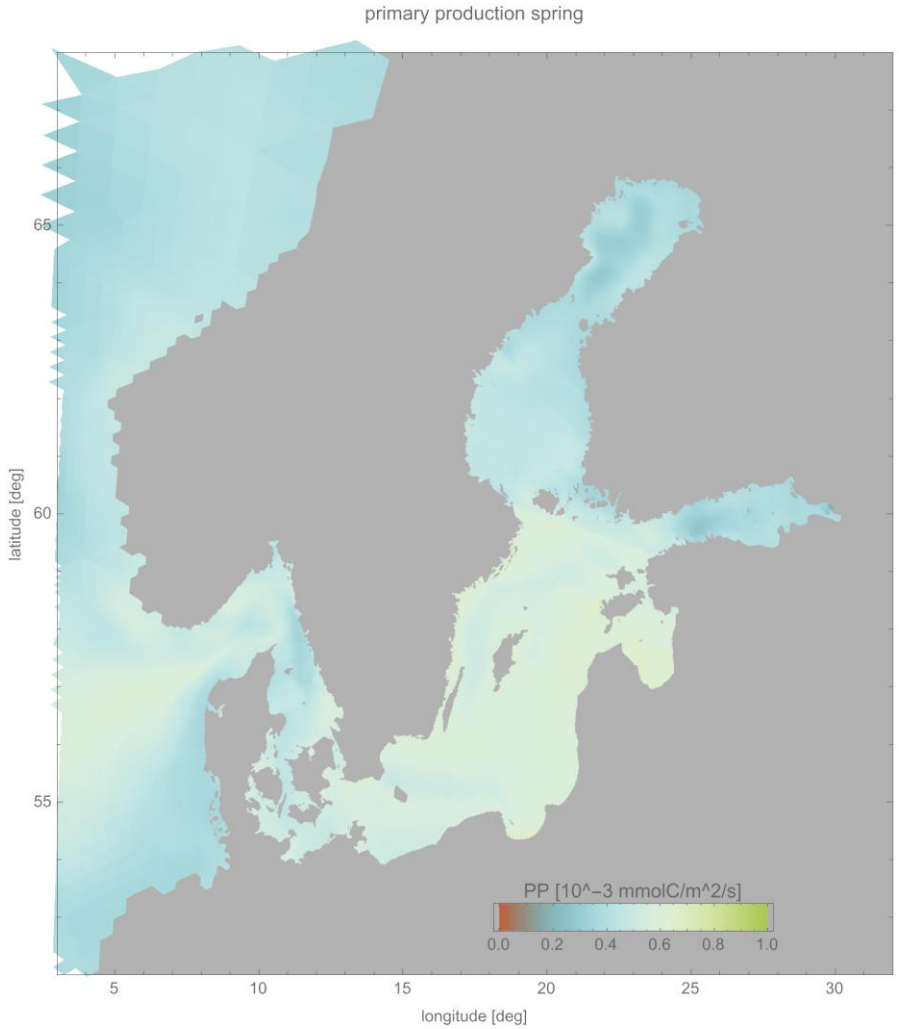
ICON_ECOSMO (Logemann et al. 2024)



ICON_ECOSMO

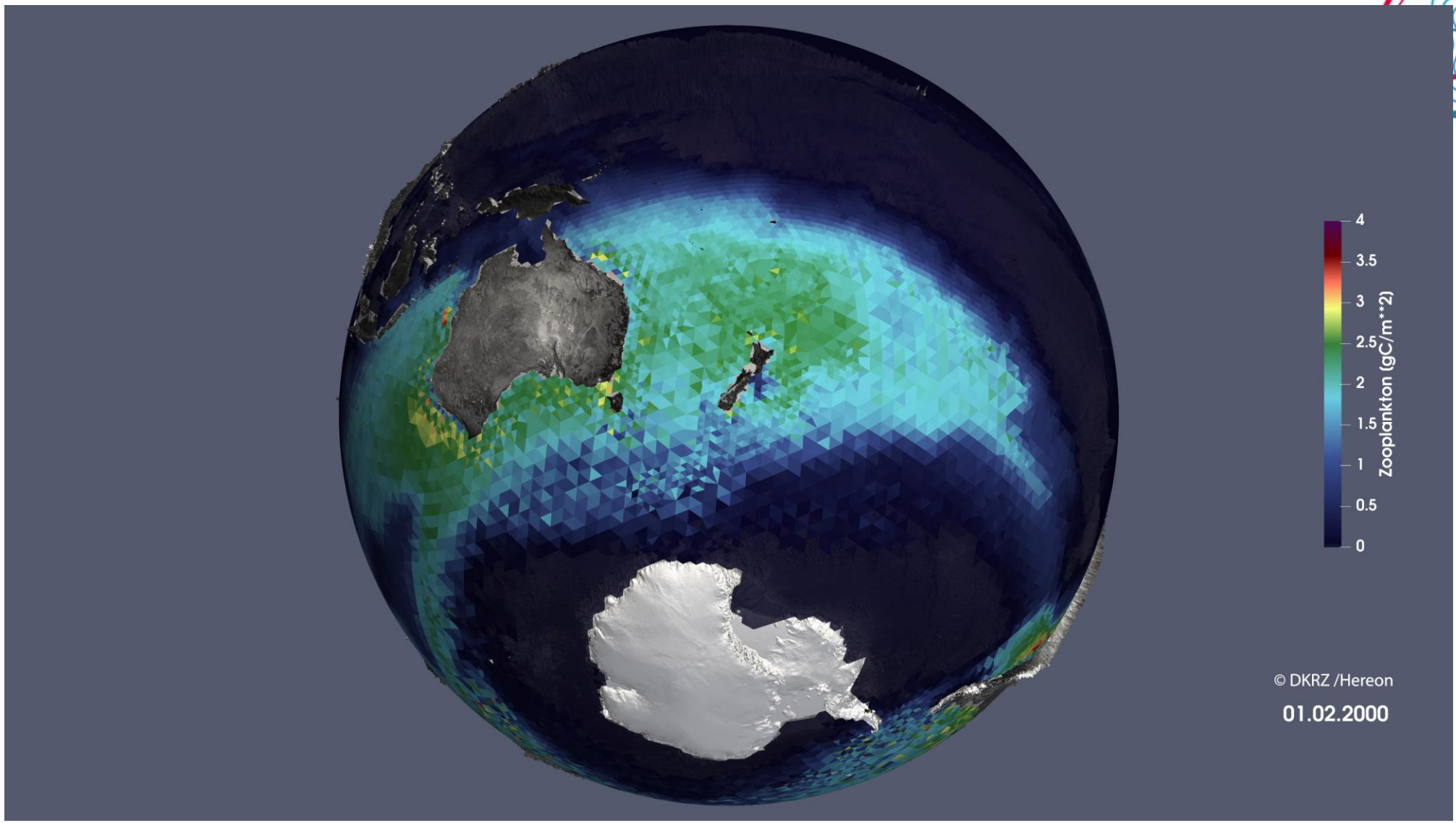


Computational mesh created with IMS 1.3
(Logemann & Klockmann 2025)



Helmholtz-Zentrum
hereon

ICON_ECOSMO



Helmholtz-Zentrum
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