

Interactive comment on “Ecological ReGional Ocean Model with vertically resolved sediments (ERGOM SED 1.0): Coupling benthic and pelagic biogeochemistry of the south-western Baltic Sea” by Hagen Radtke et al.

Anonymous Referee #1

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This paper presents the 1-dimensional numerical benthic-pelagic model resolving biogeochemical processes associated with organic matter degradation in water column, fluff layer, near-seafloor bioturbated marine sediments and solid sediments over a short timescale. The model parameters are constrained by the porewater profiles of dissolved chemical species and bioturbation rates collected at seven sites of Baltic Sea. The goal of the work is to provide a general model adapted to understand the role of different types of benthic sediments for the ecosystem of western Baltic Sea and considered as a basis for 3-dimensional model in the future. I do find the work to be novel

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and important, however, I have some comments that the authors need to address.

Specific comments.

The model description section needs much more explanations; authors should provide more equations and possibly schemes. Sometimes I had a feeling that authors did not want to be understood.

Authors do not validate their model against benthic fluxes which are usually used as the major constraint. Modeled benthic fluxes should be reported and comparison of modelled benthic fluxes to their measured values should be provided.

Authors do not provide any result related to water column. For example depth dependent mean reactivity of sinking organic carbon can be reported.

Having 115 parameters to optimize, authors need to provide a reasonable explanation of how certain local optimum was chosen.

Minor comments.

P.5, L.26: 22 layers with 1mm at the surface is not enough. The grid should be much finer.

P.9, L.21-23: 3% per day, please explain how this number was estimated?

P.10, L.16-18: Please, provide the equation for $DB(z)$.

Eq. 1,2 and 3: Replace φ with $\varphi(z)$, c with $c(t,z)$, DB with $DB(z)$

Eq. 3: Move $\varphi(z)$ out of differential as it is time independent

P.12, L.10-11: This is probably not true. Lateral migration assumes removal of organic particles of all kind but the same time it can be considered as a source of detritus from the other parts of the sea.

P.12, L.19-27: Please provide some general equation for plankton growth here.

Section 2.4.2: Please provide some general equation for phytoplankton respiration and mortality. Also, how do you account for day/night phytoplankton metabolism?

Section 2.4.3: Please provide some general equation for zooplankton growth here.

P.17, L.17: This simplification should be quantified. For example, you can run the model with constant and depth-dependent porosity and show that the results (benthic fluxes, porewater profiles) are similar.

Section 2.7.1: Very hard to understand, more detailed explanation is needed. Some equations/schemes would help.

P.22, L.25: Sedimentation rate is 0.00001 per day. Is this correct? I would say it should be 10 times higher.

P.23, L.15-16: With $\omega = 0.00001\text{d}^{-1}$ 100y is not enough to fill the column with solid species, nor does it work with $\omega = 0.0001\text{d}^{-1}$. It basically means that sedimentation is neglected in the model.

Section 4.2: In this section authors need to specify the boundary conditions for each functional level (water column, fluffy layer and sediments). Mathematical formulation of boundaries (fixed concentration or gradient) is needed.

P.24, L.20-21: How the weighting function was applied?

P.25, L.4: AHR-ES abbreviation is given without explanation.

P.25, L.16: “We used 200 ”individuals” ”. Please, bring the formula to calculate the number of individuals required by AHR-ES.

P.25, L.4-18: What is the rational to put this in the paper? I think it is not needed as long as you do not compare all major evolutionary strategies.

P.25, L.27-28: “The optimisation converged after 30 iteration steps and reduced the error function from 6363 (the value obtained by previous manual tuning) to 4797”. In

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other words, this optimization provides the result which is just 25% better than original guess. Necessity of this optimization is questioned.

P.25, L.29-31: How many optima have been found? What can you say about sensitivity of the model to the different parameter groups?

P.26, L.18-20: This should be mentioned right after P.23, L.15-16.

P.26, L.31: 23km away? I would consider it as a different station. You should at least clearly mark the point representing this site on the plots.

P.27, L.11-12: Please provide modeled fluxes of dissolved species through sediment water interface and compare them to measured values or the values typical for each region.

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