

***Interactive comment on “Assessment of a physical-biogeochemical coupled model system for operational service in the Baltic Sea” by Z. Wan et al.***

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The manuscript by Wan et al. describes the assessment of the Danish ecological model of the Baltic Sea, i.e. the HIROMB-BOOS hydrodynamical model coupled to the ERGOM biogeochemical module. As the model equations have been described in previous papers, this manuscript focuses on an extensive comparison between the model results during a two-year period (2007-2008) and the measurements of temperature, salinity, DIN, DIP, DO and chlorophyll at 18 stations. Four metrics have been applied to the data in order to assess different aspects of the model reliability : coefficient of determination  $R^2$ , Nash-Sutcliffe model efficiency, OSPAR cost Function and relative

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bias. The strength of this assessment relies in his extensive data base, covering all types of regions in the whole Baltic, from the shallow coastal zones to the deep central zone. According to visual examination of the figures as well as to the quantitative assessment given by the 4 metrics, this model fits remarkably well to the measurements of temperature, salinity and DIP, and reasonably well to the chlorophyll. Surprisingly, as the Baltic is world-known for its permanent anoxia in the deep central trench (Conley et al., 2009), the only severe discrepancy between the model and the reality concerns the bottom hypoxia of the central deep ! As organic matter probably does not accumulate in the model deep layers, no exhaustion of dissolved oxygen occurs in the central deep areas, leading to a high and slightly increasing permanent stock of deep DIN, which is totally opposite to the real situation !

So, the work presented in the paper looks impressive, and this ecological model certainly has promising capabilities...but I should ask 3 questions:

1/ Can a model of the Baltic be considered as operational if it fails at simulating one of the most famous ecological problems of the Baltic, i.e. this deep, central "dead zone" ?

2/ Is this assessment really different from a classical, off-line assessment of a model: the chosen period (2007-2008) is recent, but not in quasi real-time, and this model seems not to be actually providing real-time forecasts on the internet, does it?

3/ Why are satellite images of sea surface temperature and chlorophyll not used to re-inforce the assessment (which is already very comprehensive, I agree) ? So, my global impression is favourable, but perhaps, the deep anoxia should require a better modelling before this model can be considered as "operational". My answers to the OS general questions are given below.

Literature cited

Conley, D.J., S. Björck, E. Bonsdorff, J. Carstensen, G. Destouni, B.G. Gustafsson, S. Hietanen, M. Kortekaas, H. Kuosa, H. E.M. Meier, B. Müller-Karulis, K. Nordberg, A.

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Norkko, G. Nürnberg, H. Pitkänen, N.N. Rabalais, R. Rosenberg, O.P. Savchuk, C.P. Slomp, M. Voss, F. Wulff, L. Zillén. 2009. Critical Review: Hypoxia-related processes in the Baltic Sea. *Environ. Sci. Tech.* 43: 3412-3420.

Ocean Science questionnaire:

1. Does the paper address relevant scientific questions within the scope of OS? Yes
2. Does the paper present novel concepts, ideas, tools, or data? New comprehensive data set for assessment of an ecological model
3. Are substantial conclusions reached? Yes for overall validation, but not for the crucial deep central anoxia problem
4. Are the scientific methods and assumptions valid and clearly outlined? Yes, good metrics for assessment
5. Are the results sufficient to support the interpretations and conclusions? Yes for the coastal zones of the Baltic, not for the central deep area.
6. Is the description of experiments and calculations sufficiently complete and precise to allow their reproduction by fellow scientists (traceability of results)? Method well described, but model equations not detailed in this paper
7. Do the authors give proper credit to related work and clearly indicate their own new/original contribution? Yes
8. Does the title clearly reflect the contents of the paper? Not really: what means "operational" in that title? Not really user-oriented and no real-time version on-line for the model.
9. Does the abstract provide a concise and complete summary? The unrealistic simulation of deep bottom oxygen is not mentioned, and the alleviation to an excessive sinking of organic matter looks strange: why oxygen is not exhausted in the deep layers if too much organic detritus is falling ?

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10. Is the overall presentation well structured and clear? Yes
11. Is the language fluent and precise? Yes
12. Are mathematical formulae, symbols, abbreviations, and units correctly defined and used? Yes
13. Should any parts of the paper (text, formulae, figures, tables) be clarified, reduced, combined, or eliminated? Re-write bottom oxygen part, after model re-visiting and re-running if possible.
14. Are the number and quality of references appropriate? Yes
15. Is the amount and quality of supplementary material appropriate? Yes, except for satellite imagery (no image at all!)

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