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Biogeosciences Discussions

Interactive comment on "Link or sink: a modelling interpretation of the open Baltic biogeochemistry" *by* M. Vichi et al.

H. Thomas

hthomas@nioz.nl

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The manuscript by Vichi et al. addresses the biogeochemistry of the Baltic Sea with a special focus on nutrient and oxygen cycles. A complex ecosystem model has been employed and improved in order to analyze time series data of approximately a decade. The paper gives a comprehensive introduction in the relevant features of the Baltic Sea, which allows the reader to follow the paper easily. One strength of the paper is that it openly discusses the advantages and shortcomings of the model, i.e., it is obvious when the model does a good job, but also when it fails or is in contradiction to the observations. Both sides of the model are exploited to improve the understanding of the Baltic Sea ecosystem and finally to point to questions to be addressed by future research. The manuscript is well written and all figures are clear and useful. Some minor revisions are required, notably the section on the different scenarios. Please find my detailed comments below. After consideration of these comments I would be glad to see this manuscript published in BIOGEOSCIENCES and thus recommend

acceptance of this manuscript after minor revisions.

Detailed comments:

P221, l15: response on what? Please clarify

P223, l26: between (“e” is missing)

P226, l13-15: How was the data set by Dobson and Smith (1988) considered for the last years of the present study (1988-1990)?

P235, l1: replace “previously” by “above”

P235, l25-29: This sentence appears to be very long.

P236, l2: I would propose to insert a new chapter here. (For example 5.1: Process oriented experiments). This would underline the contrast to the earlier paragraphs in section 5, which appear to be rather a discussion. One might also consider making the discussion be section 5.1 and then the experiments 5.2 and so on.

P238, l7: Why is the absence of ammonia during winter being considered as puzzling? Ammonia appears to be a rather unstable intermediate product of biological activity. It thus can be expected to be abundant during periods with high biological activity, for example spring and summer, but it should be low in winter, when biological activity is low. Thus, the observations does not seem to be puzzling, it rather would be interesting to see, why the model produces the high ammonia concentrations during winter. How does the simulation of ammonia related to the simulations of nitrate discussed earlier? Would there be a link between the discrepancies in nitrate and ammonia?

P238, l13: proven

P238, l18: The paradox could be explained with the sinking/export of C-rich and N-poor organic matter, for example the polysaccharides described in the first section of chapter 5. A possible export of this kind of material would cause oxygen consumption with reduced N-mineralisation. See also (Thomas et al., 1999). The reduction of summer

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NO_3 in the BIW can also be achieved by a higher and earlier primary production in the surface during spring, which would keep the Nitrogen (in organic form) in the surface layer. This would be in line with the above production of C-rich material, which allows the cells to maintain their cell quota (overflow production), see p237, l1-8. Keeping the nitrogen in the surface layer (rather than removing it more rapidly to the bottom layer) would help solve the above paradox, and would also avoid the simulated accumulation of NO_3 in the bottom and intermediate layers, which are both in contradiction to the observations. An in depth solution of this problem might be beyond the scope of this paper, however the discussion of these alternative solutions might contribute to the understanding of the simulations and ultimately also of the Baltic Sea.

P240, l19 until p241, l16 and Table 1: This section is rather cryptic and it was almost impossible to me to find out the details of the different scenarios. Table 1 hardly helps to understand the scenarios and their differences. Are the inputs carbon or nitrogen, or phosphorus, or all? Please clarify also in the table. The case S2 does not seem to be considered in the discussion. As a general remark to this section I would recommend to clarify the different scenarios and to spend more words/efforts on the discussion of the outcomes, since the message of this section seems to be one of the backbones of the paper. It also would improve the understanding of how eutrophication might affect ecosystems, which is an important part of the paper.

Caption Fig12: Please insert “observational” before data. Caption Fig13: Please insert “observational” before data.

Interactive comment on Biogeosciences Discussions, 1, 219, 2004.