



***Interactive comment on “Investigation on the trophic state of the North Sea for three years (1994–1996) simulated with the ecosystem model ERSEM – the role of a sharp NAOI decline” by H. J. Lenhart et al.***

**Anonymous Referee #2**

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The manuscript describes an ecosystem model for the North Sea (ERSEM forced by physical flow fields from HAMSOM) for three different years. Several budgets are given based on the simulations and based on these the North Sea are found to be net heterotrophic.

From reading the manuscript the questions raised are interesting, but the work has become to much a listing of model outputs, with little general discussion about the results. Also, I am in doubt that the present model structure (box model) is suited for use in the North Sea, even if it is forced with a high quality 3D circulation model (HAMSOM). The circulation within the North Sea is complicated, and when averaging

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the flow fields as in the present work, all mesoscale features are lost. This is probably OK when discussing budgets in a steady state, but not when dealing with interannual variabilities. Finally, the link to the NAO seems meaningless since this is a winter value and the transports into and within the North Sea is wind driven and dependent on the wind regime through the whole year. If NAO is used, the disucssion should be based on an annual index. For this reasons I only recommend the present ms. for publication after a major revision.

Some specific comments:

- page 727, line 7. Is this the winter NAO? They are different from those given by Jim Hurrell.....
- page 727, line 15. From the text one gets the impression that ERSEM was the only well suited model, but as I recall that was not the conclusion drawn by Moll and Radach.
- page 728, line 22. It is probably correct that high saline water (above 35?) does not reach the continental coast, but it is not correct to say that water masses entering from the north do not reach these coastal areas.
- page 730, line 9. Oversimplification to say that these effects are minor.
- page 730. What is the time step used in ERSEM, and how often are the boundaries updated from the HAMSOM model.
- page 731, line 15. Fig 2b show that the model in a climatological sense is able to reproduce some of the observed nitrate patterns. Only 1994 is shown. What about 1995 and 1996. Does these perform worse or better?
- page 731. Since the work focuses on interannual characteristics it would be more interesting to see if the model could reproduce some changes in observed

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patterns between the 3 years, not a comparison to climatology that all models should do properly.

- page 732, line 24. Why should there be a connection between a winter index and the annual circulation?
- page 732, line 26. It does not make sense to speak about the whole depth range in a 2 layer box model.
- page 733, line 8. The **net** transport through this section reflects the Baltic exchange. The in/out flows discussed in the next lines is reflecting the Atlantic inflow to the North Sea due to continuity. Also, there is an imbalance in the SK numbers in Fig.4....??
- page 733. Generally speaking, it does not make sense to do this discussion within the box model. Section 5.1 should be redone using the results from HAM-SOM. The box model approach could be done in a steady state setting, but not when examining interannual differences. Also a discussion on upper and lower layers is of limited interest with a 2 layered model only.
- page 734-738. All these budgets are done in the same setting and should be redone with proper horizontal and vertical resolution.
- page 735, line 18. It is interesting to observe that there are no difference in the primary production in the southern North Sea between the three years. Is this also the case in the northern North Sea? As I recall Skogen and Moll (who is one of the co-authors) have shown large interannual differences in primary production in the same area with their models. Why is this not the case in the present setting?

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