

Biogeosciences Discuss., referee comment RC2  
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## **Comment on bg-2021-31**

Anonymous Referee #2

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Referee comment on "Retracing hypoxia in Eckernförde Bight (Baltic Sea)" by Heiner Dietze and Ulrike Löptien, Biogeosciences Discuss.,  
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The manuscript aims to retrace hypoxia in Eckenförde Bight using a general ocean circulation model coupled with an oxygen module. Dissolved oxygen dynamics within the coastal bay are investigated using the coupled model, with additional use of artificial clocks, observations and machine learning techniques. I have some comments with regard to the manuscript and the model settings used.

Comments:

1. The manuscript in its current state lacks literature on general circulation in the EB or the Baltic Sea to support later findings that low oxygen within this bay is imported and not due to local process. I'm assuming there is literature on the physics close to EB to give the reader a general idea to draw conclusions?

2. Due to the rigid walls in the northern and eastern boundaries the model acts like a "tank" and to a certain extent its not suitable for resolving remote processes. While restoration can be effective in constraining the model to prescribed values it does not replace the effectiveness of open boundary conditions.

3. The model is able to capture temperature, salinity and oxygen concentrations because its not allowed to drift freely due to the restoration. Hence the good representation from the MedMix and LoMix experiments in the Taylor diagrams. These two experiments may be representing less "aggressive" diffusivity which is also not countered by inflow as compared to the HiMix hence the good agreement. So in its current state the model is mostly suitable for resolving vertical processes as drawn from conclusions of the evaluation.

4. The higher oxygen concentrations between 30–31°N and beyond 10°E in Figure 16 suggest that there is an almost permanent feature at the boundary possibly due to the restoration and potentially weak boundary conditions which may not be strong enough to push this into or out of EB. Hence the comment that this model is currently suitable for investigating vertical processes. A hovmuller plot of dissolved oxygen in addition to the water age and residence time in Figure 17 could paint a better picture of how these factors are related.

5. Machine learning techniques are generally good in forecasting if fed enough data. The reason why there is discrepancies and between ANNs and the model is because wind may not be driving the flow in the model in EB, again, due the rigid walls and weak boundary conditions. The ANNs are able to perform well with just temperature and not wind, and this should be investigated further as its concerning. It may imply that the oxygen is consumed within EB but this can only be resolved if the boundary conditions issue is resolved.

6. The authors can use the model in its current state to investigate vertical processes or address the boundary conditions issue which is evidently persistent in the results.