

Interactive comment on “Consequences of artificial deepwater ventilation in the Bornholm Basin for oxygen conditions, cod reproduction and benthic biomass – a model study” by A. Stigebrandt et al.

Anonymous Referee #2

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General Comments

This paper describes a model of water exchange through the entrance of the Baltic Sea and the application of the model, coupled with a vertical advection-diffusion model, to investigate deep water salinity and oxygen conditions in the Bornholm Basin of the Baltic. The model is used to assess the potential effects of pumping highly oxygenated, C889

low-salinity near-surface water into the deep basin on the replenishment of the deep water and the consequences for bottom water anoxia. The model uses long datasets (two decades of data) to reproduce inflows into the Baltic Sea as accurately as possible, which then force the advection-diffusion model. The results clearly demonstrate that pumping 1000 m³/s of surface water into the deep basin could have beneficial effects on bottom oxygen conditions and therefore on benthic habitats and communities and ultimately on cod reproduction. The exchange model as presented is semi-empirical, with a high degree of tuning to observations, and may therefore have limited predictive power. However, after tuning the model fits the observations reasonably well, and as model is used in the present paper in hindcast mode only, there is justification for the high level of tuning.

The results presented indicate that this fairly simple model captures the essence of bottom water dynamics in the Bornholm Basin. Although there are clearly discrepancies between the model and the data, the agreement is acceptable for the level of sophistication. More complex coupled hydrodynamic-ecosystem models might produce better representation of the observations, but a simulation of two decades would not be possible. Compromise is necessary, and the results are fit for purpose. Importantly, in the context of the paper, the model reproduces inflows of high-salinity highly oxygenated deep water, and the subsequent decline in salinity and oxygen levels.

The paper is generally clearly written, though see comment below, and the description of the model is detailed. The discussion is rather speculative, particularly concerning the potential impacts on benthic communities and cod reproduction of ventilating the bottom water, although the authors are clearly trying to base their arguments on accepted, published science. Given that many coastal water bodies are at increased risk of eutrophication due to high nutrient runoff, the ideas raised in this paper to tackle anoxia and hypoxia and the associated ecological impacts deserve to be discussed and, in my view therefore, this paper should be published in Ocean Sciences.

Minor Comments

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A schematic of the various exchange flows between basins would be useful to help visualise the relationships between model terms.

Figures 2 and 3: Are the figure legends the wrong way round ?

P1803, L23. "why" should be "where" ?

Interactive comment on Ocean Sci. Discuss., 11, 1783, 2014.

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