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Interactive comment on "Observing and modelling phytoplankton community structure in the North Sea: can ERSEM-type models simulate biodiversity?" *by* David A. Ford et al.

Anonymous Referee #1

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The subject of the paper proposed by Ford et al. is of great interest for the marine ecologists but also for European managers, because very few distributed information is available about phytoplankton biodiversity and its changes caused by anthropogenic nutrient enrichment and warming of continental shelf waters. Contributing to fill this gap through 3D biogeochemical models requires new field measurements of phytoplanktonic functional types to validate the corresponding model state variables, as presented in this paper. Many of the authors of that paper are well-known for their previous important scientific contribution to ecological modelling of the North-West European Shelf.

The text is well written and the figures rather clear; the maps are small, but generally

usable. I suggest using more contrasted "pole" colors in the triangular representation used in figure 11.

As far as the models are concerned, a simple comparison between two versions of 3D-distributed ERSEM model is interesting, but rather difficult to be analysed, because both the physics and the biogeochemistry are different. As a caricatural example, the comparison between the assimilated temperature of NEMO-ERSEM and the free-running temperature of GETM-ERSEM-BFM (figure 4) seems to me inapplicable. Secondly, when strong differences appear, the authors should try to explain more what process (physical or biogeochemical) can be thought to be possibly the main driver.

The Taylor's diagram (Figure 3) shows (as in many models) that chlorophyll and SPM are not so realistically simulated, especially chlorophyll for the GETM-ERSEM-BFM version using the more complex biogeochemistry and sediment modelling, and SPM for the NEMO-ERSEM simpler version. The discrepancy in August chlorophyll is clearly visible on Figure 5: whereas GETM-ERSEM-BFM produces too much chlorophyll in the English Channel and the southern North Sea (especially this bloom in front of the Humber estuary) along with a too poor biomass in the central North Sea, NEMO-ERSEM has too smooth results and underestimates the chlorophyll on the coastal shallow German and Danish zones. For SPM, Figure 6 shows a good adequation for GETM-ERSEM-BFM, but a strong underestimation in the shallow waters for NEMO-ERSEM. So, I disagree a little bit with the authors when they say that "both models were still able to capture the main observed features throughout the domain." For nutrients, the too coarse maps of WOA climatologies don't allow a precise validation; but the authors could try to link the different behaviours of the two versions to their deposition and remineralisation processes : in the central North Sea, GETM-ERSEM-BFM seems to trap too much the detrital forms of N, P and Si. As far as biodiversity is concerned, GETM-ERSEM-BFM clearly gives a more realistic decomposition in phytoplanktonic functional types, while the weakness of diatoms in coastal nutrient-enriched zones seems to be strongly unrealistic in the case of NEMO-ERSEM, even in August.

The discussion could be highly improved by replacing some general considerations by a comparison with results obtained in PFTs simulation obtained by other scientists, especially those using the DARWIN model (Follows et al., 2007)

So, my general impression is that the subject of this paper is a good and actual one, but that the results of the two models used don't support really the optimistic answer given at the end of the paper by the authors: for me the ERSEM model has to be better calibrated before being considered as able to simulate biodiversity. Nevertheless, I think that this paper is acceptable as a milestone one on the long way to biodiversity modelling, but only if the authors add a bibliography-based discussion and lower their optimistic evaluation of their present versions of the model.

Literature cited:

Follows MJ, Dutkiewicz S, Grant S, Chisholm SW. 2007. Emergent biogeography of microbial communities in a model ocean. Science 315:1843-46

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