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Ocean Science Discussions

Interactive comment on "Validation of the NEMO-ERSEM operational ecosystem model for the North West European Continental Shelf" *by* K. P. Edwards et al.

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In general, we agree with most of the reviewer's statements and will amend the text accordingly. Specifically:

1. In most places when an upgrade to the system is described, only the new configuration is described, leaving it to the reader to look up elsewhere what the previous system configuration was. Adding this information would aid the reading of the manuscript. Specifically this occurs when describing the turbulence closure scheme, page 751, L15 and when describing the boundary conditions on page 750, L17. What was the river-scheme in MRCS-PE and how was the original light attenuation formulation in

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NEMO? On page 762, line 2 briefly explained what the nutrient dynamics problem in the previous version were.

We agree with this comment and will add reference to the MRCS-PE system as suggested: for the turbulence closure scheme and the boundary conditions. The river scheme is the same in the MRCS-PE but we will explicitly say this as well. Finally, the NEMO code has several light attenuation formulations available for use – most of which are more appropriate for the open ocean than for coastal waters, which is why we implemented the POLCOMS scheme for the shelf version of NEMO. We can add a reference to the NEMO users guide for more information on the light attenuation formulations within NEMO. Finally, we will add a sentence explaining the accumulation of nutrients within the MRCS domain in the MRCS-PE system.

2. The model region is relatively small and climatological nutrients are applied on the boundary, so the climatology is not ideal to use for validation and this should be mentioned as a caveat in the discussion.

We also agree with this comment and have added the following statement "The comparison with the WOA09 fields is not ideal because the WOA09 nutrients are also being used as boundary conditions for the AMM7-NE system and are, therefore, not independent." after line 19 on Page 761. As the reviewer mentions in the opening paragraph, an independent in situ data set would be preferred for the nutrient validation. This is provided in part with the L4 data and, as we say in the discussion, we are currently investigating other sources of biogeochemical data in the region that we can use for validation.

3. New results from a run with different boundary condition suddenly show up in the discussion section, why not also present the results from this run under Results'?

The main body of the paper is dedicated to the validating the current and previous operational models. While we have used a 2-year hindcast run in order to provide this comparison, in the main results section, the model setups are identical to the

OSD

9, C290–C294, 2012

operational setup. One of the main differences between the MRCS-PE and AMM-NE systems is the use of WOA nutrients for the ERSEM boundaries. So, the additional set of results included in the discussion was provided to help show the effect of including these boundary conditions on the nutrient fields within the domain. On page 762 L6-12, we provide two explanations for the improvement in nutrients with the move to the AMM-NE system. This experiment was included to help understand these possibilities.

4. Abstract: In the abstract, also mention the resolution in km of the POLCOMS-ERSEM. We will add this as it is important for the readers to realize that the resolution of ERSEM within the coupled systems has not changed. The MRCS-PE domain was also $\sim$7km resolution.

5. Abstract: It would be helpful if a sentence describing the nutrient accumulation problem in the MRCS-PE and why it is not an issue in the new model was added.

We have added "and is discussed in Section 4" to "The problem of nutrient accumulation in the MRCS-PE system appears to be solved in the new AMM7-NE system with nutrient dynamics improved throughout the domain. "

6. Abstract: " . . . with nutrient dynamics improved throughout the domain.": This statement Discussion Paper is a bit strong. In my view nutrient dynamics include the biogeochemical cycling as well as the physical transport and I don't think that it has been demonstrated that the overall nutrient dynamics is improved even if the new boundary conditions much improved the overall nutrient concentration values in the domain.

We will change "dynamics" to "fields".

7. Page 751, L5: 'Such errors . . .' please provide references for the statements in this sentence. Agreed. We have included Song and Haidvogel (1994) along with O'Dea et al (2012).

8. Page 752, line 20-22. What were the old values of these parameters and why were they changed? The ERSEM parameter changes is documented in Butenschön et al

OSD
9, C290–C294, 2012

(2012) and we will add the following explanation: Validation of intermediate results with the old parameterisation on the related POLCOMS AMM configuration (Holt et al 2012, Butenschön et al, in prep.) have shown too high chlorophyll-a values throughout the domain. Comparison with chl/C data (Gieder, 1997; Sathyendranath, 2009) has suggested a too high maximum chl to carbon ratio as a cause leading to the current parameterisation.

9. Page 754, line 26-28: What is meant by 'online' in this sentence? "Online" is used to refer to the comparisons that are done during the model run as opposed to afterwards. But, we will take the "online" out as it is confusing and doesn't add to the meaning of the sentence.

10. Page 761, line 761: This paragraph seems to fit better in the 'Conclusion'. We aren't sure which paragraph the reviewer is referring to here?

Minor comments/suggestions:

Page 747, line 6: change "modelling. Ecosystem models' to 'models. These' Agreed.

Page 747, line 20: add 'real-time' before 'snapshot' Agreed.

Page 750, line 12: In the text the resolution is 6 km, in figure 1 it is 7 km, which is correct? 7km is correct and the text has been corrected.

Page 750, line 24: Move 'such as tides' back to before 'needed' Agreed.

Page 753, line 23: Should it be "mg m-2"? Yes, this refers to the initial bed concentration which is 2-dimensional.

Page 755, line 1: It is better to refer to the figure number. Agreed.

Tables:

Table 1&2: Might as well put all three nutrient in the same table. Agreed.

Figures:

OSD

9, C290–C294, 2012

Figure 1 is missing colorbar. We will investigate the best way to add a colorbar to this figure.

Figure 2: It would be nice if the also 'on-shelf region' was indicated on the map. We think that the figure caption explains the on-shelf region well enough. Unfortunately, as the on-shelf region encompasses all of the regions except the offshelf region it was difficult to label it appropriately in the figure.

Figure 3-5, and 9: In these figures including only one colorbar could save some space. Agreed, we will update these figures.

In Figure 9 the coastal contours are missing on the lower plots. We will update this figure to include the contours as well as including only one colorbar.

Interactive comment on Ocean Sci. Discuss., 9, 745, 2012.