

Interactive comment on “Assimilating GlobColour ocean colour data into a pre-operational physical-biogeochemical model” by D. A. Ford et al.

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Thank you very much for your comments. We will address the points you raise in turn, quoting your comments in italics.

“The fact that the other biogeochemical properties are not degraded is another major result, since this multivariate data assimilation was not performed in other studies. This is also comprehensively assessed. Mentioning an improvement is a bit optimistic. For instance, a shift from a negative correlation (-0.25) to a positive correlation (+0.11) in terms of zooplankton relatively to a climatology in a few locations is certainly a good

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step forward, but it is not yet fully satisfactory. Probably more data would be necessary to conclude more firmly on this point, although it is acknowledged that it is probably not currently available.”

We accept that describing the improved correlation with the zooplankton climatology as an “improvement” is a bit optimistic, and will change this to say that there is no evidence of degradation. However we do feel that the assimilation has probably improved zooplankton concentration, this just cannot be supported by observations due to the lack of suitable available data sets. For instance, Fig. 8 shows that the zooplankton concentration is altered due to the assimilation in a manner that would intuitively be expected given the changes to chlorophyll. This is better demonstrated by the figure Fig. AC1 shown below, which we will add to the paper. Annual mean surface zooplankton concentration is shown for each run, and the change due to the assimilation is consistent with the change in chlorophyll seen in Fig. 4. Similar patterns are also seen for phytoplankton and detritus (not shown).

We also believe that the comparisons to in situ observations of nitrate and pCO₂ (which you do not specifically mention here) do show evidence of improvement. However we accept that due to the limited amount of data used in the comparison, and due to the lack of improvement shown in Fig. 9, this evidence cannot be considered conclusive, and we will make this clear in the paper. This point is discussed further in our response to the second anonymous reviewer.

“Also, “no degradation” is a better description of Fig. 9 than “improvement”.”

The word “improvement” is not used to describe Fig. 9. On P712 L15-16 we use the phrase “no major changes to the quality”, meaning “no degradation”. The use of the word “improvement” in the following paragraph referred to the comparison to the

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zooplankton climatology (which, as stated above, we will change).

"It should be stated more clearly and firmly in this paper that putting together all the state-of-the-art elements to assimilate Chla in a coupled model allows a better estimation in terms of the chla estimated by the model (compared to the control simulation), but that it has almost no positive impact on the other variables (but also no negative impact). It is important to mention that improving Chla fields does not necessarily improve other variables fields, at the moment."

We will make clear that we have not conclusively demonstrated an improvement in the other variables, and in particular that the impact on the nutrients, alkalinity and carbon variables is limited. However as stated above, we do believe there to be some evidence of improvement, albeit limited.

"I totally agree that looking at the simulation without physical data assimilation is out of the scope of the present study. But the authors have elements to conclude whether the data assimilation of physical data degrades so much the impact of the data assimilation of chla data that finally the two approaches are incompatible. Mentioning this incompatibility in the combination of these two tools could be a progress for future studies. This point could be addressed further in the paper, since it looks like the authors have enough elements to give a substantial contribution on it, given their experiments."

We will expand the discussion about the impact of physical data assimilation accordingly. In particular, we should make it clear that whilst the physical data assimilation significantly degrades the quality of the biogeochemical fields, we have not shown the assimilation of physical and of chlorophyll data to be incompatible. It is true that

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the errors in a hindcast with both physical and chlorophyll assimilation are greater than those in a hindcast with just chlorophyll assimilation. However the errors are still much lower than in a hindcast with no assimilation. Physical assimilation is currently a source of error for the biogeochemistry, but it is not an incompatible approach, and the chlorophyll assimilation does a good job of compensating for this error. We are currently investigating ways to reduce or eliminate the issues seen, and if this is successful then the demonstrable improvement that the physical assimilation makes to the physical fields should in turn help improve the biogeochemistry (compared to not assimilating physical data).

"P705, L15: In the North of Brazil, it could be possible that the lack of Chla in this place is due to an underestimation of the nutrient input by the Amazon River?"

The model currently assumes there to be no nutrient input from rivers, so this is indeed likely to be contributing to the lack of chlorophyll around the South American coast. Furthermore, these are shelf seas regions, for which the model is not designed.

"Possibly, drawing the Figs. 7 and 10 in a square form would be more clear relatively to the fact that the 1:1 line is the perfect match."

This is a good point, and we will re-draw the figures accordingly.

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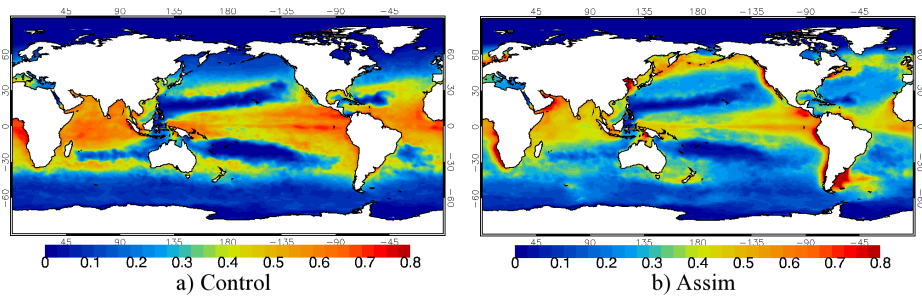


Fig. AC1. Annual mean surface zooplankton concentration (mmol N m^{-3})

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