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Biogeosciences
Discussions

Interactive comment on "Plankton ecosystem functioning and nitrogen fluxes in the most oligotrophic waters of the Beaufort Sea, Arctic Ocean: a modeling study" *by* V. Le Fouest et al.

Anonymous Referee #2

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General comments:

In this paper, the authors attempt to improve our understanding of the Arctic Ocean plankton ecosystem functioning and nitrogen cycling using a coupled 1D model forced with observations. An important effort was made to include multiple compartments and add the photoammonification process, an important addition compared to other plankton ecosystem models. However, the results are not so convincing and the discrepancies with observations not explained enough, especially for NH4. Results for SZ were not specifically presented which prevents the interpretation of the results for some of the variables. And finally, there is confusion in the text about the results with and

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without the photoammonification process. The above should be addressed in order for me to recommend this paper for publication.

Specific comments:

Abstract :

Line 2: Greater stratification in the Arctic, did stratification really increased everywhere in the Arctic?

Line 7: functioning of what?

Lines-12-14: This sentence is not clear, is the “respectively” for surface and depth-integrated or for primary and bacterial production?

Introduction:

The authors cite different study for changes in the Arctic. Some of these studies report results for the Arctic periphery, the central Arctic, the eastern Arctic, etc., which are governed by different processes but in the intro they are all discussed as the AO in general. The distinctions should be made as it brings some contradictions in the text.

Lines 2-3: I assume you mean earlier light exposure, rather than greater? Also, could the authors explain why an increase in stratification would promote earlier spring blooms in the Arctic?

Line 6: 40% widening . . . could you precise in what region, that is certainly not every-where.

Line 8: Will grazing and export really be optimized with the greater occurrence of smaller phytoplankton cells (as you mentioned above, Li et al.)?

Line 9: is warming really accelerating, could you provide a reference?

Line 21: most oligotrophic water over what region?

Paragraph starting at line 25: I do not agree with the authors. An improved physics in the coupled models is the most important factor to obtain realistic plankton dynamics and production rates (e.g. circulation, mixed layer depth, freshwater balance, sea ice concentration and thickness, snow depth, light transfer through snow and ice, etc, to obtain the appropriate amount of light and nutrient, see Popova et al., 2012, JGR, 117, C00D12, doi:10.1029/2011JC007112. A litterature review on AO models is missing here. Also, you should explain why improving the representation of turnover rates in detail, rather than a more simple parameterization would be so important since for this low production period? How your treatment of light related parameters differ from other AO models?

Observations:

Where were these observations taken? Also on Figure 1, modelling site is hardly visible. It should be mentioned clearly that the model was implemented offshelf in the Beaufort Sea as it has implications when comparing with shelf areas or inflow regions such as the Chukchi or Barents Seas.

Model:

How is DONp determined? I am a bit confused with the different types, DON, DONp, DONl. Could you specify the simulation period.

Results:

It would be more instructive to show SZ and detrital PON rather than total PON. From the results (high bact, high SP, high PP even though low LP) SZ appears to be too low.

Line 23 of page 14759: I do not think the note is appropriate since the interest is to see if the model, forced with observations, reproduces observations, which is obviously not the case. The reasons for that should be stated here, i.e., why is the so much simulated NH4?

If SZ is indeed too low, NH4 regeneration should be lower since it is such an important contributor. Is basal mortality too high?

BGD

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Line 23 of page 14763: The sentence should say for the run NOT ACCOUNTING for photoammonification, as stated in the paragraph above and in the legend of Figures 7 and 8. So the results are actually better without this process. The rest of the paper should be modified accordingly.

Interactive comment on Biogeosciences Discuss., 9, 14751, 2012.