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Interactive comment on "Bio-optical characterization and light availability parametrization in two glacial melt water influenced estuary systems (West-Greenland)" *by* L. Holinde and O. Zielinski

L. Holinde and O. Zielinski

lars.holinde@uni-oldenburg.de

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Reviewer2: The paper analyzes the results of the physical and optical conditions in areas influenced by glacial melt-water. Two major contributions are provided:
Contribution 1. Spatial heterogeneity. The paper compares specifically two transect located relatively close (on the west coast of Greenland, figure 1) with CTD, water sampling and optical measurements. The results indicate that there are significant differences between the two data sets (figures 3,4 8 and 9), pointing out the need of regular high resolution monitoring in those sensitive areas to global changes.

Contribution 2. Bio-optical model for light penetration depth. The second goal of the study is to develop a light penetration depth model as a relevant factor for bio-optical studies in Arctic environments. The model predicts the 1 percent light depth based on concentrations of Chl-a, organic and inorganic suspended matter, and CDOM absorption in the water (figure 7).
The contribution1 provides a very much-needed data to understand the optical dynamics in areas under glacial melt water influence, and only for these reason the paper should be promoted for publications (after extended discussion on these aspect). However, I think that the contribution 2 should be re-framed somehow to be included in the paper.
Reply: *Thank you for your helpful comments and underlining the relevance of the topic. Our paper indeed describes the special heterogeneity (contribution 1) and also provides a model for rapid calculation of PAR penetration (contribution 2). We have sharpened and further explained the actual conditions in these coastal systems and the relevance of the 1% depth for biological conditions.*
Manuscript changes: *Author explanation and references were added (e.g. line 36-39).*

Reviewer2: For contribution 2, authors should analyse two main questions:
1) (Q1) Why the output parameter (1 percent light depth) is needed for the scientific community? I think that this question could be relatively easy to answer, after an improved literature review on this subject.
Reply: *We choose the 1% depth as an identifier for light penetration depth because it is easy to recognize and an important well accepted parameter in biological processes as the lower boundary of the euphotic zone.*
Manuscript changes: *Author explanation and references were added (e.g. line 36-39).*

Reviewer2: 2) In the section 4 (discussion) the authors state: “The model is appropriate for rapid estimates of light availability within these melt water influenced Arctic estuaries based on water sample analysis and common bio-optical sensors within CTD

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profiles. The second question would be (Q2) Why is better for the scientific community to use a model (that provides in some cases gross estimations of 1 percent light depth), rather than directly incorporate a PAR sensor in the CTD? Taking into account that, at present; the cost of some PAR sensors could be negligible compared with the global cost of an Arctic survey.
Reply: *The main reason for not using a PAR sensor attached to a CTD is because of shadowing from the ship. This has a huge influence on the measured results. A better solution is using a free falling profiler in some distance from the ship to remove/reduce the effect of shadows as performed in this study. If this is not possible or available our model provides an alternative way to estimate PAR availability. We have added these considerations to the paper to make it clearer to the reader. Additionally, the model can be used to make estimations on changes in the PAR penetration based on changes in the SPMi or Chl a concentrations.*
Manuscript changes: *Methods (section 2.2.1) lines 86 - 88*

Reviewer2: I think that now Q2 would be the most challenging question in the present format of the paper.
Q2B: However, I think that there is an alternative argument to promote the model use: If authors provide good arguments to answer Q1, they could propose that, rather than providing “rapid estimates of light availability” the model could be answer the Q2B: Could the model provide reconstruction of light availability based on historical data records?. With historical series of light availability the scientific community would have a method to reconstruct and to analyze large scale trends (if the authors may provide examples of previous monitoring campaigns with on water sample analysis and common bio-optical sensors within CTD profiles). With this method the scientific community would be able to evaluate the effects of increased melt water discharges related to global changes.
Reply: *Thank you for your suggestions. It would be possible to use the model to calculate PAR values from historically data if this data contains concentrations of Chl a*

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and inorganic SPM. We think that is beyond the scope of our paper. Nevertheless, we added some information about possible results for an increased concentration of SPMi in climate exchange scenarios.
Manuscript changes: *Discussion (Section 4.3) lines 325-328*

Reviewer2: In summary:
1) The authors should re-frame the article considering only Contribution 1, if the authors are not able to answer Q1 and Q2B. 2) The authors may add the Contribution 2, if they are able to answer Q1 and Q2B.
P.D: I suggest to scale figure 4 in the depth range to 0-50 m, since this is the range discussed in the rest of the paper.
Reply: *Thank you for your helpful suggestions. We have improved the paper by answering the questions and sharpen the results of our analysis as explained above. Furthermore, we have changed the depth scaling in Fig. 2 to 100m so it corresponds with Fig. 3.*
Manuscript changes: *see above and Fig 2.*

Interactive comment on Ocean Sci. Discuss., 12, 1537, 2015.