

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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Reviewer3: Review of Bio-optical characterization and light availability parametrization in two glacial melt water influenced estuary systems (West-Greenland) L. Holinde and O. Zielinski, Ocean Science Discussion

General comments: Authors presented a bio-optical study in two fjord systems (Uummannaq Fjord and Vaigat-Disko Bay) in West Greenland. The study is based on a good and rather rare dataset combining a variety of bio-optical characteristics collected during one synoptic campaign in summer 2012. However, in my opinion, authors have not

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put enough effort to thoroughly look into the dataset and explore its full potential.

Reply: *Thank you for reading our paper and giving helpful comments. We changed the manuscript to sharpen and improve the scientific potential. This manuscript is an essential initial step to analyze this complex topic of bio-optical-physical interactions. Further analyses are currently in preparation in cooperation with biologist to get an in-depth view of the biological aspects with regard to Harmful Algae Blooms (HABs).*

Manuscript changes: *Throughout manuscript*

Reviewer3: In the first part of the paper, authors demonstrated that despite being geographically close, these two fjord systems have different hydrographic and bio-optical conditions. Uummannaq Fjord is characterized by lower chlorophyll (fluorescence) and higher SPMi concentrations, while opposite pattern was found in Vaigat-Disko Bay. Despite differences in these two factors (SPMi vs Chl) controlling underwater light regime, in the second part of the article authors proposed a two component parameterization of K_d/PAR based on a merged dataset. This might be partly a reason why the R-squared value ($R^2=0.41$) is so low for the regression between K_d as a function of SPMi and Chl. In my opinion, this is one of the main drawbacks of the study. Even with a limited amount of data, authors are suggested to look at data from Uummannaq Fjord and Vaigat-Disko Bay separately, and maybe try to come up with two separate parameterizations.

Reply: *Thank you for your considerations that splitting the two systems might be helpful to get better results. We have test this and the results were a better for the Uummannaq Fjord ($R^2 = 0.52$) but a bit worse for Vaigat-Disko Bay ($R^2 = 0.40$). Since we wanted to derive a more general model for this area we developed the model presented in the paper. However we have now added this information to the discussion part for a more precise description.*

Manuscript changes: *Discussion (section 4.1) lines 260ff*

Reviewer3: Second major deficiency of the article is the choice of the 1% depth of PAR

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for the modelling part and the focus on this in the discussion. Authors were not able to justify this choice.

Reply: *Thank you for your comment. This was also mentioned by the other reviewers and we have carefully added more information concerning the relevance of the 1% depth and general importance of light availability to the paper.*

Manuscript changes: *Introduction (lines 36-39)*

Reviewer3: Specific comments: Authors presented data from one single cruise representative of summer conditions in two studied fjords. Glacial fjords are known for their strong seasonality in terms of glacial melt and freshwater discharge. During the discussion not much is said about (potential) seasonality of bio-optical conditions and applicability of the proposed Kd/PAR parameterization for other seasons?

Reply: *Due to the fact that we do not have any data on the seasonal behavior in this region we abstained from making predictions. In addition, we have encountered special condition in summer 2012 (see line 29ff). We added information concerning the effects of an increase in SPMi concentrations and its influence on the 1% depth.*

Manuscript changes: *Discussion (Section 4.3) lines 325-328*

Reviewer3: Often, highest concentrations of SPMi are found in the few meters of the water column. According to the description in methods, the uppermost sampling depth was at 3 meters. Do authors have an idea whether the inclusion of data (SPMi and Chl) from the upper 0-3 m would help to improve the Kd/PAR parameterization?

Reply: *Measurements from the first 3m would surely help to improve the model. But it is difficult to obtain this data because measurement systems have problems operating close to the surface (Cheriton 2009). To avoid speculations on the upper 3m variability, we used our model for the available data from below that layer. However, we added some corresponding text to the manuscript to make the reader aware of it.*

Manuscript changes: *Methods (section 2.2.1) lines 73 & 74*

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Reviewer3: There are several corrections that should be made to improve a presentation of data and results. For example, there are a number of geographic names used throughout the text. Unfortunately, none (!!!) of those are shown on Figure 1a,b, which make reading this article difficult and sometimes annoying for a specialist not familiar with this geographic area in West Greenland. The names include: Greenland, Baffin Bay, Uummannaq Fjord, Vaigat, Disko Bay, Disko Island, Perlefiup Kangerlua Fjord, Perlefiup Sermia Glacier, Jakobshavn Isfjord, Jakobshavn Isbræ.

Reply: *We have added most of the geographic names to Fig.1 but it was not possible to add all locations to prevent on overcrowding the map.*

Manuscript changes: *Fig. 1*

Reviewer3: Not being a native speaker, I advise authors to ask their native English speaking colleagues to read through the manuscript.

Reply: *The manuscript was correct with the help of an experienced professional English speaker.*

Manuscript changes: *Throughout manuscript*

References:

Cheriton, O. M., McManus, M. A., Stacey, M. T., Steinbuck, J. V. 2009. Physical and biological controls on the maintenance and dissipation of a thin phytoplankton layer. *Mar. Ecol. Prog. Ser.* 378, 55-69.

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