

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

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Reviewer1: The paper is a very much needed study of the optical conditions in areas influenced by glacial meltwater and the effects of increased melt water discharges related to global changes.

Reply: *Thank you very much for your efforts and time spend on our manuscript. We especially appreciate that you emphasize the relevance of our data and topic. Your comments were very helpful and helped us to improve the paper. Changes we have made are traceable in our marked up version of the manuscript.*

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Reviewer1: The paper address specifically two transect located on the west coast of Greenland with CTD, water sampling and optical measurements. The goal of the study is to develop a bio-optical model to predict the 1 percent light depth based on concentrations of chl-a, organic and inorganic suspended matter, and CDOM absorption in the water. This goal is achieved though it is unclear why the authors selected photic depth as the modelling goal? I did not see anything about photosynthesis and primary production even though 1% light is actually the photic depth where there is a production +/- respiration.

Reply: *The focus of this paper is to describe the bio-optical conditions of the two systems Ummannaq Fjord and Vaigat-Disko Bay. For this goal, in addition to the measurements, a simple PAR model was developed to fill observational gaps and we did not aim it to predict primary production. 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: *Manuscript changes: Author explanation and references were added (e.g. line 36-39).*

Reviewer1: The paper is well organized and the language is okay even though English is not my first language but there are many flaws – statements with no references - and redundant information as “Greenland’s estuary system ... boundaries”. Yes, but I need some references. I know they are there, both from the west and east coast of Greenland. Find the references! In the introduction we are told that the authors obtained data from several fjord of Wes Greenland and Iceland. It might well by, but focus on the data that you present here. Anyway, the scientific level in the paper is low and the authors misunderstand the concept of estuaries. The authors claim that they studied estuaries but there only one or two stations located in estuaries. The rest are placed out the fjord/estuaries on the shelf etc. The paper applies a dynamic concept of estuaries looking at the effects of melt water/fresh water influence and according to

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this an estuary "Is a semi-enclosed area with an open connection to the ocean and with a measurable dilution of the saltwater". The authors mention part of this definition in the abstract but their stations are not located in semi-enclosed areas. Thus, the areas studied are not estuaries. Looking closely at the CTD-profiles there only a few stations with reduced salinity in the surface. The CTD-plots should only show the upper 100 m of the water column to make the plots more detailed to depths of interest regarding the optics (0-100 m) and not 0-500 m. Nevertheless, that it is not estuaries that authors studied makes reading and understanding of the paper misleading, as all interpretation of data are framed by the estuary concept but which is clearly not the right concept.

Reply: Thank you for your concerns towards the term 'estuary'. We have used it because both systems are mostly enclosed by land boundaries. A second factor on favor of the term 'estuary' is a layer of less salty water at the top of the water column (Dietrich et al., 1975, Hume and Herdendorf, 1988). This should now be better visible because we changed the CTD-plots to 100m as suggested. We have removed the term 'estuary' and are now referring to two different coastal systems which we are investigating. This also includes a change of the title in the manuscript. In addition, we have added references concerning the boundaries of the two systems. This should help to clarify the intention of the paper and make it better understandable.

Manuscript changes: *Title, Fig.2, lines 1, 3, 8, 18 and further places in the manuscript*

Reviewer1: I suggest that the authors rewrite the whole paper and frame the data and interpretations in the right context as "Bio-optical properties . . . of the Disko Bay and Uumannaq Fjord" or similar.

Reply: We have carefully added and changed the desired information to clarify the relevance of our observations and the importance of the 1% depth for biological studies. In addition, we have edited the title to highlight the two systems we are investigating.

Manuscript changes: *Title, lines 36-39*

Reviewer1: The authors can model 1 percent light depth. Yes, but how does that model

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react towards a larger input of suspended matter? Run some model scenarios with variable chl-a and SPM concentrations. That would be interesting and scientifically relevant to answer which they do not in the present version. *Reply: Thanks for the advice. As we wanted to focus on the current state of these two systems at the time of the expedition our objective was to supply a method for filling observational gaps. Using the model to make predictions for changing concentrations is however possible. For example, we have run the model with an increased SPM concentration (+50%). This decreases the 1% depth by up to 30% depending on the original SPM concentration. We have added this information to the discussion and conclusion sections.*

Manuscript changes: *Discussion (Section 4.3) lines 328-331*

References: Dietrich, G., K. Kalle, W. Krauss and G. Siedler (1975). "Allgemeine Meereskunde."

Hume, T. M. and C. E. Herdendorf (1988). "A geomorphic classification of estuaries and its application to coastal resource management—New Zealand example." *Ocean and Shoreline Management* 11(3): 249-274.

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