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Biogeosciences Discussions



# *Interactive comment on* "Estimating absorption coefficients of colored dissolved organic matter (CDOM) using a semi-analytical algorithm for Southern Beaufort Sea (Canadian Arctic) waters: application to deriving concentrations of dissolved organic carbon from space" *by* A. Matsuoka et al.

**Anonymous Referee #2**

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General comments

The manuscript entitled "Estimating absorption coefficients of colored dissolved organic matter (CDOM) using a semi-analytical algorithm for Southern Beaufort Sea (Canadian Arctic) waters: application to deriving concentrations of dissolved organic carbon from space." by Matsuoka et al. presents a semi-analytical algorithm for the

remote detection of the CDOM absorption coefficient at 443 nm (aCDOM(443)) from ocean color. The algorithm is designed specifically for use in the Western Arctic Ocean. Although it is similar in concept to the GSM algorithm, this new algorithm includes new parameterizations that help distinguish CDOM absorption from that of non-algal particles. The algorithm was developed using data from field measurements made in the Chuckchi Sea and along the Northern Alaskan slope, and was validated using data collected during the Malina study (vicinity of the Mackenzie River). The algorithm was applied to MODIS Aqua data to derive aCDOM(443) in surface waters of the Southeastern Beaufort Sea during August 2009 (year of the Malina field sampling). A published relationship between aCDOM(443) and DOC (Matsuoka et al., 2012) derived from data acquired during Malina was applied to estimate corresponding surface DOC concentrations.

Overall, the manuscript is logically organized, written in proper English, and is within the scope of Biogeosciences. The manuscript deals strictly with the development and validation of a CDOM semi-analytical algorithm, but the methodology used appears sound. The CDOM algorithm itself represents a worthwhile addition to the Malina special issue, although I would have liked to see more application of the algorithm. The DOC results represent a weak aspect of the manuscript.

Below are some specific comments (major comments followed by minor comments) that, I think, need to be addressed before publication. I believe they would improve the overall quality of the manuscript.

Specific comments

The following are major comments:

1) The semi-analytical algorithm presented here is less straightforward to apply than an empirical algorithm. The need for this level of complexity could be better justified. A simple way to do this would be to compare the performance of the proposed semi-analytical algorithm to that of a simple empirical algorithm (one that uses a simple band



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ratio Rrs412/Rrs555 for example). The empirical algorithm would be developed and validated using the same data sets used to develop and validate the semi-analytical algorithm. The two algorithms could be compared side by side.

2) It is very important for potential users of this algorithm to be able to easily reproduce this algorithm. Currently, a lot of the information necessary to reproduce the algorithm is scattered throughout the manuscript. The diagrams (Fig. 2 and 7) are useful to describe the algorithm, but I think a step-by-step description of how the algorithm is to be applied would be very helpful to potential users. A clear, step-by-step "recipe" could be added in the appendix and would follow the diagrams of Figure 2 and Figure 7 (or one diagram that combines both). It would provide all the equations and parameters necessary to implement the algorithm in one single location.

3) The results on DOC represent a weak aspect of the manuscript. The relationship between aCDOM(443) and DOC is already published, and no validation nor interesting application of the retrieved DOC is provided. The manuscript is often misleading with regards to how DOC data are used and presented in this study. For example:

Abstract: Line 13-14. The sentence makes it sound like it is a result of this study. In fact the relationship was established in Matsuoka et al. 2012. Please rewrite accordingly.

Materials and Methods: I do not see the necessity of describing the DOC data in the materials and methods because the algorithm relies entirely on a published relationship between CDOM and DOC. Nothing new is actually done with DOC data.

Section 2.2: Section is entitled "Datasets for evaluating the CDOM absorption and DOC concentration algorithms" but the DOC product is never evaluated.

4) I find the description of the k-means clustering a little confusing. The authors explain that an optimum number of clusters is 4 (based on the Calinski–Harabasz index), but they end up mentioning that defining only 2 clusters is enough for CDOM absorption. Please provide a better justification for the choice of cluster numbers.



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5) Overall, the writing style is OK but I would encourage the authors to go through the manuscript again and try improve some of the wordy sentences used. Two examples are the sentences on Lines 6-11 on page 13746, and Lines 9-12 on page 13754. This would improve the overall readability of the manuscript.

The following are minor comments:

Title: I would consider making the title shorter.

Figure 1: I would suggest using only the 200-m and 2000-m isobaths to delineate the shelf and Canada Basin, respectively. The 500 and 1000-m isobaths do not add any useful information and interferes with the locations of some stations. In the caption, please mention that the SBI and MR data are used to develop the algorithm, and the Malina data are used to evaluate its performance.

Figure 4: You could add the word “oceanic” to plot (a) and (c) and “turbid’ to plot (b) and (d) to make it immediately obvious to the reader. Also, why are the +/- 50% lines only shown in plot (d). The terms coastal and turbid seem to be used interchangeably. Please stay consistent with the terms used.

Figure 5 and 6: I would suggest combining these two figures into a single one. If sea ice “concentration” is shown, then a scale of values should also be added.

Table 2: The average error associated with the retrievals (+/- ?? %) would be a useful addition to this table.

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Interactive comment on Biogeosciences Discuss., 9, 13743, 2012.