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Comment

Interactive comment on “Remote sensing the dynamics of suspended particles in the Mackenzie River plume (Canadian Arctic Ocean)” by D. Doxaran et al.

Anonymous Referee #2

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General Comments

The authors have conducted a careful in situ characterisation of suspended particles in the Mackenzie River Plume and considered the implications of these measurements for remote sensing. The study is important, as the region is very sensitive to on going climate change, yet cannot be easily monitored due to its remote location. The approach is sound, and the authors have obviously taken great care to acquire a comprehensive data set in a challenging environment. However, there is a certain lack of rigour in the presentation and interpretation of the results. I believe the manuscript can be greatly improved by providing a clearer assessment of the performance of the semi-analytical

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model derived to estimate suspended particulate material (SPM) from remote sensing reflectance, performing more quantitative and rigorous interpretation of the results and giving some careful attention to the prose.

Specific Comments

p. 5205, title: The title is perhaps not a true reflection of the findings of the paper. I'd like to suggest altering it slightly to something like, "Optical characterisation of suspended particles in the MacKenzie River Plume (Canadian Arctic Ocean) and implications for remote sensing".

p. 5206, line 26: Insert 'will' between 'work' and 'require'.

p. 5208, line 24: Please change 'remote sense' to 'remotely sense'.

p. 5209, line 16: Insert 'a' between 'of' and 'ridged'.

p. 5209, line 17: Insert 'the' between 'as' and 'stamukhi'.

p. 5209, line 23: Suggest changing this slightly to read, "...light limitation caused by solar cycle, ice, ..."

p. 5210, line 2: Please change 'meters' to 'meter'.

p. 5215, line 28: Hooker et al. 2012 is not in the reference list.

p. 5217, line 15 & anywhere R2 is reported: Please include the number of regression points when reporting R2, both in the text and on the plots.

p. 5217, line 23: Delete 'is'.

p. 5218, line 1: Please change 'were' to 'was'. SPM is singular.

p. 5218, line 2: Please tell us here where the deep chlorophyll maximum was located. Was it in the ocean, delta or plume waters and at what depth was it located?

p. 5218, line 9: Do you mean strong variation in SPM concentrations with depth?

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Please clarify.

p. 5220, 1st para.: Please report N (no. of regression points) and some metric of error for regressions like this, e.g. RMSE, MAPE or similar.

p. 5220, line 6: Please change 'were' to 'where'.

p. 5219-5220, regression description: I'm not entirely sure that figures 4a and b are required and here is why: After you describe this regression based on absorption at 440 nm, you then go on to tell us that wavebands around 440 and 675 nm should not be used to retrieve SPM due to the confounding influence of phytoplankton pigments. So, wouldn't it make more sense to explain that you wanted to identify the best wavebands to use for SPM retrieval, show us figures 4c and d, then tell us that due to the influence of pigments and CDOM, bands x, y and z should be avoided? I think you can tell us in the text that a_{ac9} is well correlated (include statistics!) with spectrophotometer ($a_{cdom} + a_p$) without the use of a plot.

p. 5220, line 16: Please be aware that $a_{nap}:a_p$ is not how you have labelled the y-axis in figure 4d. Please make them consistent.

p. 5220, line 25: If you have not done so already in the text, please define beam attenuation and backscattering symbols (c and b_b) and provide units (m^{-1}).

p. 5220, line 28: Report R^2 , N and error metric of the regression line in the text.

p. 5221: See comment above for ALL regressions reported in this section.

p. 5221, line 13: What is the value SPM-specific backscattering coefficient here? Do you mean the average value of $bbp(715)/SPM$ (in units of $m^2 g^{-1}$ – although it is more usual to report specific coefficients in $m^2 mg^{-1}$) for all data points shown? As it is currently written, I'm not sure what you mean in this sentence. Please clarify.

p. 5221, line 21: Please change 'are typically' to 'typically consists of'. SPM is singular.

p. 5221, line 24: Please change this sentence to read, "... as SPM transitions from

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mineral rich to phytoplankton dominated.”

p. 5223, line 21: The resulting mean relationship between $R_{rs}(780):R_{rs}(560)$ and what – SPM? And, what do you mean by ‘mean relationship’ – the fit? Please re-write this sentence to clarify.

p. 5223, line 26 – p. 5224, line 5: You show us the SA and empirically derived behaviours in figs. 6a and b, but how about showing us a plot of measured SPM versus semi-analytically modelled SPM along with statistics? It looks like you have a decent handful of data points to allow this. This would provide an unambiguous assessment of the performance of the SA model. Also, the use of the term ‘cross-validation’ on line 4 is inappropriate. Cross validation has a very specific statistical meaning and involves the iterative calculation of statistical parameters on randomly selected subsets of data from a dataset. This is not what you have done.

p. 5224, lines 10-19: Please explain explicitly how you performed this sensitivity analysis. We don’t need paragraphs and paragraphs of details, but we need something like, “...contribution to total absorption. This was achieved through a series of sensitivity analyses in which the proportion of absorption due to CDOM was varied between x and y, etc., etc. ...” Right now, we figure out you performed sensitivity analyses only at the end of the section.

p. 5224, line 21: What ‘obtained SPM quantification relationship’? The semi analytical one or the empirical one? Please clarify.

p. 5224, last para.: Careful here. I think you need some sort of statement about how you have to assume that adequate atmospheric correction can be achieved and that adjacency effects are assumed to be negligible in MODIS imagery. Do you have any match ups between in situ R_{rs} and satellite R_{rs} that would allow you to make a quantitative statement about this? If not, make it clear what your assumptions are.

p. 5225, line 10: The same again here. You say the first method proved to be ‘suitable’,

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but on what criteria, flagging? That doesn't really tell you anything about whether or not these atmospheric correction schemes are successful for your study site.

p. 5226, line 3: Please change 'were' to 'was'.

p. 5226, line 29: Please change "cross-validation" to something like, 'a correlation was observed between...'. See the same comment above.

p. 5227, lines 1-2: See my comments above re validating the algorithm. "Tends to validate" is not acceptable. Please provide some sort of quantitative means to assess your algorithm. You have a SA model and several measured data points – I think it should be possible.

p. 5227, line 16: Please change "lower" to "less".

p. 5227, line 19: Please change "to be" to "from being".

p. 5228, lines 5-20: In this section, you discuss SPM concentration, yet in figs. 8 and 9, you show bbp(715). Are plots of bbp-derived SPM more appropriate? Also, I don't think you ever refer to fig. 9 (apologies if I missed it). Additionally, in both figures, you show salinity, but it is never explicitly referred to in the text. Either remove the salinity plots, or refer to them in the text.

Whole of section 3.5: Please report number of data points along with R2 and any relevant statistics.

p. 5229, line 14: Please change "dataset to" to "dataset with".

p. 5229, line 14: There are some missing words here. "...carried out during ??? as part of the Canadian..."

p. 5229, line 20: You say "...are therefore in agreement with satellite observations". How? I think you need to very carefully say they are QUALITATIVELY in agreement as you have no means of validating the satellite measurements.

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p. 5230, line 8: How were the monthly SPM concentrations estimated – the SA algorithm? Please state.

p. 5230, line 14: At the river mouth, do you expect bottom reflection or adjacency effects to be important? Please state if you made any assumptions about these effects.

p. 5230, line 16: SPOC?

p. 5230, lines 23-end: These results might be more effectively presented as a table.

p. 5231, Conclusions: Much of this is a discussion and should either be omitted or the section should be re-titled Summary and Conclusions. Also, if you do choose to include all of this material, you cannot make statements like “. . .POC concentrations can be accurately estimated. . .(in situ or remote sensed)” as you have no validation points. You CAN say your results point to the potential utility of remote sensing data. Read through the manuscript and make sure you make statistically defensible statements.

p. 5233, last par.: This is the real conclusion.

Figures: Ensure that the number of data points and errors (where appropriate) are reported on all of the plots.

Fig. 4: Axes labels were too small to read in my copy.

Fig. 7: The left hand side of this figure is cut off.

Figs. 8 & 9: Consider changing to bbp-derived SPM or change the text as appropriate. Also, the (b) panels in both of these figures are never really referred to in the text.

Fig. 10 caption, line 4: Please change “comparisons” to “comparison”.

Interactive comment on Biogeosciences Discuss., 9, 5205, 2012.

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