

Interactive comment on “Patterns of suspended particulate matter across the continental margin in the Canadian Beaufort Sea” by Jens K. Ehn et al.

Anonymous Referee #2

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Review of ‘Patterns of suspended particulate matter across the continental margin in the Canadian Beaufort Sea’ by Jens Ehn, Rick Reynolds, Dariusz Stramski, David Doxaran and Marcel Babin for Biogeosciences

I was very interested to read this manuscript, whose main goal is to develop a relationship between beam attenuation data collected by transmissometers and suspended particulate matter and particulate organic carbon. Much archived transmissometer data exist for this region so finding such relationships could give valuable historic information on suspended particles. This is a very complex region and others have struggled to find statistically significant relationships between these properties in such complex regions. In general, I think that the authors did a convincing job of showing that there are robust relationships.

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It seemed like a secondary goal of this manuscript was to describe the physical forcing responsible for the high or low particulate concentrations. Unfortunately, this is where I think this manuscript fell apart. The interpretation of the physical data was vague and few solid conclusions could be made from the very long discussion. I got the sense that the authors had limited understanding of the physical oceanography of this region.

Perhaps a better approach would be to choose only one physical process that is related to suspended particles. I see the main storyline of the manuscript as a comparison between the attenuation and bottle data. Proof of concept of this relationship could be shown by focusing on only one process, such as the Mackenzie River plume. There is room here for a very thorough study of this process and much new information could be gained on by coming up with concrete conclusions related to one physical process.

I recommend that this manuscript undergoes major revision before it can be reconsidered for publication. Below are several other concerns and suggestions that I have:

- Page 1, line 6 – Several times throughout the manuscript, the authors state that the surface layer is a mixture of sea ice melt and river runoff. While this may be true, the composition of the surface layer hasn’t been quantified so the source of the particles in the freshwater can’t be determined. The authors could attempt a freshwater budget as was done by Yamamoto-Kawai et al. (2008, doi:10.1029/2006JC003858) or they can acknowledge that they don’t know the source of the freshwater or the particles therein.
- The Introduction is in general quite confusing. I think that a more clear description of the region would greatly help readers not familiar with this area. In addition, a stronger literature review of previous SPM and POC work in this region, and the mechanisms that transport these particles, would set the stage nicely for focusing this manuscript.
- Page 2, second paragraph – This paragraph is quite confusing and needs more focus
- Page 3, lines 14-15 – Why weren’t lines 400 and 500 analyzed in this study?
- Page 3, lines 25 -27 – What other depths were sampled in addition to the surface and

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SCM?

- Page 3, line 29 – What is an aliquot?
- Page 3, line 29 – What is considered a sufficient volume of water? Was this based on the time it took to filter or something else? What determines whether a duplicate or triplicate was sampled?
- Page 4, lines 10 to 12 – Some other studies sampling SPM rinse the filters with ammonium bicarbonate or ammonium formate. Could the authors please explain why they didn't do this?
- Page 5, line 8 – Please describe the interquartile range method, with a reference if applicable
- Section 2.4 – Comparison of data between different transmissometers is notoriously difficult due to different calibration values and instrument drift. Is the use of dark voltage offset to allow for comparison of transmissometer data between cruises? If so then could the authors please state the accuracy of this method, with references if applicable.
- Page 6, line 7 – What depth were the other sensors located at on the mooring?
- Section 2.5 – Why were data from only CA05 shown? This mooring is at the edge of the Cape Bathurst upwelling region, which is not particularly representative of the region. Several other moorings have been deployed along the Canadian Beaufort during the study period, 2004 to 2009. Why was only this mooring selected to represent the region?
- Page 6, line 28 – where is the proof that there were strong easterly winds in June 2009?
- Section 3.1.1 – Please add some references to the different water mass definitions.
- Page 7, lines 5-6 – Please see Jackson et al (2015, 10.1002/2015JC010812) for information on Pacific winter water in this region

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- Page 7, lines 10 – 17 – The c_p values in this paragraph don't appear to match those in Figure 2
- Page 7, line 18 – what does the 'strong chl-a fluorescence signal mean? Couldn't they be quantified by discrete chlorophyll samples?
- Page 7, line 22 – What is the source of CDOM in Pacific Winter water? Perhaps more information can be added from Guegen et al., 2012 (doi:10.1016/j.dsr2.2011.05.004)
- Page 8, line 10 – There is no information about the location or methods used for barge sampling
- Page 8, lines 24 – 26 – Why is it not possible to measure PSD using the Coulter technique in low salinity, turbid waters?
- Page 8, line 32 – I disagree with this statement. The relationships shown in Figure 4b are not very convincing. Is the relationship statistically significant?
- Page 9, lines 8-10 – What is the difference between the MALINA and Amundsen data?
- Page 9, lines 18 -20 – Of these three regression analyses, why is only ii) shown in Figure 5?
- Page 9, line 26 – do the authors mean 'nonlinear power function' instead of 'nonlinear least squares regression'?
- Page 12, lines 20 – 26 – Figure 8 is very unclear and possibly incorrect. I can't see the statements in this paragraph supported in Figure 8
- Page 12, line 28 – I can't see the wind speeds in Figure 8a
- Page 12, lines 31-35 – Don't these lines contradict lines 11-13 on page 12?
- Section 3.3.3. This section need much more work. How was cross-shelf defined? What depths were influenced by cross shelf currents? How do we know that the cur-

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rents observed at CA05 were representative of the rest of the region? How was a cross-shelf episode defined? I'm not entirely sure how this section is giving evidence of upwelling and relaxation

- Section 3.3.4 – I don't see the point of this section. What new information does it tell us about SPM and POC in the Canadian Beaufort Sea?
- Page 13, line 29 – Could the authors please be more clear with where the current intensification is observed? I refer the authors to Forest et al (2015, <http://dx.doi.org/10.1016/j.csr.2015.03.009>) for discussion of other strong shelfbreak currents in the region
- Page 14, lines 10-11 – What causes this clear water extension onto the shelf?
- Page 14, lines 24-25 – Is there proof of downwelling return flow and after upwelling?
- Section 4 – I am unclear exactly how the physical observations described in section 3 lead to the listed conclusions in section 4. Much more work needs to be done to understand the physical processes before they can be related to the particle concentrations
- Figure 1 – Please make the CA05 mark larger and easier to see
 - o It is difficult to distinguish between the different colored stars
- Figure 2 – Why is the very freshest water on the western shelf away from the Mackenzie River? It doesn't appear that this very fresh water is correlated with the highest attenuation
 - o It would help the reader understand the text if the stations could be marked on these figures
 - o What does the grey area mean?
- Figure 3 – Why are the error bars backwards?
- Figure 4 – It would help the reader interpret this if boundaries were drawn around the

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3 different defined areas

- o Figure 4b – I don't see very strong, statistically significant relationships here. Also, is the salinity from the same depth that the water was sampled from?
- Figure 6 – It is difficult to see the writing of the different cruises
 - o The data look smoothed. Can the authors please state how they smoothed the data?
- Figure 8 – I really struggled with this figure. It is difficult to interpret, has very small writing, and has a huge amount of information.
 - o The wind and current data in particular were difficult to distinguish. It was near impossible to see upwelling or downwelling as this figure was laid out
 - o I think that the depths in the temperature and salinity plots were mislabeled – the shallower water shouldn't be saltier
 - o There should be some explanation as to why such salty water was observed in figure 8d. Water of this salinity would have to be upwelled from several hundred meters depth, and a significant upwelling event would need to be evident in the wind data.
 - o I don't understand what the different colours mean in 8c
- Figure 9 – Please mark the mooring location on line 100 (CA05)
 - o I couldn't distinguish between the different contour lines
 - o Please include the station locations
 - o The current values don't make sense to me. General definitions in oceanography are that northward and eastward currents are positive and southward and westward currents are negative. Having different definitions makes this figure very confusing