Biogeosciences Discuss., 10, C8311–C8315, 2014
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Biogeosciences Discussions
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Interactive comment on "Absorption and fluorescence properties of the eastern Bering Sea in the summer with special reference to the influence of a Cold Pool" *by* E. J. D'Sa et al.

Anonymous Referee #1

Received and published: 28 January 2014

Paper title: Absorption and fluorescence properties of the eastern Bering Sea in the summer with special reference to the influence of a Cold Pool

Authors: E. J. D'Sa, J. I. Goes, H. Gomes, and C. Mouw

General comments: The authors examined optical properties including both absorption and fluorescence of colored dissolved organic matter (CDOM) in the eastern Bering Sea (EBS) using a large dataset. Spatial/vertical distribution, sources, and photo-chemical/microbial degradation of CDOM are addressed together with hydrographic features and dissolved organic carbon (DOC). These types of analyses are important not only for better understanding of optical properties of but also for primary productivity

of productive EBS as CDOM controls light penetration in the water column. However, this manuscript requires more work. I had to read the manuscript several times to understand exactly what the authors described in the text. The section of Results is particularly difficult to follow. The main reasons are as follows. First, linkages between optical properties of CDOM and hydrography are not well explained. Because these optical properties are explained based on water masses, the hydrography should be clearly examined. Second, spatial distributions of a series of variables (e.g., temperature, salinity, chl flouroscence, DOC, ag355, etc) are not clear, which makes difficult to follow. Finally, some important relationships are missing (e.g., a spectral slope of CDOM (SCDOM) versus aCDOM(λi), which provides a useful information about such as photo-bleaching; SCDOM versus a fluorescence component), is not presented. So the effect of photo-bleaching that the authors mentioned in the text reads like speculation without evidence.

Several specific comments are also provided as below. Taking into account these comments would help for better describing optical properties of CDOM in EBS. After the revision, the paper would be appropriate to a publication in BG.

Specific comments:

-Page L19110 Line 15: 24 $\pm$ 2.25 μm? Not 24 $\pm$ 2.25 * 10ˆ-3 μm?

-Page L19118 Lines 13-15: “Relationships between the CDOM...”. This sentence should be in section of discussion rather than in section of results. Lines 16-20: “However, a decreasing...”. No these trends can be seen in Figure 2. Where do we see data points corresponding to cold pool waters? Same for warmer waters of the south middle shelf. Lines 28-29: “This could be attributed...”. Vague expression. Also, this sentence should be placed in the section of Discussion.

-Page L19119 Lines 1-3: “Similarly, the increase...”. How can you prove that? It would be better to show relationship between SCDOM and aCDOM(λi) to examine the effect of photo-bleaching. In Figure 2d, do S275-295 values increase with increasing temper-

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ature significantly? Line 6: Shouldn't "Chl fluoroscene" be converted into chlorophyll concentrations and shown as log-scale? It could provide a clearer relationship. Lines 7-10: "ag355...". Do ag355 values increase with increasing DOC significantly in the inner shelf and the UP region? Provide statistical values. Again, which data points correspond to inner shelf and UP in figure 2f?? Lines 10-13: "In the UP region...". Low ag355 and high SCDOM in the UP are not clearly shown in Figure 3.

-Page L19120 Lines 3-5: "Chl fluorescence and DOC...". I don't see similar trends between DOC and ag355 in the inner shelf and outer shelf/slope waters in figures 3c and d. Why don't you examine directly DOC versus chl relationship and provide the related statistical values? Also, the latter half of this sentence is rather discussion. Lines 16-19: "Some of the highest...". SCDOM versus aCDOM(λi) relationship would provide a useful information for the effect of photo-bleaching. Again, the latter half of this sentence is rather discussion, not results.

-Page L19121 Lines 25-28: "A lens...". How about the effect of brine rejection during ice formation in winter [e.g., Dittmar, 2004; Matsuoka et al., 2012]?

-Page L19122 Lines 9-10: "The stratification appeared...". Please add density contours to Figure 6 and check it. Lines 10-15: "With ice covering". Apparent oxygen utilization (AOU) would be useful to examine the presence of ice in previous winter. These sentences should be placed in section of Discussion. Lines 15-19: "Patterns in...". Why don't you show Nutrient data? Lines 19-27: "DOC concentrations...". Enhance the ranges of Figures 6d-f to see the patterns more clearly. Lines 21-22: "but was elevated...". I cannot see clear relationship between ag355 and DOC in cold pool is shown in Figure 6. Line 22: "increased biological activity". Apparently, there is no clear relationship between ag355 and chl fluo even in cold pool. Lines 22-24: "However, sections of the transect...". Not clear.

-Page L19124 Lines 7-8: "Fluorescence intensities in the...". How can we know that? Lines 8-10: "Inner shelf...". Not clear.

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-Page L19125 Lines 4-6 and 26-28: Avoid redundancy. Lines 6-10: I'm confused here. Figure 4e suggest that high ag355 values in the inner shelf attributed to river input. If so, the source of CDOM would be of terrestrial origin, not marine source. However, in section 3.2.1, you clearly mentioned that C1 is marine component. C1 is high in the inner shelf. These results suggest that in the inner shelf, both marine and terrestrial origin of CDOM were high. Please verify that.

-Page L19126 Lines 15-18: "However...". Examining relationship between SR and ag355 would be useful to check your conclusion.

-Page L19127 Lines 16-19 & 20-23: According to figures 6 and 12, high chl fluoroscence in the cold pool is not clearly correlated with high values in C4.

-Page L19128 Lines 8-10: "In the surface mixed later...". How did you calculate the averages losses? Lines 10-13: "The earlier ice retreat...". Again, SCDOM versus aCDOM(λi) relationship is useful to check the effect of photo-bleaching. Lines 14-16: "Although, the protein-like...". I cannot really see the clear correlation between chl fluorescence and C4 according to figures 6 and 12. Lines 17-19: Please see my comments on L19128 & lines 10-13 above. Line 20: "to some extent" is a vague expression. Eliminate this type of words in the text. Lines 25-27: Figure 10f shows spatial distribution of SR at mid-depth ($\sim$ 28 m). Does solar irradiation influence optical properties at this depth? Lines 26-29: Please consider the effect of brine rejection regarding ag355 values, S275-295, and SR.

-Page L19130 Lines 14-16: "In contrast, fluorescence...". Relationship between SR (or S275-295) and each component of fluorescence (especially C4) would be useful.

Figure 2: Please add SCDOM versus aCDOM(λi) relationship. This relationship is particularly useful to examine the effect of photo-bleaching. Add explanation for abbreviations (i.e., MS, IS, etc). Figures 5&6: Add density contours. Figure 6d-f: Enhance the ranges. Figure 8: SCDOM vesus a C component might be useful to examine a source of CDOM. Figures 11&12: Add density contours.

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References

-Dittmar, T (2004), Evidence for terrigenous dissolved organic nitrogen in the Arctic deep Sea, Limnology and Oceanography, 49, 148–156.

-Matsuoka, A. and A. Bricaud, R. Benner, J. Para, R. Sempere, L. Prieur, S. Belanger, and M. Babin (2012), Tracking the transport of colored dissolved organic matter in Southern Beaufort Sea waters, Canadian Arctic: relationship with hydrographical characteristics, Biogeosciences, Vol. 9, doi:10.5194/bg-9-925-2012, 925-940.

Interactive comment on Biogeosciences Discuss., 10, 19109, 2013.