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Biogeosciences
Discussions

Interactive comment on "Spectrally resolved efficiencies of carbon monoxide (CO) photoproduction in the Western Canadian Arctic: particles versus solutes" *by* G. Song et al.

Anonymous Referee #2

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General Comments:

This paper presents and compares apparent quantum yield (AQY) spectra for the photochemical production of carbon monoxide (CO) in filtered and unfiltered estuarine, shelf, and seawater samples. Much work has focused on chromophoric dissolved organic matter (CDOM) as a photochemical source of CO (as well as CO2) and the contribution of this pathway to carbon cycling through the remineralization of dissolved organic carbon. Relatively little is known about the role of particulate organic matter (POM). As such, the authors provide novel and significant contributions to the field both in terms of the involvement of particles and differences observed in samples from the

deep chlorophyll maximum layer. While comparison of filtered and unfiltered samples provides insight regarding particle- versus CDOM-based CO photoproduction, I am not convinced that the derivation of a CO AQY for particles (based on mathematical manipulation of the AQY-filtered and AQY-unfiltered) is entirely appropriate. Stronger rationalization is needed for how/why bulk particulate and POM CO AQY were retrieved. The spectral differences in AQY-CDOM and AQY-total should be focused on rather than attempting to isolate the effect of particles alone.

Specific Comments:

Page 16171/Line 14: Do you have any experimental evidence to support your claim that scattering had only a minimal effect? This claim warrants further discussion.

Page 16172/Lines 5–17: There are assumptions involved in the modeling of AQY spectra from measured CO photoproduction rates that lead to uncertainty unless corrected for (e.g., changes in absorption coefficients over irradiation time due to bleaching, conversion of DOM to POM (or POM to DOM), settling of particulate matter, etc.). Furthermore, there is uncertainty associated with evaluating the wavelength dependence of CO photoproduction by fitting a curve to data points generated using cutoff filters. Without evaluating this uncertainty, it is unclear whether equation 6 is appropriate. Can the difference in AQY observed in the filtered and unfiltered samples be completely attributed to particles? Is CDOM producing the same amount of CO in presence and absence of particles? How valid is it to assume that screening/scattering effects are negligible?

Page 16174/Lines 1–12: Particulate optical density was measurement but no other data is given to quantify/characterize particulate matter (suspended particulate matter and particulate organic carbon were not measured). Is there any absorption coefficient/organic carbon data available for this region in the literature that you could use to estimate the quality and/or quantity of particulate material in your samples?

Page 16177/Line 12 – Page 16178, Line 11: This section is difficult to follow. How was

doing a sensitivity analysis to evaluate AQY-POM the first step in retrieving AQY-POM? The approach seems to be given in reverse of how it was applied.

Page 16179/Lines 22-25: How was this done? Did you measure POM? How do you know that new CDOM wasn't produced from POM at the same time that old CDOM was lost (bleached)?

Page 16199/Table 2: Consider including a(total,412) for comparison with a(CDOM) and a(particle).

Technical Corrections:

Page 16166/Line 27: Reference cited should not be given as a web address.

Page 16198/Table 1: Temperature units (degrees C) are given for Salinity rather than Temperature.

Interactive comment on Biogeosciences Discuss., 9, 16161, 2012.