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Interactive comment on "Photodegradation and biodegradation of dissolved organic matter on the surface of the Greenland Ice Sheet" *by* Miranda J. Nicholes et al.

Anonymous Referee #1

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This paper examines the photodegradation and biodegradation of algal-derived dissolved organic matter (DOM) on the Greenland Ice Sheet (GrIS). Filtered bulk-ice-melt and extracted-pigment samples were exposed to artificial radiation tracking the evolution of DOC, absorbance and fluorescence of DOM. The light-exposed samples were subsequently inoculated with microbial isolates from the GrIS. This is a well written paper. The methods are largely sound, but I have one major concern regarding self-shading (inner filter effect). Basically, given the large absorbance values, I wonder if the CDOM nearest the light was shading the CDOM behind it which means that the absorbance and photodegradation were underestimated. It is my understanding that the filtered ice and pigment extracts were placed into "250 mL pre-combusted Pyrex

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crystallising basins" which were placed directly under the lamps [Sections 2.1 to 2.3]. How deep was the sample in these basins (pathlength)? Given absorption coefficients of 200 /m at 254 nm (Figure 1a) and a 1 cm pathlength, the absorption coefficient was likely underestimated by 57 % [Hu et al., 2002, Limnol. Oceanogr., 47(4), 2002, 1261–1267]. The same calculation for the pigment-extracts (a254=50 /m) gives a 21 % underestimation. In these calculations I guessed a pathlength of 1 cm (very likely for the absorbance and fluorescence measurements), but this would have to be <1 mm for my concerns to be invalid. If the absorbance was underestimated, then the fluorescence correction in section 2.5.1 and SUVA values are also in error. These errors may be similar for the subset of ice treatments or the subset of pigment-extracts (similar absorbance within each subset, therefore consistent error), but any comparison between the two subsets is invalid. I therefore read the rest of the results and discussion rather superficially (as they will likely change). This is a good study and I would like to see it published, but I would like the authors to reprocess their data [Hu et al., 2002] as it may alter their results substantially.

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