

Interactive comment on “Concentration, sources and light absorption characteristics of dissolved organic carbon on a typical glacier, the northeastern Tibetan Plateau” by F. Yan et al.

Anonymous Referee #1

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This is a well thought out and well written study. It examines the role of dissolved organic carbon in influencing potential snow and ice radiative forcing on a glacier on the Tibetan Plateau. While the major result (a mean of 10% radiative forcing by DOC relative to black carbon) is relatively small, I believe this study is sufficiently novel enough with sufficiently robust results to merit publication in the Cryosphere with only the following minor questions/revisions:

Minor points

1. It is assumed that the strong relationship between Ca²⁺ and DOC (Fig. S3) reflects a primary source for Ca²⁺ and DOC from the same allochthonous source. Could not the DOC however be produced by later autochthonous or heterotrophic biological

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activity within the snowpack/ice surface, catalysed by nutrients associated with the dust? This should be at least discussed, and abstract and concluding statements adjusted accordingly.

2. How was discharge measured? You give the discharge data in the supplementary info, but you need to either a) give details of methods used to discharge at the gauging station or b) cite a reference for this data

3. Line 82 – be better to give numbers of different samples individually here, not just sum of total samples

4. Lijne 82 – how was ice sampled – using an ice axe? Shallow drill? To what depth? Were they also collected in the same plastic bottles after crushing?

5. Line 115 – how were the plastic bottles cleaned?

6. Line 162 – I'd use pre-combusted or pre-baked rather than pre-burned

7. Line 164 – I am unclear as to the methodology here. You state that the experimental samples are first filtered through 0.7µm nominal filters, THEN incubated. But won't the filtration remove much of the biological activity? Plus isn't refrigerating the already filtered samples to act as controls effectively the same as the non control samples? Do you mean instead that samples were actually incubated prior to filtration, and then filtered at each time point then refrigerated? If so, please rewrite. And if so, please state the values of controls and place them on Fig 3. Note that you are unlikely to remove all microorganisms when filtering through the nominal 0.7µm filters, so they shouldn't be expected to be sterile i.e. the initial samples may also have had some biological activity, hence the BDOC values should be seen as minimum values.

8. Line 177 – DOC could also be influenced by microbial activity – see point 1 above

9. Line 189 – again, should mention potential biological activity here

10. Line 198 – you estimate from extrapolation that 43.2% DOC could be reminer-

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alized within 28 days. How does 28 days compare with the likely residence time of supraglacial runoff and river runoff, where will the water be in this time – still in a river, or lake, could the DOC survive long enough to impact additional downstream ecosystems?

11. Line 205 – I don't think Anesio et al 2009 looked at viruses. A good additional reference for viruses would be Bellas et al 2012 'Viral impacts on bacterial communities in Arctic cryoconite' *Env Res Lett* 8 <http://iopscience.iop.org/article/10.1088/1748-9326/8/4/045021>.

12. I found that the number of acronyms made it harder to read. For those used only a couple of times (e.g. BrC for brown carbon, WSOC for water soluble organic matter) I'd write them out in full each time simply to aid readability.

13. There are too many decimal points e.g. in abstract 6,949.4 kg (line 27) should be rewritten as 6,950 kg; 425.8 (line 26) should be rewritten as 426. And the same throughout the main text and supplementary information.

14. Figures:

Fig. 2. Add in error bars both ways, plus put $n = x$ under each bar for sample numbers.

Fig. 3. I would have thought that the relationship here could also be adequately described by a linear regression. Also, need to put control (refrigerated) values on here.

Fig. 4. Would help to put some lines as dotted/dashed (when printing in black+white)

Fig. 5. Again, be better to have one line dotted or dashed plus have different symbols to aid interpretation when printing in black + white.

Fig. 6. How was discharge calculated and smoothed from raw data?

Fig. S2. Typo – should be elevation, not evelation

Fig S4 – use different symbols for ice and snow to aid readability

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Fig S5 – use different symbols for MAC and AAE to aid readability

Fig S6 – add sample numbers, errors, reduce to one d.p.

15. Tables:

Table 1. Use 3 sig figures throughout (e.g. 332.4 should be 332)

Table 2. Footnote unclear

Table S1. Please clarify resolution – e.g. for snowpack I presume it is vertical resolution, for ice I presume horizontal distance on glacier, or is it calculated vertical distance?

Table S2 BK2 (top line) is out of line. Plus would be better to replace BK numbers with date to show how they encompass the time of study. Could also include the mean + STDEV at bottom

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