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Atmospheric Chemistry and Physics Discussions

Interactive comment on "An 800 year high-resolution black carbon ice-core record from Lomonosovfonna, Svalbard" *by* Dimitri Osmont et al.

Anonymous Referee #2

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This paper describes a rBC chronology from Svalbard that extends from 1222 to 2009. This chronology is supplemented with an impressive multi-proxy approach to determine rBC source attribution as well as a forest fire history. I'm impressed with the body of work presented here, but I am concerned that several weaknesses exist that merit attention before publication. For example, I find that the discussion of rBC and snowpack melting is weak and contains inconsistencies (details below). Further, and I think that this is not unique to this paper, when you're making conclusions based on labile and/or unstable organic proxies, there's been no consideration given to post-depositional processes affecting those proxies, nor possible changes to those proxies during analysis. For example, did you monitor changes in formate during analysis?

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Discussion paper

Where duplicate samples run, etc... Changes in formate, VA, p-HBA, levoglucosan, either post-depositionally or during the analysis are going to have an effect on your interpretation and so should be considered, or at least controlled. More detailed comments follow:

Intro Line 35: Not that I think that you should get into a prolonged discussion about the causes of Arctic amplification, but Serreze and Barry (Global and Planetary Change, 2011) might be a more suitable citation as they explain that it's not simply an albedo issue.

Page 2, line 14: consider changing the word "nowadays".

Page 2, line 20...: I find this argument to be somewhat weak. I don't think that this study seeks to determine source attribution on a global scale, but rather is limited to the Arctic. "BC in the environment" implies a global scale, especially when it follows a summary of northern-hemisphere BC chronologies. Rather than "BC in the environment", maybe consider "BC in the Arctic"?

Page 7, line 22: The rBC flux and concentration records are not similar, but the trends in each record are...

Page 7, line 25: Is this significant correlation between annually averaged rBC and anthropogenic aerosols, or the 11-year moving averages? How was this correlation calculated, because the data does not appear to be normally distributed.

Page 8, line 29: Your qualitative treatment of the "similarities" between LF and HDF rBC records is weak. Arguably, they don't look similar, and the similarities that you propose are lagged, or seem to be... Invoking "local differences in transport, deposition and melting effects" to explain why they don't match is a cop out unless you can provide evidence that these mechanisms are in play.

Page 8, line 40: Is it strange that you don't find the impact of World War II in the rBC record?

Page 9, line 18: Again, invoking melting without providing evidence that it's happened is a cop out.

Page 9, line 30 and onward: This section is difficult to follow with several inconsistencies. 1) evidence for surface melting as indicated by the presence of "local algae" between 1900 and 1940 doesn't match your dip in rBC from 1915-1935. The Svalbard airport temperature record really doesn't tell us anything about conditions that might produce melting at any point during the year, nor does the Arctic temperature anomaly. To me, the strongest indication of melt is the melt index, which spans between 1915-1935, as indicated by your shading, but doesn't cover the entirety of your low rBC period, that spans from ∼1905-1935.

Page 10, line19: Have you provided any evidence that these algae layers exist?

Page 10, line 21: You use possible artifacts associated with sample treatment and/or analytical treatment to explain an anonymously low rBC decrease that doesn't correspond to melt layers. If we accept this, then how would this artifact affect any rBC reading that you've provided? If you're going to invoke the artifact argument to explain an anonymous result, doesn't that undermine the result for any sample that was treated in the same way?

Page 11, line 24: "Formate can also undergo post-depositional effects", such as? Are you referring to, at least in part, biogeochemical processing in the snowpack? Did you test for changes in formate during sample analysis? Were the samples fixed to inhibit microbial alteration during sample preparation and analysis?

Page 12, line 14 and onward: Can these dates be presented as a table? It's difficult to keep track of when presented in the text.

Page 12, line 34: Are you suggesting that fires in Tibet deposited rBC in Svalbard? Do you have any evidence to suggest that rBC would stay aloft long enough to travel that distance? Earlier, you suggested that rBC could be transported from Canada if the

right atmospheric conditions prevailed. I would think that transport from Tibet would be more of a stretch.

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