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## ***Interactive comment on “Sources of light-absorbing aerosol in arctic snow and their seasonal variation” by D. A. Hegg et al.***

### **Anonymous Referee #1**

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The present study is an interesting and important work on the sources of light-absorbing aerosols in the arctic snow. It uses e.g. different ratios of vanillic acid to levoglucosan to infer and justify two different types of biomass burning sources. The paper should be published after taking the following comments into account which deal to a large extent with the justification of the statistical analyses:

- The authors do not describe how they calculate the error matrix for the PMF calculation - The authors should do a more careful job justifying their 4 factor solutions. The authors use e.g. the term optimal solution on page 13765. The term optimal should be grounded on more than just Q. - How does the solution vary with  $f_{peak}$ , different starting values for PMF, etc. How robust are the results obtained taking rotated PMF solutions. How do 5-factor or 6-factor solutions look like? Why were they not taken into

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account. A lot of these details could be described in supplementary material. They can use as an example Ulbrich et al., ACP, 2891-2918, 2009. to see how this can be done.

- Some results are based on Doherty et al. and Grenfell et al. which are not published yet .. so the authors need to give more details if they include data from their unpublished work. It is not fully clear how non-BC LAA is calculated. What is the justification of the absorption exponent of 5.0 (p. 13760, line 22).
- How do different assumptions on the angstrom exponents change the results here.
- Mass absorption efficiency in line 26, p. 13760 .. for which wavelength.
- In the paragraph 13757 line 21 – 13758 line 12 there is no discussion on the transport patterns only on the time of emissions.
- P. 13762: how do the results change if a different altitude is chosen (e.g. 300 meters or 1000 meters) ..
- Literature on the use of the angstrom exponent to quantitatively derive the wood burning contribution should be added. Favez et al. (2009b) is based to a large degree on the work of Sandradewi et al. (ES&T, 3316-3323, 2008). .. See also Sandradewi et al. (Atmos. Environ. 2008) and Kirchstetter et al., JGR, 2004)

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