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Interactive comment on "Properties of black carbon and other insoluble light-absorbing particles in seasonal snow of northwest China" *by* Wei Pu et al.

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Response to Editor

Dear Authors, Both reviewers have an overall positive evaluation of your paper, but both also note significant deficiencies in your work, which may cast doubt on the robustness of your methods and conclusion. Reviewer 1 in particular is not fully convinced by your use of the PMF method. He also notes a lack of detail or erroneous points in your description of analytical methods. Reviewer 2 questions the time-representativity of your data set. He also makes an interesting comment regarding the radiative impact of BC in snow. I encourage you to submit a very carefully revised version, where all measurement uncertainties and data representativity are clearly detailed and their effects taken into account, in particular regarding their possible impact on the conclusions drawn from your PMF analysis. Your modifications will be evaluated critically before possible acceptance of your paper in The Cryosphere.

Best regards Florent Domine

We are very grateful for the editor's comments and suggestions, which are very helpful for us to improve and clarify the presentation of our results. The following are our key point responses to the editor's comments.

Reviewer 1 in particular is not fully convinced by your use of the PMF method. He also notes a lack of detail or erroneous points in your description of analytical methods.

R: We have added a more detailed description of the PMF method, which includes: (1) A more detailed analysis process; (2) The methods of uncertainties calculations; (3) The principles for selecting the optimal PMF results. We also presented a description of the input components and the values of the associated uncertainties in our study. In addition, the character of each component was identified according the signal-to-noise ratio and the effect on tracing emission sources. Details could be found in the Responses to Referee 1 and the section 3.4.1 in revised manuscript.

Reviewer 2 questions the time-representativity of your data set. He also makes an interesting comment regarding the radiative impact of BC in snow.

R: Generally, the sampling sites were selected 50 km away from cities and at least 1 km upwind of the approach road or railway to minimize the effect of pollution from local sources across northwestern China. But we also agree with the reviewer that understanding spatial and temporal differences of ILAPs in snow is still challenges. Therefore, the comparison of the seasonal and interannual variability of the ILAPs in snow was investigated, and the result shows that the differences of ILAPs in snow are relatively small in the Arctic and northeastern China (Doherty et al., 2010; Wang et al., 2013, 2017). We note that further snow field campaigns were still performed worldwide to limit the uncertainties of ILAPs in snow due to the spatial and temporal differences across northern China, the Himalayas, North America, Greenland and the Arctic since 1980s (Cong et al., 2015; Dang and Hegg, 2014; Doherty et al., 2010, 2014; Hegg et al., 2009, 2010; Huang et al., 2011; Xu et al., 2009, 2012; Zhao et al., 2014; Warren and Wiscombe, 1980, 1985). For instance, a similar paper on the mixing ratios of ILAPs in Arctic snow has been widely used for validating modeled snow BC mixing ratios (Doherty et al., 2010). Therefore, we indicated that the datasets in this study can contribute to advancing remote sensing techniques and reducing the uncertainties of the model simulations to enhance our further understanding ofÂăthe climate impacts of ILAPs in snow and ice.

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Please also note the supplement to this comment:
http://www.the-cryosphere-discuss.net/tc-2016-233/tc-2016-233-AC3-supplement.pdf

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