Reply to referee #2

In this paper, the authors try to figure out how important of mineral aerosol in snow and sea ice. Generally, this is a scientific paper with well written on discussing the optical properties of the mineral aerosol and snow/sea ice. This paper fit the scope of the journal, and I recommend this paper could publish without any changes, but only explain the following question.

The authors thank the referee for their good evaluation and supportive comments.

Question 1: Page 23137 equation 2: As I know, the snows and sea ice samples were collected based on field studies (Marks and King, 2014). So the light-absorbing impurities in sea ice were not only include mineral aerosol, but also black carbon and organic carbon. But in this paper, the authors only mentioned the optical properties of mineral aerosol in snow and sea ice samples. Please explain or how to separate the optical properties of BC and OC in sea ice.

In our previous paper (France et al. (2012)), we describe how to separate the effects of light-absorbing impurities from black carbon for snow on sea ice. The following text has been added to the current work:

p 23150 line 13: Light-absorbing impurities other than the mineral aerosol deposits described in Section 2.2 were not considered. In the case of studies considering multiple light-absorbing impurities in the snow or sea ice, France et al. (2012) demonstrated how to separate the effects of light-absorbing impurities from black carbon for snow on sea.

Whilst the authors agree that considering light absorbing impurities other than mineral aerosol deposits such as black carbon or organic carbon would be more realistic, the snow and sea ice were only considered to contain mineral aerosol deposits in this study. Considering mineral aerosol deposits as the only light absorbing impurities was guided by the wish to keep the study simple. Indeed, if the snow and sea ice was considered to contain black carbon, the parameter space would have been too large and therefore identifying the effects from individual types of light absorbing impurities would have made the study more complex. The fact that the snow or sea ice from which the optical properties were obtained from field studies may have contained any black carbon does not affect the findings of this paper. Furthermore, the results from this paper can be used as input for climate models, justifying the use of a single absorber in the snow or sea ice.

Question 2: An important reference by Wang et al., 2013 should be cited because of the optical property of mineral dust in seasonal snow was investigated in that paper. Wang X., S. J. Doherty, and J. Huang, 2013: Black carbon and other light-absorbing impurities in snow across Northern China. J. Geophys. Res. Atmos., 118, 1471/1492.

The authors are grateful to the referee for pointing out this omission. The reference has been added to the introduction of the paper.

[1] J. L. France, H. J. Reay, M. D. King, D. Voisin, H. W. Jacobi, F. Domine, H. Beine, C. Anastasio, A. MacArthur, and J. Lee-Taylor. Hydroxyl radical and nox production rates, black carbon concentrations and light-absorbing impurities in snow from field measurements of light penetration and nadir reflectivity of onshore and offshore coastal alaskan snow. *Journal of Geophysical Research: Atmospheres*, 117(D14), 2012. D00R12.