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Discussions

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Interactive comment on "Development of an improved two-sphere integration technique for quantifying black carbon concentrations in the atmosphere and seasonal snow" *by* Xin Wang and Xueying Zhang

Anonymous Referee #1

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General comments

The authors report the development of a two-sphere integration spectrophotometer for quantitive measurement of the mass concentration of ambient BC (black carbon) and BC in the snow. As BC is a major light-absorbing aerosol, which will accelerate the snow melt after its deposition onto the surface of snow or ice, thus plays a key role in regional and global climate change. The reported instrument provides an important and useful method for measuring BC in snow. By using the developed instrument, the authors investigated the spatial distribution of BC light absorption in surface snow

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Discussion paper

across northern China during Jan. to Feb. 2014. This section is interesting, which may provide a better constrain of BC simulation in the earth system.

I have the following comments to improve the manuscript.

Specific comments

1, Abstract, line 41 and line 42: BC absorption contributed 68.5%-95.9% of total light absorption in the atmosphere and 52.3%-93.3% in seasonal snow over northern China. In my experience, the values for atmosphere air are a bit too high. The wavelength needs to be specified here. Or are they mass concentration contribution?

2, Page 4, line 101, what is the reason that causes 60% error for snow measurement with SP2 method? More discussion will better show the clear advantage of the developed instrument in this paper over the current available methods. Also in line 106, "biases remain", what are the biases sources? I suggest to give a table to list the uncertainties of each instrument for both ambient and snow measurement.

3, Page 5, line 132, is there possible for the loss of light absorption organic aerosol?

4, Page 7, the spectrum information and an example for the data processing for this part are encouraged to be shown in the supporting information. The wavelength should be specified? Did the authors make an average over the selected range?

5, Page 9, line 234, there is a typo. Figure 2 should be Figure 3. How to determine the filter loading?

6, Page 10, Fig. 4 was lost in the text.

7, the results got from TSI method were smaller than that with the two-step method for the snow samples over northeast China (Fig. 6), but the results for Lanzhou were the opposite (Fig. 7). Some more discussion is encouraged to explain the underestimated and overestimated of these two methods?

8, Page 12, line 322, is this method related to size distribution?

9, Page 34, Fig. 3, the Y axis should be S/S0, not –ln(S/S0). The authors gave the fit equation in the figure: y = a*exp(-b*x)+c.

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