**Atmospheric
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Interactive
Comment

# Interactive comment on "The distribution of snow black carbon observed in the Arctic and compared to the GISS-PUCCINI model" *by* T. Dou et al.

### Anonymous Referee #1

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This paper discusses black carbon concentrations in snow near the Arctic Ocean. It presents a useful analysis. I would request the authors to address the following questions and comments.

In the equation for C(h), please state upfront whether h is known at each site or it is estimated, since Figure 1 does not give snowpack depth, only percent of depth. Also, does h vary by site? What is its typical value?

Since the model is run with winds relaxed toward reanalysis fields, it seems to be run as a chemical transport model rather than a climate model, which is defined as a model that predicts, rather than prescribes, meteorology and ocean properties. Please clarify in the text, since the text claims that the model run is a climate model.

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Please provide a summary of BC emissions by source in a table.

Is BC transported vertically in snow and ice in the model? If so, how? If not, how much uncertainty does this bring into the model?

How is wet deposition of BC calculated? Is it based on an empirical function precipitation? Similarly, how is BC dry deposition calculated? Is it a function of size?

It would be useful to see a vertical profile of BC over the Artic and how it would compare with HIPPO data near the Arctic (e.g., Schwarz et al., 2010)?

The authors should provide the ratios of wet deposition to wet plus dry deposition worldwide and over the Arctic and compare with other studies.

P. 11253. "Model results have been interpolated..." What interpolation method was used?

Figure 1. The figure shows percent of total snow depth. It would be helpful to put approximate actual snow depths in the caption.

Figures 3 and 5. The results for each 2007-2009 look similar. I would suggest to consolidate into one average plot for the three-year period.

Figure 6. A scatterplot of modeled versus measured values from this figure would appear not to give nearly the same accuracy of the scatterplot in Figure 4. Please explain why the error in Figure 6 is so much larger than that in Figure 4.

References

Schwarz, J.P., J.R. Spackman, R.S. Gao, L.A. Watts, P. Stier, M. Schulz, S.M. Davis, S.C. Wofsy, and D.W. Fahey (2010) Global-scale black carbon profiles observed in the remote atmosphere and compared to models, Geophys. Res. Lett., 37, L18812, Doi:10.1029/2010GL044372.

Interactive comment on Atmos. Chem. Phys. Discuss., 12, 11245, 2012.