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Atmospheric Chemistry and Physics Discussions

Interactive comment on "Tagged tracer simulations of black carbon in the Arctic: Transport, source contributions, and budget" *by* Kohei Ikeda et al.

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Reply to Short Comments #1

Thank you very much for the helpful comments.

1. Using the GEOS-Chem model, a recent study (Qi et al., 2017a) systematically analyzed the key factors controlling black carbon distributions over the Arctic, such as BC emissions, wet and dry depositions. It would be very helpful if the authors could include this reference and add some discussions on it. Reference Qi, L., Li, Q., Li, Y., and He, C.: Factors controlling black carbon distribution in the Arctic, Atmos. Chem.

Phys., 17, 1037-1059, doi:10.5194/acp-17-1037-2017, 2017a.

Answer: We have added the recent study of Qi et al. (2017a). (Page 2, Line 28; Page 16, Lines 27-29)

2. The authors updated the default BC aging scheme in GEOS-Chem with the Liu et al. (2011) parameterization. However, a recent study (He et al., 2016) developed a new microphysics-based BC aging scheme in GEOS-Chem, which significantly improves BC simulations. Could the authors add some discussions on it? Reference He, C., Li, Q., Liou, K.-N., Qi, L., Tao, S., and Schwarz, J. P.: Microphysics-based black carbon aging in a global CTM: constraints from HIPPO observations and implications for global black carbon budget, Atmos. Chem. Phys., 16, 3077-3098, doi:10.5194/acp-16-3077-2016, 2016.

Answer: We have added He et al. (2016) to point out the importance of microphysics-based parameterization of BC aging. (Page 2, Line 27; Page 16, Lines 27-29)

3. The authors updated the BC wet scavenging by reducing the ice cloud scavenging rate. On the other hand, BC wet scavenging in mixed-phase clouds is also very important. Qi et al. (2017b) improved the BC wet scavenging in mixed-phase clouds in GEOS-Chem by incorporating an empirical parameterization. I suggest that the authors include some discussions on this aspect. Reference Qi, L., Li, Q., He, C., Wang, X., and Huang, J.: Effects of Wegener-Bergeron-Findeisen Process on Global Black Carbon Distribution, Atmos. Chem. Phys., In press, 2017b.

Answer: We have added Qi et al. (2017b) to mention the importance of wet scavenging in mixed-phase clouds. (Page 2, Line 28; Page 16, Lines 27-29)

4. For the authors' information, Qi et al. (2017c) used a GEOS-Chem adjoint model to analyze the sources of surface black carbon in the Arctic. It would be useful and informative if the authors could discuss the consistency and/or inconsistency between the present study and Qi et al. (2017c) study in terms of the analyses and/or con-

clusions. References Qi, L., Q. B. Li, D. Henze, H. L. Tseng, and C. He: Sources of Springtime Surface Black Carbon in the Arctic: An Adjoint Analysis, Atmos. Chem. Phys. Discuss., doi:10.5194/acp-2016-1112, 2017c.

Answer: We have added Qi et al. (2017c) to reference (Page 3, Line 14). Qi et al. (2017c) focused on source contributions of the Arctic BC on a relatively shorter time scale (April 2008). We compared our results with previous studies that treated source contributions on seasonal and annual time scales. Thus, we would like to include the study of Qi et al. (2017c) only in the introduction section.

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