

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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The authors used a tagged tracer method to assess the transport and emission sources of BC to the Arctic. It's a very interesting study and the topic is very important. I have a few short 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

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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.

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.

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.

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 conclusions.

References

Qi, L., Q. B. Li, D. Henze, H. L. Tseng, and C. He: Sources of Springtime Surface

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Black Carbon in the Arctic: An Adjoint Analysis, Atmos. Chem. Phys. Discuss., doi:10.5194/acp-2016-1112, 2017c.

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