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Atmospheric Chemistry and Physics Discussions

Interactive comment on "Microphysics-based black carbon aging in a global CTM: constraints from HIPPO observations and implications for global black carbon budget" *by* C. He et al.

Anonymous Referee #2

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A microphysics-based BC aging scheme is developed to replace the simplistic treatment of BC aging with a fixed e-folding time in GEOS-Chem. The scheme takes three processes into account to parameterize BV aging, i.e. condensation, coagulation and chemical oxidation, and their relative importance are discussed. GEOS-Chem simulations with the new scheme predicts a 2–6 higher BC aging rate than that from the fixed aging scheme over polluted continents, resulting in a better agreement of BC concentrations compared to HIPPO observations. A series of sensitivity experiments are performed to test the key parameters in the scheme. The scientific results and the improved model delivered in this study are of interest to the whole aerosol modeling community. I believe the paper merits publication in ACP after addressing the following

minor concerns.

Considering that BC largely affects aerosol optical depth in the atmosphere, it is interesting to know if such an improvement in BC treatment helps to reduce uncertainty of the simulated AOD in GEOS-Chem compared to satellite measurements.

Particle density, geometric mean diameter, and geometric standard deviation are given when converting aerosol mass to number concentration. Sensitivity experiments in this study have shown the potential large influence of the aerosol representation on the BC sedimentation and wet removal. Can a two-moment/three-moment aerosol scheme [Li et al., 2008] be a better solution for this problem? Some discussions along this line would be valuable.

The chemical oxidation scheme [Poschl, 2001] used in this study was developed long time ago. It would be better to know the uncertainty with this scheme compared to the recent laboratory and in-situ measurements [Khalizov et al., 2013; Qiu et al., 2012; Wang et al., 2013].

Suggested references:

Li, G., Y. Wang, and R. Zhang, Implementation of a two-moment bulk microphysics scheme to the WRF model to investigate aerosol-cloud interaction, J. Geophys. Res., 113, D15211 (2008)

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Y. Wang, A. Khalizov, M. Levy, R. Zhang, New Directions: Light Absorbing Aerosols and Their Atmospheric Impacts, Atmos. Environ., 81, 713-715 (2013)

Interactive comment on Atmos. Chem. Phys. Discuss., 15, 32779, 2015.