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Atmospheric Chemistry and Physics Discussions

Interactive comment on "Contribution of ammonium nitrate to aerosol optical depth and direct radiative forcing by aerosols over East Asia" *by* R. S. Park et al.

Anonymous Referee #1

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Review of "Contribution of ammonium nitrate to aerosol optical depth and direct radiative forcing by aerosols over East Asia" by Park et al.

This paper estimates the contribution of ammonium nitrate to AOD (aerosol optical depth) and ADRF (aerosol direct radiative forcing) over East Asia, based on CTM and radiative transfer simulations with data assimilation technique. Of novel interest, the paper specifically evaluates CTM performance for ammonium nitrate and firstly estimates the influences of NH4NO3 formation on AOD and ADRF.

The authors use sound methods and the conclusions are supported by the evidence.

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Interactive Discussion

Discussion Paper

In addition, the paper is well written and clear. Therefore, I recommend it for publication in ACP after minor revision. Detailed comments below:

1. In this work, the authors evaluated CMAQ-estimated particulate concentrations by comparing with EANET-measured concentrations, especially for three particulate species (nitrate, sulfate, ammonium; Figs. 4-6). Why do authors only estimate the contribution of ammonium nitrate to AOD and ADRF? As the authors indicated in Eq. 4, the contributions of several particulate species, such as ammonium sulfate, elemental carbon, organic mass, to AOD and ADRF should be presented and discussed in the end of section 3.3. The concentration of ammonium sulfate and their radiative effects over E. Asia will be comparable. One figure or summary table will be enough.

2. The wavelength dependency of aerosol optical properties, such as AOD, SSA, and g, are properly considered in the radiative transfer calculations. But, in this paper, the authors only mentioned that AOD and SSA were estimated at a wavelength of 550 nm (Sec 2.3). Detailed descriptions should be added. In addition, how the authors considered the vertical distribution of aerosols in radiative transfer calculation?

3. Have the authors check the accuracy of ADAM-estimated dust concentrations? Dust aerosols in spring may largely contribute both scattering and absorption of aerosols.

4. In this study, the authors only show the ADRF at the surface, but atmospheric forcing and ADRF at the top of the atmosphere should be presented and discussed. In addition, it should be added how the AERONET ADRF were calculated (e.g., Fig. 12).

5. In this paper, it is hard to evaluate ASSIMILATED-AOD by comparing monthly-averaged AERONET AOD. How the comparison given in Fig. 10 was made? Is assimilated AOD for only daytime is considered? Showing a comparison between assimilated AOD and AERONET AOD for simultaneous (or hourly mean for only day-time) is needed.

6. P19202 L25: ". . ...the cloud bottom height was assumed to be 200 m above the

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surface following the. . ...". Under this assumption, where the aerosol layer is? Below the cloud layer or above the cloud layer? It is unclear how the authors calculate ADRF under all-sky conditions. Another issue that what's the accuracy of MODIS-derived cloud top height.

7. Minor technical corrections: P 19196 L 16, Title of Section 2.6, and so on: use "radiative transfer model" instead of "radiative transport model". SBDART is not a transport model.

Interactive comment on Atmos. Chem. Phys. Discuss., 13, 19193, 2013.