

General comments:

The current paper compared the simulated size distribution of inorganic aerosol components with the observation in USA and Canada. The evaluation of simulated size distribution is very important for evaluating model performance in simulating impacts of air pollutants on human health and environment. However, long-term and multi-station monitoring of such data is hard to obtain since the MOUDI observation usually needs money and labor. However, the current paper has overcome the limitation by collecting data from the several sets of field campaign across USA and Canada from different years and compared them to one long-term simulation data. The target of the manuscript is well within the scope of the current journal and the manuscript is well written and organized. Therefore, the current manuscript will be accepted after the authors reply to the referee's minor questions and comments, either general or specific, and revise the manuscript, accordingly.

One thing I would like to confirm is about the treatment of hygroscopic growth effects on both measured and simulated aerosol size distribution. My question is at what relative humidity aerosol size distribution was supposed to be measured by the MOUDI system, ambient, room, or even drier than both. Also, is the relative humidity consistent with that used for the derivation of simulated size distribution of chemical components? If the both humidity values are not consistent with each other, it is natural that the measured and simulated size distributions are inconsistent even though the simulation of aerosol size distribution is perfect. Please clarify the humidity measured and used for the calculation.

Throughout the manuscript, the authors discussed overprediction or underprediction of the peak diameter but it was not clear if the discrepancy is significant or minor. Are there any statistical measures for predictability of peak (or width) of the modeled size distribution?

Specific comments:

[1] p. 3866, ln. 4: "which includes updates to" updates from which version? 5.0.0, or previous?

[2] p. 3866, ln. 13: "AERO6" needs reference.

[3] p. 3869, Eq. (2): " $D_{gv}$ ". If  $D_{gv}$  represents geometric volume mean diameter as noted in ln. 21 of p. 3869,  $\sqrt{\rho_j}$  is better to be excluded from Eq. (2). If  $\sqrt{\rho_j}$  is included in Eq. (2),  $D_{gv}$  could be  $D_{gva}$ , e.g. aerodynamic diameter of  $D_{gv}$ , or something like that.

[4] p. 3873, ln. 21-24: “The PILS data ... which partially accounts for the scatter in Fig. 5.” It is a little bit ambiguous statement. If MOUDI gives accurate average of PILS and the durations of averaging are common for MOUDI and the simulation, the substantial variation of PILS does not account for the scatter in Fig. 5. Or, did you intend to mention the artifact of MOUDI, namely, chemical reactions occurring on the filter during the long duration, whereas PILS gives more accurate values? Please be specific.

[5] p. 3874, ln. 17-25: How does the model treat  $K^+$  emission from biomass burning? Judging from Eq. (6), 0.0176 ACORS could be the one but is it so? ACORS might include anthropogenic and biomass burning and so the factor 0.0176 for biomass burning  $K^+$  may vary depending on the relative abundance of anthropogenic versus biomass burning particles in each grid cell. Also ACORS is the coarse mode particles but combustion generated  $K^+$  may exist mostly in the fine mode. Does the model consider  $K^+$  emission in the fine mode, which is just missing in Eq. (6)?

[6] p. 3875, ln. 17: “the total mass of particles with aerodynamic diameters less than  $2.5 \mu\text{m}$ ” Please be a little more specific, e.g. “the total dry mass of particles with ambient aerodynamic diameters less than  $2.5 \mu\text{m}$ ”. (“50% cut-off diameter is  $2.5 \mu\text{m}$ ...” may not be needed here, though.)

[7] p. 3876, ln. 4: “summer” and “winter” Which months? Please specify.

[8] p. 3878, ln. 6-7: “implementation of a new gravitational settling scheme”. It appears a gravitational settling scheme in a previous version has been updated to a new one. In this case, “implementation of a gravitational settling scheme” would be better.

[9] Table 3: “ $D_{gv}$ ” Is it aerodynamic diameter as defined in Eq. (2) or geometric diameter?

[10] Figure 1 (for readers who are not familiar with American geography): The colored circles were hard to be identified. Can those be replaced by numbers or can numbers be added to the colored circles? Also, showing acronyms of sites in the right column of Figure 1 is helpful since only acronyms were used in the main text.