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Interactive comment on "Fine particle pH and sensitivity to NH$_3$ and HNO$_3$ over summertime South Korea during KORUS-AQ" *by* Ifayoyinsola Ibikunle et al.

Anonymous Referee #4

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The authors conducted thermodynamic modeling analysis on the acidity and inorganic aerosol gas-particle partitioning in the South Korea during an aircraft field campaign. The authors also determine the "chemical regime" of PM sensitivity to ammonia and nitrate availability and found that the aerosol formation is always sensitive to HNO3 levels, especially in highly polluted regions, while it is only exclusively sensitive to NH3 in some rural/remote regions. This manuscript is well written and organized, and the topic of PM control strategy is relevant to this journal. However, I am concerned about the validity of the new approach.

In the NPC-pH method, the authors estimated pH without using observed gaseous-

NH3 concentrations. Given that there are many measurement data of gaseous NH3, the validity of the NPC-pH method should be evaluated by using the observed NH3 data (e.g., Calnex or SOAS campaign in Table 1) before the application to this method to the data without the observational NH3 data. Without this verification, the discussion on the PM control diagram with this method is less convincing. I strongly recommend the authors to conduct verification of this method from comparison of the model simulations with and without observational NH3 data.

In addition, the authors showed in Figure 3 that the simulation results diverged with the Guo method with the increase of iteration number. Here, the similar analysis with the NPC-pH method could clearly demonstrate the superiority of the NPC-pH method, so I recommend the authors to include such analysis.

Specific comments:

L246-266: It is difficult to understand the methodology and the results of this analysis. How did you combine datasets of total NO3, total SO4, and total NH4? How many datasets did you prepare? Why did the authors evaluate the NPC-pH method by in-putting total NH4 into the model (and not NH4+ as in Figure 4). In which condition (e.g., ranges of inorganic component concentrations), the results of NPC-pH method deviate from those of equilibrium method (Figure 5).

Figure 1: I'm afraid that the data in this figure is not strictly PM1, but include PM with a size < 4.1 micro-m (NVS).

Table S1 (L374-375): I recommend the authors to add average temperature and RH, so that analysis of Figure 9 could be more informative.