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Discussions

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 #3

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Ibikunle et al. developed a new algorithm to estimate aerosol pH when gas-phase ammonia measurements are not available. They applied this method to the dataset from KORUS-AQ aircraft measurements to identify effective PM control strategies in South Korea using the framework developed by the same group which separates sensitivity of PM to NH3 and HNO3 availability into different domains. This paper presents an important topic, and will contribute to our understanding of the connections between PM level and aerosol pH. This paper is publishable after considering the following revisions.

Major comment:

1. Size-dependent aerosol pH could be very important and interesting to explore. In

Line 168- Line 172, the authors claim that particles are internally mixed in their study and cite some previous work. However, I couldn't find a size distribution plot for different species in the aircraft AMS in Nault et al. 2018 to support this statement. I suggest that the authors include a P-TOF figure from the aircraft AMS in the Supplementary Information to discuss more. From the ground-based AMS in Kim et al., they show that organics dominate fine particle mass in the smaller size range, and are major components in larger size range as well. This brings up another issue of how organic-inorganic phase separation affects the pH estimation method used in this work. I think the authors could extend a little bit more on mixing state and the role of organics in the paper to address possible size-dependent pH.

Minor comments:

1. The term "NVCs" first shows up in Line 127 but is explained later in Line 148. Please explain NVCs in Line 127.

2. In Figure 2 flow chart, when NH3 varies much between iterations (the "yes" scenario), shouldn't the algorithm continue to update NH3total? It seems to me the "yes" and "no" decisions should be reversed here.

3. In Figure 6, it may be a little misleading to use "NH3 – dominant" because it makes people think that gaseous ammonia dominates total NH3 but in reality ÉŻ(NH4+) is high in this region. It can be labeled as "NH3 sensitive" as shown in Figure 1 in Nenes et al 2020a. Similarly, "HNO3 - dominant" can be "HNO3 sensitive".

4. In Figure 6, the caption indicates that the aerosol liquid water content is 10 μg m-3 but in Line 281, the text reads "predicted liquid water content (13.78+/- 10.52 μg m-3)." What is the reason behind the different numbers?

5. Line 349, "ammonium" in the particle phase?

6. Are the PM mass concentrations here PM1? Need to clarify.

7. What is the difference between "HNO3/NH3 sensitive domain" (in Line 365 and in

Line 412) and “NH3-HNO3 sensitivity domain” (Line 381). If they refer to the same domain, better to be consistent. “HNO3/NH3” indicates it is a ratio.

8. Different fonts were used in figure captions in Supplementary Information. Please be consistent.

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