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Atmospheric Chemistry and Physics Discussions
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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 #5

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This paper presents the results of a thermodynamic equilibrium analysis to isolate the NH3-dominant vs. HNO3 dominant regimes by analyzing the atmospheric chemical observations measured during the KORUS-AQ campaign. The authors related the results to the policy of mitigation strategies for high levels of PM concentrations over the Korea. Above all, this study seems to be important in terms of dividing emission reduction strategies into two regimes in terms of policy approaches. Overall, this manuscript seems to deserve publication in acp, suggesting that between two emission reductions (HNO3 vs. NH3), HNO3 (or NOx) reduction is better to be chosen as a priority in emission reduction, than NH3 reduction. However, the current conclusion would become more solid by supplementing the following comments (below).

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Discussion paper

(Key Comments)

1. Before submitting the current comment, I noticed the point of anonymous referee#2, pointing out the implications for policy making: transported nitrate via free troposphere (L48) vs. local concentrations within PBL(1km). I recommend the authors to take a note on the differences from identical tests for two separated synoptic periods (classified by Peterson et al. 2019): Stagnation under a persistent anticyclone (May 17–22) and transported haze development (May 25–31).

Peterson, D. A., Hyer, E. J., Han, S.-O., Crawford, J. H., Park, R. J., Holz, R., Kuehn, R. E., Eloranta, E., Knote, C., Jordan, C. E., Lefer, B. L., 2019. Meteorology influencing springtime air quality, pollution transport, and visibility in Korea. Elem. Sci. Anth. 7 (1), https://doi.org/10.1525/elementa.395.

2. It needs to be stated that HNO3 control does not have the same meaning as NOx control. (e.g., line 367). Even if NOx emissions are reduced, HNO3 generation may not decrease much due to fluctuations in HNO3 generation efficiency. This is related to the non-linearity of NOx-HNO3 reaction from three dimentional atmospheric chemistry viewpoint, rather than from equilibrium perspectives

Fu et al(2020), https://dx.doi.org/10.1021/acs.est.9b07248, Environ. Sci. Technol. 2020, 54, 3881−3889

3. It is worth mentioning that besides chemical equilibrium, there may be a role of ammonia, eg in the oxidation process of NOx:

Li et al(2018), PNAS 115 (28) 7236 7241, doi .org/10.1073/pnas.1807719115, Zhang et al(2020), PNAS 117 (8) 3960 3966, doi .org/10.1073/pnas.1919343117

4. Regarding the NOx control vs NH3 control described in "Summary and broader implications", why not both "NOx and NH3 controls"? Reductions in both NOx and NH3 emissions at the same time seems to be a reasonable approach to reducing both nitrate and avoiding large increases in particle acidity. If there are any advantages of

reducing both, please describe in the manuscript.

(Minor Comments)

5. line 52, 56, 655-656: RSSR, 2016 => RSSR, 2017

6. line 58: rephrase "air quality mitigation strategies", e.g., air pollution mitigation strategies

7. line 425: add the citation info for Wong et al. (2020) to the references section

8. line 701-710: cite Warner et al. (2017) and Womack et al. (2019) in the text

9. Figure 2: need to switch "Yes" and "No"

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