Atmos. Chem. Phys. Discuss.,
https://doi.org/10.5194/acp-2019-1128-RC1, 2020


Atmospheric Chemistry and Physics Discussions
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# *Interactive comment on* "Numerical analysis of the impact of agricultural emissions on $PM_{2.5}$ in China using a high-resolution ammonia emissions inventory" *by* Xiao Han et al.

**Anonymous Referee #2**

Received and published: 10 April 2020

China is one of the largest agricultural countries in the world. The NH3 emissions from agricultural activities in China, such as fertilizer and husbandry, farmland ecosystems, livestock waste, crop residue burning and fuel wood combustion, significantly affect regional air quality and horizontal visibility by contribution to secondary inorganic aerosols. In the manuscript, the air quality modeling system RAMS-CMAQ (regional atmospheric modeling system-community multiscale air quality), coupled with the ISAM (integrated source apportionment method) module is applied to capture the contribution of NH3 emitted from total agriculture (Tagr) in China. It explores that the annual average contribution of Tagr NH3 to PM2.5 mass burden in China was 14-18%. Specific to the PM2.5 components, Tagr NH3 provided a major contribution to ammonium

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Discussion paper

formation (87.6%) but a tiny contribution to sulfate (2.2%). Though the Tagr $NH_3$ only contributed 10.1% of nitrate under current emissions scenarios, the reduction of nitrate could reach 98.8% upon removal of the Tagr $NH_3$ emissions. The results are meaningful, but the explanation for these phenomenon was not enough. I recommend the manuscript to be accepted after some minor revisions, and detail some issues below.

Major points: 1. The most important gas in this manuscript was $NH_3$, but there are no $NH_3$ in Figure 2 in comparing between the modeled and observed results. 2. Why is the $NH_3$ contribution to nitrate small under "rich $NH_3$" conditions and large in "poor $NH_3$" environments? What is the internal logical relationship? 3. The study period is January, April, July, and October, but only the modeled and observed results in January and July are compared in Figure A1, A2, A3 and A4. 4. The author thinks that the obvious deviation between the observed and modeled $SO_2$ in January may be a systemic underestimation due to the lack of emission intensity in this month. Did the lack of emission intensity only appear in $SO_2$? Why are $SO_2$ and $NO_2$ underestimated and $PM_{2.5}$ overestimated? 5. How much $NH_3$ is removed in Figure 7? And it's more intuitive to use a negative value for reduction. 6. Why do the trend of the decrease in ammonium mass concentration accelerate while $NH_3$ emissions is less than 20%? 7. What is the horizontal distributions of the contribution percentage of $NH_3$ emissions to ammonium, nitrate and sulfate mass concentration, respectively? Which aerosol determines the horizontal distributions of SNA mass concentration? Why is the horizontal distributions of $NH_3$ emissions different with the horizontal distributions of the contribution percentage of $NH_3$ emissions to SNA mass concentration?

Minor points: 1. In Figure 6 and Figure 7, it should be the horizontal distributions in January, April, July, and October. 2. In Line 226, it should be “Since $NH_3$ concerns mainly with secondary inorganic aerosols (SNA): sulfate, nitrate, and ammonium formation”. 3. In line 269, what is “TA $NH_3$ emission”? 4. In Line 833, should is it “The regional percent (%) of Tagr $NH_3$ contribution”?

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