

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

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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 PM_{2.5} mass burden in China was 14–18%. Specific to the PM_{2.5} components, Tagr NH₃ provided a major contribution to ammonium

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formation (87.6%) but a tiny contribution to sulfate (2.2%). Though the Tagr NH₃ only contributed 10.1% of nitrate under current emissions scenarios, the reduction of nitrate could reach 98.8% upon removal of the Tagr NH₃ 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 NH₃, but there are no NH₃ in Figure 2 in comparing between the modeled and observed results. 2. Why is the NH₃ contribution to nitrate small under "rich NH₃" conditions and large in "poor NH₃" 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 SO₂ 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 SO₂? Why are SO₂ and NO₂ underestimated and PM_{2.5} overestimated? 5. How much NH₃ 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 NH₃ emissions is less than 20%? 7. What is the horizontal distributions of the contribution percentage of NH₃ 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 NH₃ emissions different with the horizontal distributions of the contribution percentage of NH₃ 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 NH₃ concerns mainly with secondary inorganic aerosols (SNA): sulfate, nitrate, and ammonium formation". 3. In line 269, what is "TA NH₃ emission"? 4. In Line 833, should it be "The regional percent (%) of Tagr NH₃ contribution"?

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