

Interactive comment on “Agricultural ammonia emissions in China: reconciling bottom-up and top-down estimates” by Lin Zhang et al.

Anonymous Referee #3

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This manuscript first derives top-down estimation of growing season NH₃ emissions in China using TES satellite NH₃ retrievals and GEOS-Chem adjoint model. Based on published methodology, it then develops an improved bottom-up NH₃ inventory from fertilizer application and animal wastes in China. It finally applies both the top-down and bottom-up NH₃ inventories in the GEOS-Chem forward model to compare with in situ surface measurements of ammonia and ammonium wet deposition, showing that both the inventories improve the model performance. The manuscript is well motivated, scientifically sound, and well written. I recommend publication after the following comments are addressed.

First, there is a lack of detailed comparison between the top-down inventory and the bottom-up inventory developed by the authors (e.g. spatial, seasonal), as well as a

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lack of discussion if the improved bottom-up inventory would match better with the TES retrieval. They showed that both inventories improved model simulation of surface wet deposition fluxes of ammonium, but this is indirect evidence and hard to interpret with regards to the emissions effect.

Second, it would help future studies if the bottom-up inventory developed by this study can be compared more quantitatively with the existing ones analyzed in the manuscript. A good place would be to plot that inventory in Figure 1 in comparison with the other ones displayed in the Figure.

Third, on line 109 they stated that the difference in bottom-up inventories is due to different base year, but in later places they stated that satellite data do not show a large trend of NH₃ emissions in China and their model simulation was for the year of 2008 only, in spite of the use of multi years of TES observations. So my question is whether emissions would differ significantly by year, and if so, it would improve the scope of the manuscript if discussion could be added on the representativeness of year 2008 emissions they developed as the bottom-up inventory for other years, as well as offering suggestions on how scaling factors can be applied if their inventory is applied to other years.

Finally a technical issue about the GEOS-Chem model. It states that the model uses RPMARES as its thermodynamic module (line 172). I think the GEOS-Chem standard version uses ISORROPIA II thermodynamic equilibrium model. Is there a particular reason why the standard model setting is not used?

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