

## ***Interactive comment on “Atmospheric ammonia and particulate inorganic nitrogen over the United States” by C. L. Heald et al.***

**Anonymous Referee #2**

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The manuscript entitled "Atmospheric ammonia and particulate inorganic nitrogen over the United States" examined atmospheric ammonia and particulate nitrate formation over the US using surface and satellite measurements interpreted with the GEOS-Chem model of atmospheric chemistry. Satellite measurements of ammonia column and in situ aerosol measurements were used to evaluate the model performance. It showed ammonia emissions in the model were biased low over California and the Midwest in spring. It also showed significant model overestimates of nitrate concentrations over the northeast and Midwest. Sensitivity simulations were conducted to test possible causes for the nitrate overestimates. It further examined the seasonal and spatial variability of gas-particle partitioning over the US. The study is comprehensively performed, and the manuscript is well written. I recommend publish on ACP after the following minor comments been addressed.

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### **Comments:**

1. Page 19462, Line 10: Can you include here the typical values of DOF for the ammonia retrievals?
2. Page 19463, Line 19-20: Are the emissions in the model fixed for the three-year simulation?
3. Page 19465, Line 13-15: To my understanding, the regression slope calculated from the reduced-major-axis regression fit does not reflect the overall model bias. The value of the slope equals the ratio of standard deviations of the two variables, so it does not reflect the model bias. I suggest also report the normalized mean difference.
4. Page 19468, Line 6: Suggest change "retrieved concentrations" to "retrieved model concentrations" to avoid confusion with satellite retrieved values.
5. Page 19471, Line 27: Does the artificially decrease in nitric acid concentrations only go to change the gas-aerosol thermodynamic partitioning? Would it change other gas phase chemistry in the model? Please clarify.
6. Page 19472, Line 15: Should "Fig.3" be "Fig. 5" that shows ammonia concentrations were biased low in winter?
7. Page 19488, Fig. 4: Please state in the figure caption that this GEOS-Chem simulation is the baseline simulation. Is it possible to use a different color (e.g. grey) to show areas with number of observations in gridcells smaller than 4, so that in the 5th column white color only shows areas with small differences.
8. Page 19491, Fig. 5: Missing a sentence "... (solid)..." in the figure caption.

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