Atmos. Chem. Phys. Discuss.,
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Atmospheric Chemistry and Physics Discussions

Interactive comment on "Reviewing Global Estimates of Surface Reactive Nitrogen Concentration and Deposition Using Satellite Observation" *by* Lei Liu et al.

Anonymous Referee #2

Received and published: 1 June 2020

This manuscript discusses recent advances of estimating surface Nr concentration and deposition, presents a framework of using satellite data to estimate surface Nr concentration and deposition, and summarizes the existing challenges for the satellite-based methods.

The manuscript is very clearly written and logically organized. It provides sufficient and up-to-date literature citations. Listed below comments and suggestions for changes are relatively minor, but should be carefully considered. I recommend publication after addressing following comments:

1. L290: It is unclear to me how the vertical resolution of GEOS-Chem can resolve the

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Discussion paper

vertical gradients that are likely to exist in source regions. The authors should clarify these several issues: (1) the vertical structure of the model, (2) the measurement characteristics of the surface observation (including height), (3) how this information is used to calculate surface concentrations. 2. Fig. 10b: It is true that NH3 can be more accurately retrieved in one region than another depending on the thermal contrast. But it is not clear to me why this would be so much better in China than that in the US? I guess it is also just a matter of detection limits? It could also be related to more reliable simulation of mixing, depending on sufficient observational input into the parent weather model. Please clarify this issue. 3. L531: For the estimated ammonia deposition, its uncertainties from remote sensing and models should be discussed more in this manuscript. 4. title: I suggest to change the satellite observation to "satellite retrievals" since IASI NH3 data were not a direct satellite observation but a reanalysis data using the statistical methods. 5. L30: The abbreviation must be defined for the first occurrence. 6. L137: Replace ACTM with Atmospheric chemistry transport model 7. L306: Added the references of the equations. 8. L333: Added the references of the equations.

Please also note the supplement to this comment:
https://www.atmos-chem-phys-discuss.net/acp-2020-91/acp-2020-91-RC2-supplement.pdf

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