

***Interactive comment on* “Global deposition of total reactive nitrogen oxides from 1996 to 2014 constrained with satellite observations of NO₂ columns” by Jeffrey A. Geddes and Randall V. Martin**

Anonymous Referee #3

Received and published: 8 April 2017

Overall, this is an excellent paper that estimates the trends in deposition of NO_y using satellite observations of NO₂ as constraint.

My major comment is that I recommend a coherent section on model and data uncertainties that may affect your analysis and conclusions. Here are some examples of what such a discussion may include:

Appendix 1

MERRA meteorological fields: Are there any biases in precipitation or transport that may affect your results, such as through simulated wet deposition? Are there any

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known biases that change over time in MERRA, such as occur as new observations are brought into the assimilation system over your 20 year simulation period? These are important biases to discuss as global coverage of surface observations (e.g., wet deposition) are sparse over most of the globe.

GEOS-Chem: No model is perfect? Any known issues?

Chemistry: What are the known chemistry uncertainties in the relevant reaction mechanisms? You've answered this with your sensitivity test in Section 3.4.

Emissions: Are there biases? For instance, are the NEI NO_x emissions biased?

Travis, K. R. et al., 2016. 'Why do Models Overestimate Surface Ozone in the Southeastern United States?', Atmospheric Chemistry & Physics, 16, 13561-13577, doi:10.5194/acp-16-13561-2016,2016.

Section 3.4: How does the model simulation of ammonia compare to observations, such as from AIRS, and the very long record of SO₂, such as from the same instruments that you use for NO₂?

Warner, J. X., Wei, Z., Strow, L. L., Dickerson, R. R., and Nowak, J. B.: The global tropospheric ammonia distribution as seen in the 13-year AIRS measurement record, Atmos. Chem. Phys., 16, 5467-5479, doi:10.5194/acp-16-5467-2016, 2016.

Section 2: Satellite NO₂: It is no easy task to create an inter-consistent long-term data record using multiple satellite observations, so this topic deserves some discussion. What are the uncertainties and potential biases? For example, a priori vertical profiles change over time.

My minor concerns are:

Page 4, Line 9: Since the topic of this Nowlan paper is similar and from the same group, it may be worth a sentence describing the major conclusion of this paper and how your manuscript is different/better. In fact, you may want to do briefly so the same

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for the other papers mentioned in this same paragraph.

Figure 2: The two rows of plots look identical. Is there any way to show differences between the two periods? If not, I'm not sure it's helpful to show both rows.

Interactive comment on Atmos. Chem. Phys. Discuss., doi:10.5194/acp-2016-1100, 2017.