

Interactive comment on “Responses of surface ozone air quality to anthropogenic nitrogen deposition in the Northern Hemisphere” by Yuanhong Zhao et al.

Yuanhong Zhao et al.

zhanglg@pku.edu.cn

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Comment: This manuscript presents a modeling study on the effects of anthropogenic nitrogen deposition on ozone pollution through surface-atmosphere exchanges. The Authors combine GEOS-Chem with CLM to produce an interesting, smart modeling experiment to study several processes (e.g. soil NO_x, biogenic VOC, LAI, dry deposition velocity, etc) that affect surface ozone. They find that enhance atmospheric N deposition increases surface ozone by changes in biogenic VOC emissions and dry deposition velocities. Enhanced atmospheric N deposition also increases soil NO_x emissions, but the effect on surface ozone is more scattered. The resulted

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increases in ozone are comparable to changes in climate and land use alone, as determined by previous studies. This study highlights the importance of considering biosphere-atmosphere feedbacks in future air quality predictions. The effect of human activities on atmospheric N deposition and further consequences to ecosystems and air quality is an important topic and results from this work are of relevant interest for the ACP readers. The manuscript is of very good quality, well written and organized. I did not find any major concern with the analysis and manuscript in general, and consider this article adequate for publication. I have added a few comments and editorial corrections below, and I hope the Authors consider in the revision of their manuscript.

Response: We thank the reviewer for the helpful comments. All of them have been addressed in the revised manuscript. Please see our itemized responses below.

Main Text

Comment: Line 153 Typo, ‘CRUNCEP’ not ‘CURNCEP’

Response: Changed as suggested.

Supplementary Material

Comment: Line 21. In ‘RNO_x:N₂O’ equation. Is ‘ATAN’ the Arctangent?

Response: Yes, we now state: “the NO_x over N₂O emission ratio, which varies with the gas diffusivity (D/D₀) as described by the arctangent (ATAN) function (Parton et al., 2001)”.

Comment: Line 61 Typo, ‘Hanes Woolf’ Mechanism,

Response: Thanks for pointing it out. The typo is now corrected.

Comment: Line 67 Odd sentence, “f(T_{soil}) represents the limitation of soil temperature on plant nitrogen uptake that we apply the same function as soil decomposition and nitrification in CLM”.

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Response: We change the sentence to: “ $f(T_{\text{soil}})$ represents a function of limitation of soil temperature on plant nitrogen uptake as described in Thomas et al. (2013)”.

Comment: Line 75 How does the modifications in CLM (NH₃ volatilization, N update and soil NO_x) correct LAI? Do all these modifications contribute the same, or is it mainly because the N uptake by the plants? May you please elaborate?

Response: The correction to LAI is mainly from updates on plant nitrogen uptake. We now add in the section 2.2: “These modifications also slightly correct the large CLM overestimations in the vegetation LAI (Dahlin et al., 2015; Duarte et al., 2017) (Figure S2) mainly due to reduced nitrogen uptake by plant in our model.”

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