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Geoscientific Model Development Discussions

Interactive comment on "Incorporating ^{15}N into the outputs of SMOKE version 4.6 as the emission input dataset for CMAQ version 5.2.1 for assessing the role emission sources plays in controlling the isotopic composition of NO_x, NO_y, and atmospheric nitrate" *by* Huan Fang and Greg Michalski

Anonymous Referee #1

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In this paper by Fang and Michalski, the authors incorporated N isotope signatures of various NOx sources into the US EPA trace gas emission model SMOKE to simulate spatial and temporal variability of ambient d15N-NOx in the US Midwest region. Although comparisons between simulated and measured ambient d15NOx do not provide direct evidence for NOx source partitioning, due to the atmospheric mixing effect

and isotopic fractionations as pointed out by the authors, this work is an important initial step toward better use of NOx isotopes to resolve uncertainties in local and regional NOx emission inventories. I have two questions.

First, it seems that the authors did not consider the uncertainties associated with emission inventories and the d15N signatures in their simulation. For example, the NEI inventories are known to contain large errors, especially for biogenic sources. As pointed out by the authors, the d15N signatures are also highly uncertain and span large ranges for individual sources. However, only an average value was used for each source. What if the d15N source signatures varied over space and time? Would this variability in the source signatures change significantly the simulated spatial and temporal patterns?

The second question I had is regarding the plant canopy effect on biogenic NOx removal. As mentioned by the authors, soil-emitted NOx can be removed by overlying canopies to a large extent (up to 75%). However, this effect was not considered in the simulation. I am curious to see if the simulated d15N patterns would be changed by explicitly considering this canopy effect.

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