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Interactive comment on "Isotopic characterization of nitrogen oxides (NO$_x$), nitrous acid (HONO), and nitrate (NO$_3^-$(p)) from laboratory biomass burning during FIREX" *by* Jiajue Chai et al.

Anonymous Referee #1

Received and published: 6 August 2019

(I apologize in advance for not figuring out the LaTeX commands for "del" and "per mil" symbols for my comments.)

This paper discusses the results of measurements of the isotopic composition of NOx, HONO, and particle nitrate emission from laboratory biomass burns done as part of the FIREX campaign. This represents the first measurements of the isotopic composition of HONO from biomass burning, a critical component of the smoke radical budget in the ambient atmosphere. They find that the isotopic composition of the HONO and NOx is well corelated, suggesting they are formed via similar pathways.

The paper is very well-written and while I am not competent to evaluate the analytical

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Discussion paper

chemistry methods used, they are described thoroughly in the paper and it is clear the authors put a lot of thought into their experimental setup. The results are clearly explained and the conclusions follow from the evidence presented in the paper. Overall, this is a very good manuscript and should be published after minor revisions to address my minor concerns listed below.

L20: Missing and "and" before "proton-transfer-reaction"

L31: "connected via formation pathways" is a very vague phrase. Can you be more specific about how they are linked here?

L33: It seems odd to mention the importance of your particle nitrate measurements here, since you didn't think they were important enough to mention the quantitative results in the previous paragraph. Can you please add those results to the abstract?

L38-39: Why are the del18O measurements for each species expected to track with the influence of ozone, photochemistry and nighttime chemistry? That isn't obvious to me.

L49: While everyone knows what cooking and heating are, "prescribed" is an uncommon term and should be defined. I'd also refer to "prescribed burning" to match the "ing"s in the other terms.

L93-96: This sentence is hard to understand, with many "and"s stringing things together. Can you please rephrase, maybe splitting into two sentences to make the meaning clearer?

L152-154: I have no idea how these acronyms were made – how did "subalpine fir" become "ABLA"? Not critical as you define them, but it was a strange choice that left me constantly flipping back to understand what was burning.

L236-237: Please describe how you corrected the NOx for HONO interference, as you say on L235 that HONO is partially, not completely, converted on the catalyst.

L341-342: I'm assuming the bacteria preserves the isotope ratios and/or you can correct for the effect of the bacteria, but that isn't obvious to me, so you might want to clarify that here.

L388-394: Your explanation for the low HONO values in Fire #12 being linked to smoldering combustion and lower MCE (0.87) isn't very convincing, as Fire #15, which you note on L385-387 had the highest HONO, had an MCE of 0.89, as did Fire #17. My guess is you don't have enough information to really explain why Fire 12 was anomalously low in HONO, but in any case, you need to revise this section to include the caveat about the MCE of Fire #15.

L435 and elsewhere: Since you have both positive and negative values, I'd use the word "to" instead of the n-dash symbol to connect the ranges. i.e. "-4.3 per mil to +7.0 per mil" instead of "-4.3 per mil - +7.0 per mil."

Data availability: Consider using the CERN Zenodo archive (zenodo.org) or similar free service to store the data in a public repository with a unique DOI.

Figure 1 caption: Mention that the HONO and HNO3 in these plots was measured using the MC/IC method from the text

Table S1 caption: Please make a more descriptive caption.

Table S2 caption: Please explain why some data are missing (below detection limit? Instrument error?)

Figure S1 caption: Please clarify what the p values are for, e.g., the slope of a linear correlation?

Figure S2 caption: The caption is hard to understand. Try "Linear regression between (a) del15N-HONO and del15N-biomass (equation) and (b)..." instead.