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Atmospheric Chemistry and Physics Discussions

Interactive comment on "Isotopic Constraints on the Atmospheric Sources and Formation of Nitrogenous Species in Biomass-Burning-Influenced Clouds" *by* Yunhua Chang et al.

Anonymous Referee #1

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Chang et al. reported the isotopic composition of nitrogen species in cloud water at a mountain site in North China, during a biomass burning event. They analyzed the data with isotope mixing model and CQC module to investigate the sources and formation mechanisms of nitrogenous species in cloud water. The study contributes to the growing body of isotope measurements around the world, and the methods could be useful for source and chemical process analysis. The manuscript can be improved by adding more in-depth analysis/discussion on the data. Also, there are a number of places which need to be modified or clarified. The figures are not in good quality, and

most of the figures are too fuzzy to see clearly.

It would be interesting also to examine the isotope information in the aerosols collected at the same site during the same period. The comparison between cloud and aerosol would provide more useful and meaningful information to further understand the sources and formation mechanisms of these nitrogenous species.

I also agree with the comments of Chen, 2019, and the author should provide more information and assessment on the uncertainties of the results. The exact numbers may not be representative given the small number of samples.

In addition, I would suggest the author to further examine the influences of cloud water content and cloud process on the change of isotopic data in the same cloud event. The changes and variations of these δ values may not necessarily result from the differences in source or formation mechanisms. In section 3.3, all the equations and descriptions (page 15-17) are the same as in Chang et al., 2018. I would suggest the author condense this part and include it in the methodology section. More details may be provided in SI.

Specific comments: Line 111. Were the six cloud water samples collected during two or three isolated cloud events?

Line 129. The treatment and analytical protocol can be the same as previous literature, the detection limits and errors, reproducibility, recovery rates would be varied for different research. Please clarify.

Line 141. Please clarify how the sample values were corrected.

Line 189 and Table 1. Better to use consistent units.

Line 193. It is better to compare with the results at Mt Tai during non-BB seasons. The comparison with other regions cannot be used to support the author's statement.

Section 3.2. As mentioned above, did the variations reflect different periods of the

cloud event? Will the cloud evolution process affect the results/conclusion of source analysis?

Line 209-214. This information can be included in the introduction, but it seems not useful to explain the measurement data in this study.

Line 223-226. The statement is too speculative and does not scientifically sound. Without the isotope analysis, you can still conclude that there is a link between different process.

Line 232. Please provide reference or evidence to support the statement.

Line 233-235. Was this 'no significant difference' found in this measurement? Otherwise, how could the author deduce the conclusion here?

Section 3.3. More information on the uncertainty of the numbers is needed. In addition, considering the uncertainty, the significance digit can be rounded.

Line 289-291. The measurement data in six samples can be affected by different factors, and doesn't necessarily to be the same as the emission inventory.

Line 291-296. These descriptions are generally correct and reasonable. However, this discussion seems not directly link to the data/result in this study.

Line 326-328. It is better to compare with low-altitude data in the same region. Otherwise, the comparison may not make sense.

Line 345-346. It seems the author did not discuss the production pathways in clouds, which can be very interesting if the author can do further analysis in this area.

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