Review of "Atmospheric $\Delta^{17}O(NO_3^-)$ reveals nocturnal chemistry dominates nitrate production in Beijing haze" by He et al.

In this study, the authors investigated the formation pathways of nitrate based on $\Delta^{17}O(NO_3^-)$ and $\delta^{15}N(NO_3^-)$. The authors concluded that nocturnal pathways (N_2O_5 + H_2O and NO_3 radical + hydrocarbon) dominated the nitrate production during polluted days. Measuring the isotopic composition is an important, but underutilized approach to reveal the sources and formation pathways of atmospheric species. This study brings new insights into the nitrate sources during polluted days in Beijing. Overall, the interpretation of results is sound. However, there is room for improving the discussions. While I suggest publication after major revision, I hope that the authors will consider the following comments to make the manuscript more readable and hopefully more impactful.

Major Comments

1. "Nitrate" is not clearly defined in the manuscript. Based on reactions in Table 1, "nitrate" refers to HNO3. However, in method section, filter-extracted NO_3^- ion is analyzed. Is the implicit assumption that there is no isotope fractionation from HNO_3 to NO_3^-? Please clarify. In the literature, "nitrate" sometimes includes both inorganic nitrate (e.g., NH_4NO_3) and organic nitrate (e.g., isoprene hydroxyl nitrate). Please clarify if organic nitrate is included in the analysis of this study? In other words, can organic nitrate be analyzed by the bacterial denitrifier method?
2. Correlation between $\Delta^{17}O(NO_3^-)$ and $[NO_3^-]$. It is plausible that the positive correlation is caused by that nocturnal pathways contribute more the $[NO_3^-]$. However, how to explain that the correlation is degraded when $[NO_3^-]$ is > 50 μg m^{-3}? Does it suggest that when $[NO_3^-]$ is high, NO_3^- is not from nocturnal pathways?
3. Section 3.4.4 is confusing. If coal combustion is the major contributor to NOx and coal combustion has the largest $\delta^{15}N(NO_3^-)$, why is the $\delta^{15}N(NO_3^-)$ very low (i.e., mostly ~0) in October?
4. Many calculations are not clearly described. For example, line 214-217, it is not clear how these fractional values are calculated. Line 277, how is $[\delta^{15}N(NO_2)- \delta^{15}N(NO_x)]$ calculated? On a related note, what is the rationale to correlate $\delta^{15}N(NO_3^-)$ with $[\delta^{15}N(NO_2)- \delta^{15}N(NO_x)]$?

Minor Comments

1. Line 118-126. Show the estimated diurnal trends in the SI.
2. Section 2.4. Discuss the purpose of using MCM estimation.
3. Line 194-203. The authors used two methods to estimate the alpha value. These two methods should be compared and the discrepancies should be discussed.
4. There are many gramma errors in the manuscript. For example, line 249, add “that” after “suggest”. Sentences from line 304 to 306 and from line 263-267 have many gramma errors. These two sentences are too long and should be broken down. The authors should check throughout the manuscript.