Review of egusphere-2022-867
Anonymous Referee #2

Lemes et al. evaluated the performance of the inverse dispersion modeling with controlled releases of NH_3 and CH4 based on both open and closed path atmospheric sampling. The work used one single model, the backward Lagrangian stochastic model, to perform the analysis. Since the deposition of NH_3 on the surface may be significant and that of CH_4 not, the simultaneous measurements could provide a means of evaluating the deposition rates of NH_3. To this end, this work can be potentially quite interesting to the community. On the other hand, the manuscript can be better structured, and several important aspects should be clarified before the manuscript can be accepted for publication.

General comments:

1. Here the recovery rates were used to calculate the deposition velocity of NH_3. Although the authors are aware that this is not completely correct, and call it "apparent" deposition velocity, the assumptions behind this calculation have not been fully discussed, e.g., what are the sampling biases, the inverse modeling biases, the measurement biases that are related to and not related to sampling line deposition?

   A new approach has been used to calculate the NH_3 deposition velocities. This new approach assumes a recovery equals to the measured Q_{CH4} for each of the measurement systems, which allowed to evaluate better the deposition related to the sampling line in section 3.4. In addition, a more detailed explanation regarding the calculations about NH_3 deposition velocities was added in section 2.6.

   Section 3.5 title was changed, the new title is "Uncertainties and sensitivity analysis". An entire paragraph was added to discuss precision for CH_4 and NH_3 concentration measurements was with the different. In addition, the sampling line adsorption bias related to the line-integrated system under the best conditions was also included.

2. The different causes for the mismatches in the calculated deposition rates have been presented; however, not sufficient efforts have been attempted to disentangle them. For example, the deposition of NH_3 on the sampling line could be directly compared, evaluated, and corrected for. Why has this not been done?

   The following text was added in section 3.4 to explain the difference between the calculate deposition rates. "The difference between the two ways of estimating υ_{ad}^{*} is not surprising since: i) bLS-derived deposition may be influenced by methodological uncertainties and therefore deviate from true deposition, ii) calculated resistances are associated with uncertainties due to estimations of physical parameters."

   In addition, the sampling line adsorption bias related to the line-integrated system under the best conditions was also evaluated in section 3.5.

3. A thorough analysis (or some sort of analysis) of the uncertainties of the inverse dispersion modeling is lacking. Note that inverse dispersion modeling has already been applied and evaluated in many other studies, e.g., Weller et al., 2018, Caulton et al., 2018, Shah et al., 2020, Andersen et al., 2021, Morales et al., 2022. It is well known that the inverse dispersion estimate based on one single measurement path is very uncertainty, which must be at least acknowledged.

   The uncertainties of the bLS model was already in the first version of the manuscript in the introduction. "The IDM is simple, flexible (Harper et al., 2011), robust even in non ideal conditions

and has a reported accuracy of 100 ± 10% when it is properly used (e.g., place of instruments, filtering criteria) (Harper et al., 2010)." The different studies mentioned were read, but unfortunately directly relation to this study was found. Regarding one single measurement path, it is known that it is an advantage to have more paths with more instrument for longer time measurement campaigns. However, for a release experiment with maximum 4h of measurement with stable conditions, one path placed downwind to the source was to sufficient to catch the downwind plume.

Minor comments:

P48: labor intensive and costly Changed as suggested.

P97: are adequately met Changed as suggested.

L106-109: It is not really novel. It is a novel method because it is the first time that a closed-path has been used with a line-integrated measurement system.

P129: …analyzers from Picarro Added as suggested.

P133: measures Changed as suggested.

Table 1: What's the uncertainty of the content of NH3 of the gas cylinder? The 2% uncertainty for both NH3 and N2? Yes. Table 1 shows the content of the gas cylinder used in each controlled release experiment.

L176-178: It's confusing here. What's the difference of a single point vs. the rest of the experiments? As is written, they all use PTFE tubes, insulated, and heated, and 40°C. Is 80°C the only difference? The difference between the point and line-integrated system is the number of positions where the gas sample is taken from. The point system has only one inlet, while the line-integrated has several. The inlets of the line-integrated system are made of custom-built critical orifices (0.25 mm ID or 0.5 mm ID polyetheretherketone) to guarantee similar inflow (<10 % variation) in each inlet. Three different versions of the line-integrated system (line) were built and used during this research. Both systems consist of PTFE and PVDF (only line 3) tube that was insulated and heated up to 40°C (point, line 1), 60°C (line 2) or 80°C (line 3). The length of line 1 was 16m, while 12m for line 2 and 3. More details about the measurement systems were added in section 2.4.

L213: calculated Changed as suggested.

L258: leaf area index Changed as suggested.

L306-312: This paragraph belongs to the method section. It is also included in the method section. But it was repeated in section 3.2 to help the reader to understand the difference between the three lines.

L385: These results Changed as suggested.

L406: Any correlation analysis result here? The following sentence shows the results.