Reply to comments made by Reviewer #2

We thank the reviewer for the comments and concerns.

Please find below our detailed replies to all the comments.

**Comment 1:** Calculating cumulative emissions – why don’t you use linear interpolation? I do not think that your results will change, but I think that use of arbitrary Q10 is not any better than to estimate cumulative/daily flux using linear interpolation. Calculation of daily emissions can be done by dividing annual accumulative emissions by number of included in cumulative flux estimation days.

**Reply:** We thank the reviewer for raising this point. All calculations were modified as suggested using linear interpolation and numerical integration between sampling times. The text was modified accordingly: “...by linear interpolation and numerical integration between sampling times. Cumulative N₂O flux estimates for N₂O\textsubscript{In} and N₂O\textsubscript{Adjacent} were taken as the average of the cumulative fluxes of the 12 individual chambers, each”.

**Comment 2:** Why do you think that your modeled emissions are better than observed? I think that for real answer if static chamber methods under- or overestimate real fluxes a comparison between static chambers and eddy-covariance based measurements is needed. And, **Comment 3:** You are using 3D flow model and some simple assumptions, you may model the water flow well, but I doubt that you can model N₂O emissions. At least DayCent model, after ~30 years of development cannot.

**Reply:** Our field measurements show that the measured N₂O flux is highly affected by the location of the chamber’s base relative to the drip line. We agree that eddy-covariance based measurements may provide a good tool to validate our field measurement on a larger scale. Nevertheless, in the discussed emitter-spacing scale eddy-covariance could not be used.

Please note, that we do not think that our modeled emissions are better than the
measured/observed emissions. Further, we do not think that the simple assumptions used by us to model N\textsubscript{2}O fluxes accurately capture the “true” N\textsubscript{2}O flux, as rightfully commented by the reviewer. Yet, our results raise a question as to what is the “correct” or the most representative way to capture the true ambient N\textsubscript{2}O emissions around a single dripper, part of a drip line, when using static chambers.

N\textsubscript{2}O fluxes are mainly driven by N availability and form (i.e., nitrate vs. ammonium), oxygen availability, and soil water content [readily expressed as the ratio between the volumetric water content and the porosity (WFPS)]. Thus, we decided to use a robust 3D flow model to study the effect that a chamber base may have on water and N distribution in the top soil. The main assumption for both the 3D flow model and the DIDAS model simulations/computations was that the ambient N\textsubscript{2}O emissions (i.e., not affected by the base) will be those emitted from a location with minimal perturbation by the base. That is, places where the N-form concentrations and distributions, and the water content are not affected by the base.

With this assumption in mind, the model was used to:

- Evaluate the impact of the dripper location relative to a base (i.e., inside, adjacent, few cm away, etc.);
- Find the optimal base diameter;

**Comment 4:** I am wondering if your proposed method to calculate optimal chamber (base) size for field measurements of soil N\textsubscript{2}O emissions (monogram) will provide better flux estimation. I think that few weeks of additional measurements comparing the proposed “optimal base size” with bases used to acquire data for the manuscript under discussion will improve the manuscript. If you are claiming that using modeled flow of water and nutrients, you can determine the optimal chamber – prove it.

**Reply:** In continuation to the reply to comments 2 and 3, to date, the standard method for static chambers calls for the use of basses. Hence, there is no way to get the “true” ambient N\textsubscript{2}O emissions from a single dripper. With that in mind and the model’s limitation in predicting N\textsubscript{2}O emissions (simplified assumptions), we do not see how few weeks of additional measurements comparing the proposed “optimal base size” with bases used to acquire data will benefit the manuscript.

Our intention was to merely raise the problem of the systematic, 3D heterogeneities around a dripper, to present relevant, simulated results, and to propose relevant methodologies assisting in deciding regarding the size and placement of the base. It will take many users in many conditions (soil types, wetting patterns, variable N carbon (C) and O regimes), rather than a single study, to tell whether these methodologies are constructive or not.