Authors comments:

Thank you for the critical comments and useful suggestions.

The following revisions will be made in response to editors comments:

The authors made key changes in response to the recommendations of the referees, and the uncertainty analyses and clear suggestions to use results to guide future studies are exemplary. I recommend a few minor revisions to improve accuracy and readability.

- Please clarify 'successful' process-based models on page 3. The approaches that were discussed may have addressed (in part) the study objectives and therefore may be considered successful depending on the criteria for success (noting also 'successfully applied' on page 5).

Our aim is to calibrate an empirical model on site level data and apply this model for peatlands on European scale across all land use categories. Therefore a successful application should have more explanatory power than the application of mean values approaches. The explained variability can be measured by the model assessment criterion NSE. If a model is capable of explaining more variability than just by taking the mean value, we talk about a successful model application on site level. This is described in section 2.2 on page 6. In addition if this model can be upscaled to European scale it fits to our requirements to improve prediction of emission budgets based on functional relationships to environmental and anthropogenic factors, which is our first study aim in section 1.
To make clear, what a successful model means, we changed the phrase on page 3 to: '*So far, there are no process-based models of N_2O fluxes for organic soils that could be upscaled or explain the variability of measured N_2O fluxes from European peatlands better than average emission factors.*',

added: '*A successful upscaling of an empirical model could reduce the uncertainty of emission budgets by including functional relationships to driving parameters.*'

and changed the statement on page 5 to: '*This data-driven fuzzy logic model has been applied to predict and upscale annual N_2O fluxes for agricultural mineral soils in Germany. The model performance was superior to other empirical approaches and explained up to 72 % of the variability in the data set.*'

- Page 11 top line 'integrating'. Also, why take the square root of equation 4 when the variance is arguably more common to report than the standard deviation?

In this context the word '*integrate*' means consideration of covariance in the uncertainty estimation. We changed it to '*considering*' to make it more clear. Also, we used the standard deviation in equation 4 because it has the same unit as the fluxes and is therefore easily readable in text passages and tables.

- Page 12 'could be a better predictor'; note also non-subscripted 2 in N_2O.

We changed the phrase '*could be a better predictor*' to '*could explain more variability*' and put the 2 in N2O into lower case.

- On page 17 the sentence 'In forests we observed C/N ratios...' could be simplified.

We simplified the sentence to: '*In forests we observed C/N ratios below 30 also under acid conditions. Therefore the stated relationship between pH and C/N exhibits too much variation to get*

utilized'

- *Section 3.4 includes a very long paragraph with lots of information that is a bit difficult to read. Simplifying the structure of this section would aid readability.*

We simplified section 3.4 by adding three subsections (Regions, Evidence and Variability) and build in line breaks for every land use categories to improve the readability.

- *Units should appear more frequently on page 22 line 4.*

We added the units to every specified budget on page 22.

- *Please avoid using the dot to denote multiplication in the Fig. 3 legend.*

We removed the dot in the caption of Figure 3.