(comments of the editor are printed in blue, responses of authors are held in black)

We would like to thank the editor for his highly constructive comments on our manuscript bg-2017-96 "Constraining a complex biogeochemical model for multi-site greenhouse gas emission simulations by model-data fusion"

Comments to the Author:
Dear authors,

many thanks for the thorough revisions, which have addressed the reviewer concerns. I find that the manuscript has been significantly improved. However, I have a couple of minor items that need to be addressed before the manuscript can be accepted for publication.

Best wishes,
Sönke

Comments:

- title: can you think of a more telling / concrete title (e.g. mentioning CO2 and N2O, the land cover types, and/or the geograhic region)? While your study a generally applicable concept of a case-study, the results are specific to the study location.
We changed the title to "Constraining a complex biogeochemical model for CO2 and N2O emission simulations from various land uses by model-data fusion".

- I'm confused with the inclusion of G2: I've search the document several times for G2 to find a reason why it was not modelled. If I've missed this in the text, it may lead better highlighting. However, given that the title of the paper is constraining a model (and not on GHG fluxes in a Hessian landscape), I don't see why these data need to be included at all, if these data are not used for the model fusion, or highlighted in discussion and conclusion as an important area for model development?
We decided to delete G2 from the manuscript.

- I think the conclusion section (or an additional Discussion section) needs to be extended to briefly explain what this study has contributed in terms of novel understanding of GHG fluxes at the study location (at least in terms of potential for new knowledge now that the system works). Currently, the conclusion section is a good summary of the manuscript, but ...
We extended the conclusion chapter with the following outlook: "The herein presented novel GHG study catchment enables a number of future studies. The forest sites could be further used to investigate the influence of leafs on the concentration of N through fall. The presented grassland dataset allows to quantify the nitrate uptake of riparian zones in more detail, e.g., by model coupling analysis, as done by Klatt et al. (2017), to account for potential interactions of land use patterns. Such a model setup would allow upscaling in space, e.g., for the generation of GHG inventories or an analysis of more detailed management scenarios in time. Under the viewpoint of eutrophication and drinking water security, the presented agro-ecosystem plays a pivotal role, as it receives high amounts of reactive nitrogen (N) in form of mineral fertilizer and manure. Our measured data can lead to novel understanding, how to develop and test mitigation measures to reduce N pollution on the landscape scale. The existing model setup can be further used in a forecast mode, e.g. to estimate optimal timing and location of fertilizer application to minimize N_2O emissions and NO_3^- leaching, while at least maintaining yields. Continuous measures of greenhouse gas emissions can be used to evaluate possible mitigation measures."

Minor comments:

- p3 L11: Light beech or European/common beech?
Changed to: “young European beech”

- p3 L 18-19: Please check these numbers. Is wet deposition really that low? What about dry deposition? Note the unit still needs to be kg N / ha / yr.
We came up with these wet deposition values by using measured mean annual rainfall and measured annual mean N concentrations data. Now, by using a more realistic time dependent linear regression to generate daily data, we come up with higher values: 2.70 kg N ha^{-1} a^{-1} and 4.32 kg N ha^{-1} a^{-1} for nitrate and ammonium, respectively. We changed the text at the respective parts of the manuscript and Table 4 (where these values are used) accordingly.
Additionally, we added a statement to the dry deposition: “Dry deposition of N was not measured and can be assumed to add another 30-60% to total atmospheric N deposition (Flechard et al., 2011).“

- Section 2.3.1 - given the tiered model-data-fusion later, briefly explain already.
here whether or not CO2/N2O losses feedback (and if so how) on water cycle and plant physiology
We added the following statement in this section: “It exists an effect of the simulated gaseous losses on the available nutrition’s for plant growth, which in turn effects water cycle through changing water uptake and transpiration. However, we neglect this comparably minor interaction effects in our model-data fusion approach, as outlined in section 2.3.2.”

- Section 2.3.2 - please introduce the meaning of tier 1 and 2 already at the beginning. Otherwise, this is still hard to follow (ie. tier 1 = water and plants, tier 2, GHG given tier 1).
We added the following statement at the beginning of this section: “Tier I is designed to constrain the investigated parameter space for simulating water cycle and plant growth, while tier II builds up on tier I and aims to fit the parameters for the biogeochemical process, which drive the GHG emissions.”

page 7 L 25: define "major effect"
We added: “…, i.e. simulated soil moisture did not change substantially with changing biogeochemical model parameters.”

page 10 L13 (and possibly similar instances): four numbers are given, but associated with three treatments, which does not work out. Please clarify text (here, and possibly at similar occasions).
Corrected accordingly.

in general: avoid the use of "quite" low etc. thorughout the manuscript. Please use exact language.
Changed as proposed.

Please revise figure axis label to be larger and thus easier to decipher.
Changed as proposed.