Biogeosciences Discuss.,
https://doi.org/10.5194/bg-2018-490-RC1, 2019

Biogeosciences Discussions
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Interactive comment on "Estimating the soil N_2O emission intensity of croplands in northwest Europe" *by* Vasileios Myrgiotis et al.

Anonymous Referee #1

Received and published: 6 February 2019

The manuscript "Estimating the soil N2O emission intensity of croplands in northwest Europe" describes the estimation of N2O emission factors, relative leaching losses and relative uptake of applied N fertilisation by using the process based model LandscapeDNDC. The results are accompanied by the quantification of modelling uncertainty taking uncertainties of soil properties and model parameters into account. The article is clearly written, e.g. concepts and applied methods are understandable and conclusion sound. The comprehensive comparison of upscaling results with other study is noteworthy as it allows assessing the plausibility and issues of the derived factors. Shortcomings and constraints of the model application are named and critically discussed and might serve ongoing research. Therefore the work is recommended for publication. However some aspects could be addressed: One important aspect of

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the novel approach is that exchange via crop uptake and leaching is also considered. The reasonability of leaching losses and uptake are discussed. Discussed N fluxes do not include gaseous losses of NO and N2 and the storage change of NO3, NH4 and organic N in the soil (which seems to be an important element of the N budget). It would have been interesting to see these fluxes and changes too. Those might be useful references for upcoming studies. It was an aim of this study to quantify crop specific N2O emission factors in Scotland. Emission factors modelled here represent one specific year (2013). It is unclear how the climate conditions of this year compare to mean average climate conditions of Scotland. Extraordinary dry or wet conditions might bias the estimated emission factor (also for NO3 and N uptake fractions) and thus restrict its applicability. The uncertainty ranges of parameters described in table 1 are comparable to the uncertainty ranges of the Posterior distributions in Myrgiotis et al. (2018b). In this publication (Myrgiotis et al. (2018b) the effect of parameter distributions on measured N2O emissions is discussed but not the effect on annually aggregated emissions. From figure 4 in Myrgiotis et al. (2018b) it seems that if modelled N2O range failed to cover measured values these measured values were often emission peaks. Therefore my question is: Are model uncertainties of annually aggregated emissions well represented by Monte Carlo analyses using the described parameter ranges. It is also not clear to me what kind of uncertainty range is produced (95% confidence limits, standard deviation). In this chapter correlations between model parameters and between soil properties that have been sampled are not mentioned. For instance, the relationship between bulk density and SOC or SOC and clay content is well known. Independent sampling (not considering these relationships) might affect modelled uncertainty ranges. If parameter ranges are based on Myrgiotis et al. 2018b sampling from the multivariate posterior parameter distribution would consider the correlation between parameters. It might be useful to address these issues in the discussion or describe the methods more clearly in the MM part. It is not mentioned from what kind of distributions sampling was performed (uniform, normal distributions or posterior parameter distributions).

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P16/L7: Fitton et al., 2017 not in brackets P16/L16: “dataset compiled by Stehfest and Bouwman” P18/L12: “The low sensitivity of the predicted crop N uptake to model parameters and soil inputs reflects the fact that, under sufficient N supply, climate is the main determinant of crop growth and, consequently, N uptake.” , supply instead of suppply, for the importance of soil properties versus climate see Hoffmann et al. 2016

Hoffmann, H., Zhao, G., Asseng, S., Bindi, M., Biernath, C., Constantin, J., ... & Gaiser, T. (2016). Impact of spatial soil and climate input data aggregation on regional yield simulations. PloS one, 11(4), e0151782.

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