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Interactive comment on "Nitrous oxide emission hotspots from organic soils in Europe" *by* T. Leppelt et al.

Anonymous Referee #1

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The manuscript describes an empirical model approach that is used to describe main drivers of N2O emissions, to estimate the N2O budget for European organic soils, spatial hot spots of emission rates and as an evaluation of static IPCC emission factors. The authors derive annual N2O fluxes from a literature survey that consists of published studies until mid 2013 (109 sites, different amount of sampling years). An empirical fuzzy logic modelling approach is used, that has successfully been applied to agricultural mineral soil emissions in Germany (Dechow and Freibauer 2011). For upscaling, the model was then applied to a peatland map in GRASS GIS using two different land use maps (CORINE land cover and Historic Land Dynamics Assessment) and various (spatial) representations of input drivers.

The fuzzy logic model was applied to the entire data set with limited success, so that

the data set was partitioned into different land use classes. Based on different environmental drivers, the model approach predicts emissions from all classes except for the natural peatlands. Hotspot emissions were defined as modeled fluxes above the 90% quantile per flux distribution by land use category after upscaling. Cropland and grassland model estimates are robust, but for the other classes the uncertainties exceed the flux rates. The upscaled N2O budgets estimates based on the two different landcover classifications do not significantly differ from each other. Similarly, Budget estimates based on average emission factors or IPCC emission factors do not significantly differ from the upscaled fuzzy model estimates. Nevertheless, comparing the spatially explicit fuzzy approach with the static IPCC emission factors approach and the average of the flux observations reveal differences in each emission factor estimate implying under-sampling of hot spots.

The manuscript is an interesting study and a good fit for publication in Biogeosciences. However, the manuscript would benefit from a more basic description of the fuzzy logic approach (which I myself are not very familiar with) as well as the upscaling procedure and related uncertainties. I found the discussion of uncertainties too short, especially considering that it is an explicit topic of the study (research question 2). Also, I found parts of chapter 3.4 and 3.5 difficult to read because of a mix of methods and results/discussion.

Minor comments:

9141, l. 8 – l. 20 : After introducing the NSE, later in the manuscript an NSE_cali and NSE_cv are mentioned that should be explained here.

9154, l. 15: With reference to Fig. 8 – I understand that the models are upscaled with two different landcover classifications. Which one is represented in fig. 8?

9154, l. 16- 23: This seems to be a methodological description and should be described more extensively in the methods section.

9157, l. 15-21L Again, this seems to be a methodological description of parts of the extrapolation and should be described in the methods section.

9158, l. 21- 9159 l.3: This chapter can be added to chapter 3.5.

9160, l. 5-6: This conclusion has not at all been mentioned or discussed earlier.

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