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Interactive Comment

Interactive comment on “Inventories of N_2O and NO emissions from European forest soils” *by* M. Kesik et al.

M. Kesik et al.

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Comment to Anonymous Referee #2

The reviewer commented on the Most Sensible Factor (MSF) method, in which a defined parameter combination is used to calculate the upper and lower uncertainties boundaries for model estimates. Since the uncertainty estimate for maximum emissions with the MSF method is lower (and for N2O only 50%) as compared to the Monte Carlo method he asked if the MSF method is sufficient to examine the uncertainties in predicted N2O and NO fluxes. We do think that the MSF method is a valuable approach towards estimates of input related uncertainties of model predictions. However, as our comparison with the Monte Carlo approach for 50 grid cells show, the approach does not yield the full range of uncertainty as predicted with the Monte Carlo method. Though we tried several parameter combinations, there are still possibilities for optimisation. E.g not to use the maximum clay content within the maximum scenario, but to

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first evaluate the entire dataset at which clay content highest N2O (or NO) emissions are found and to use this value into a maximum (and vice versa in the minimum) scenario. But also this does create some additional uncertainties, since such an “optimal” texture for high (low) N trace gas emission may not be reported for every grid cell, so that one would need to think about the definition of ranges and not of single values. This will finally bring us to the use of Monte Carlo approach (or comparable methods), which - in view of the computation time needed - we only applied to 50 grid cells. Our conclusion on this point is as followed: With the MSF method we do somewhat underestimate the maximum N trace gas emissions. The solution would be to fully apply the Monte Carlo method. However, this can only be achieved if the model code is further optimised with respect to the needed computation time. We are working on this and hope that we will be able to also the Monte Carlo approach on larger datasets in the near future.

We also added one sentence at the end of the respective paragraph to comment on the problems with the MSF method: “Due to the underestimation of maximum N trace gas emissions the uncertainty estimates with the MSF method are not fully satisfactory, but do represent at present the best uncertainty estimate we can achieve. The full application of the Monte Carlo method (or of comparable methods) to all grid cells would be the favourable method to estimate prediction uncertainties. But for this a further optimisation of the model code with regard to the reduction of computation time is required.”

The reviewer also asked why the wet N deposition uncertainties were not included in our uncertainty analysis? The answer is simple: since we have had only one value for each grid cell (and each year) with regard to wet N deposition, we have not thought about it. But for sure the reviewer is right and changes in N deposition do have a significant effect on simulated N trace gas emissions. We added an additional figure to show on site scale the effect of changes in N deposition on N trace gas emissions from forest soils. However, it should be noted that the effect is more long-term and is not as strong in a one year simulation. We supplemented the manuscript as followed: "Due to the lack of an uncertainty range for regional N deposition, the effect of this on N trace gas fluxes was not included in the uncertainty analysis. However, Fig. 5 shows on a site scale that variations in N deposition will significantly feedback on soil NO and N2O fluxes even in one year simulation runs. I.e. increases in N deposition by e.g. 50% would increase simulated N2O and NO fluxes at our 19 test sites by approx. 38% or 21% (Fig. 5)."

Minor comments: - Abstract page 781, line 22: as you suggested the first NO has been deleted

- Introduction page 782, lines 6 and 7: further has been deleted

- Page 786, line 4: solar was added

- Page 786, lines 11 to 14: I do not understand the meaning of the sentence "Furthermore, the model needs information about inorganic N concentration in rainfall which are used to calculate throughfall values of N, surrogate of wet and dry deposition, in independency of forest type and N concentration." In the text it says, "Ě surrogate of wet and dry deposition, in dependency of forest type and N concentration." (not in independency!). It means, that the model calculates throughfall values of N. These throughfall values of N consist of wet and dry deposition. For this calculation information about N concentration in rainfall and about forest type is needed. We reworded the sentences for clarification: "Furthermore, the model needs information about inorganic N concentrations in rainfall which are used to calculate throughfall values for N. Throughfall is a surrogate of wet and dry deposition and is depending on forest type and N concentration. The formulas used in PnET-N-DNDC to calculate throughfall values are described by Li et al. (2000)."

- Page 787, line 20: stand information are forest stand information. To clarify this we deleted stand and inserted forest.

- Page 789, line 9: The considered depth of the soil for the SOC content is 0 to 20cm. This information is now given in the manuscript.

- Page 792, lines 7, 15, 18: What is the link between NO (or N2O) emissions and clay content (or fraction)? Line 7 the authors say that biogas emissions vary in inverse with clay fraction but lines 15 and 18 they say the opposite.

We did a mistake in line 7. Sorry for this. The statement was corrected to: “Ěthe modelled N2O and NO emissions usually increase along with an increase in SOC content and clay fraction as well as a decrease in pH.”

- Page 793, line 3: skeleton rate in the soils is the stone fraction in the soil. For clarification ‘skeleton rate’ was changed to ‘stone fraction’

- Chapter 2.5: It would be good to add the ‘same’ set of soil properties (6) were testing with MSF. We followed this suggestion and made clear that we used the same parameters for MSF and Monte Carlo analysis.

- Tabel 2 and 3: What is the RMSPE? It is the Root mean square prediction error (= simple-to-produce measure that provides useable statistics to verify model forecasts but conceals intensity and movement errors (see Kiese et al. 2005). Give the achievement of RMSPE compare to a simple RMSE? RMSPE is in the same as RMSE, but the term RMSPE is often used in conjunction with trhe evaluation of model prediction errors. We changed the legends of tables to RMSE to avoid any misunderstanding

- Fig 2,3, and 8: the legend fonts are too small It is hard to increase the legend fonts for Fig’s 2,3 and 8 without covering part of the maps. However, we are sure that the resolution of the maps will be increased in the final version. This will also increase the readability of legend fonts.

- Tables 1,2 and 4 the fonts are too small We increased the fonts of tables in order to increase readability.

Interactive comment on Biogeosciences Discussions, 2, 779, 2005.

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