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Discussions

Interactive comment on "Parameter-induced uncertainty quantification of soil N₂O, NO and CO₂ emission from Höglwald spruce forest (Germany) using the LandscapeDNDC model" *by* K.-H. Rahn et al.

Anonymous Referee #2

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The authors present a study to assess the uncertainty in the simulations of the process based LandscapeDNDC model for N2O, NO and CO2 for the site in Höglwald. The focus of the paper is on the parameter uncertainty of the model analysing the 67 parameters of the soil chemistry sub-module. Thereby they explicitly exclude the uncertainties coming from the plant growth and soil water module and therefore very probably underestimate the total uncertainty in the simulations. In order to choose the most influential parameters they use the method develop by Morris (1991) to screen

the parameter space in a sensitivity analysis. Using the Morris method left 26 most sensitive parameters for the calibration. The convergence criterion for the chains in the calibration was based on Gelman et al. (2003). The posterior parameter distributions are than sub sequentially sampled for the comparison with independent data for the years 2004 to 2007. I think the work is very suitable for the Journal of Biogeosciences by presenting a sound analysis of one of the most detailed biogeochemistry models currently used. The methods are sound and conclusions are justified. I can only recommend minor changes which I would like to outline in the following. First there are some consistency problems. In the paper they talk about N2O and NO and CO2 explicitly excluding the soil water module. In the method section at page 5258 in line 18 water content is mentioned again. This would require clarification. It is also only the method section at page 5257 line 13 that they state to use weekly aggregated data instead of daily values. Given the fact that N2O emissions are event driven and the model is running on the daily time step I would like to have some more detailed explanation for the choice. The method section also states to use a uniform prior (p5256) but in table 2 and in the results the standard deviation (sd) for the prior is given. In my opinion sd is not a good descriptor for a uniform distribution. The results section is quite clear. In the discussion I am bit concerned about the statement at page 5264 line 14-16. The authors say they have shown successfully the application of Bayesian methods for a complex biogeochemical model, when it was in fact only shown for one sub-module. Scaling from this experience is not straight forward given, that the other modules are at least as complex as the one under investigation. This is especially true for the soil water module where bi-modal distributions are quite likely which are a problem as also mentioned by the authors. The flat posterior distribution for some parameters could also indicate either the data where not sufficiently informative for the model or the model is over parameterised. It might also be that the parameter interact strongly with modules that were excluded like plant growth for CO2 or soil water for N2O ? This is quite important and I would like some discussion at this point. I recommend to look into Beven and Binley (1992);Beven and Freer (2001);Kennedy and

O'Hagan (2001) . It would also be nice to discuss in more detail the interconnection of correlated parameter like mentioned in the results page 5261 line 10-20. Like in the discussion the author's state in the conclusion they have looked at the most influential parameters without limiting this to the module which was analysed.

Beven, K., and Binley, A.: The future of distributed models: Model calibration and uncertainty prediction, Hydrological Processes, 6, 279-298, 1992. Beven, K., and Freer, J.: Equifinality, data assimilation, and uncertainty estimation in mechanistic modelling of complex environmental systems using the glue methodology, Journal of Hydrology, 249, 11-29, 2001. Kennedy, M. C., and O'Hagan, A.: Bayesian calibration of computer models, Journal of the Royal Statistical Society. Series B: Statistical Methodology, 63, 425-450, 2001.

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