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Biogeosciences 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.

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We would like to thank the author for his valuable comments, especially for the suggestion of the DREAM algorithm, which we will consider in further studies.

We used the R statistic of the second edition of the book from Gelman et al. 2004. Following the introduction of the statistic in section 11.6 of their book, some recommendations for the threshold of R are given. The suggested threshold depends on the

problem and should be near 1. However the authors of the book do not state that the threshold should be always 1.1. Since the values are somehow arbitrary, to our opinion on the one hand a value of 1.1 does not really proof that the chains have converged, and on the other hand a value of 1.2 does not proof that the numerical chains have not converged. Furthermore, Gelman et al. suggests to take the last halve of the samples up to convergence (according to R) which here took already 31'565 iterations. We took even 50'000 additional samples after the chains converged (according to R) when they were sampling from the posterior, which supports the request for additional samples. We do not claim that the chains have totally converged in particular for the difficult parameter EFFAC which took most of the calculation time until the statistic showed "convergence" and we also address this problem in the discussion of our paper. However, the R statistic values of 23 out of 26 parameters were at the same time below 1.1. Regarding the time (3 months) that was used to construct the more than 4 x 81000 samples and the convergence of the other model parameters neither we see that the estimation of the marginal posterior of the parameter EFFAC can be substantially improved, nor that an important information gain can be achieved. As we used 4 chains we do already have 200'000 samples for the estimation of the marginal posterior of EFFAC.

We re-checked the trajectory plots of EFFAC. The bi-modality could clearly be seen in 3 out of 4 chain plots, where the algorithm samples alternately from each mode, divided by short traversals through an unattractive region. The 4th chain does at least show a tendency for the same behavior. If one of the modes would not be as attractive as the other one, than the chains might have sampled from only one of the modes after finding the more attractive one, but would not go back to the other mode and vice versa. In our case we can only conclude that the marginal distribution of EFFAC has two modes. We could have used stronger priors in order to support one of the modes, but by that we would lose the interesting information that there are parameter constellations with totally different parameter values for EFFAC which produce model simulations of same quality. This information can be further used by modelers to re-check their model code,

but this was not the aim of this paper. Furthermore a bi-modal distribution is not bad per se. As we want to quantify the uncertainty of the model output originating from the uncertainty of the model parameters, the shape of the parameter distribution is not important at all. If we are uncertain about the correct parameter value, it is worth to run the model with all likely values to get all uncertainties of the model output.

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