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Biogeosciences Discussions

Interactive comment on "Quality or decomposer efficiency – which is most important in the temperature response of litter decomposition? A modelling study using the GLUE methodology" *by* J. Å. M. Wetterstedt and G. I. Ågren

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The authors address the important topic of exploring mechanistic explanations of temperature sensitivity of soil respiration. This furthers the understanding of the control of one of the most important climate-biosphere feedbacks. They make use of data assimilation into model parameters to compare different model assumptions.

The manuscript is generally well written and the conclusions are supported by the presented results.

My only major concern is, that I cannot follow paragraph 2.3.4: the random realization of the model. I do not understand the application of “the simulated annealing algorithm” to the sample of parameter sets. This issue is not described further in the manuscript. I assume the algorithm was used to find the mode of the distribution of ML and the associated set of parameters. Why is it not sufficient to use the original sample parameter sets? Why does the repeated application of an optimization algorithm with different starting points but the same model result in different parameter sets? If it just finds local minima, the resulting distribution is likely very dependent on the properties of the simulated annealing algorithm and not a representative sample of the parameter space. This needs to be defended. Alternatively, one might consider using Monte Carlo Markov Chain sampling or the Kalman filter to obtain a representative sample of parameters in high likelihood regions. Fortunately, the conclusions from the distributions (Fig. 4) are very precautious. Hence, I expect the sampling, which might be not fully adequate, to not impair the conclusions.

A second minor concern is the insufficient description of the "two initial qualities" scenario. How were the initial qualities selected and the carbon distributed between them?

Specific comments (page-line) 5-2: Has the chosen likelihood measure any relation to a probability distribution of the measurement errors? Least squares correspond to Gaussian errors. The chosen function seems to me to correspond two different exponential distributions for positive and negative errors.

5-8: The LMs of the different temperatures are weighted by the number of observations. This gives more weight to an observation from a series having small n than to an observation from a series having larger n. Why was this done? How much did number of observations differ?

6-5: Sampling each parameter independently corresponds to assuming zero correlations in the multivariate initial distribution of parameters. This might be explicitly stated. However, later on (12-25) the authors refer to positive coupling between e_0 and u_0.

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An adequate sampling and data assimilation scheme allows addressing questions of such correlations.

7-3: typo: weight

7-17: The choice of positive LM seems quite arbitrary and results in different sample sizes. How about using all parameters sets yielding a LM within a quantile of say 95-100% across all resulting LMs?

7-27: Might move the reference to Fig 3a further down. In my reading I pondered about Fig3a for quite a time and only then reading the following sentence. Reading it before I had looked at Fit 3a would have been a good help.

9-1: Where is the explanation of the scenario with two initial qualities? In the methods section (3-8) there is a ("see below"). Table 1 caption is also not helpful to me for this case. How did you select and distribute the initial qualities?

12-23: Contributing to the discussion on temperate effect on decomposer efficiency: One could expect cold-adaptation to increase maintenance costs and to increase with falling temperature. On the other hand there is evidence for a tradeoff between growth rate and efficiency (Lipson et. al 2008), and microbes adapted to cold conditions to be more of the K-selected strategy with lower growth rates and higher efficiency. Lipson, D. A.; Monson, R. K.; Schmidt, S. K. & Weintraub, M. N. (2009) The trade-off between growth rate and yield in microbial communities and the consequences for under-snow soil respiration in a high elevation coniferous forest. Biogeochemistry, 95, 23-35

12-25: Lower biomass does not necessarily lead to less extracellular enzyme production. Schimel and Weintraub 2003 proposed that microbial population rather decreases growth than lowering enzyme production in order to sustain a population. Schimel, J. P. & Weintraub, M. N. (2003) The implications of exoenzyme activity on microbial carbon and nitrogen limitation in soil: a theoretical model. Soil Biology and Biochemistry, 35, 549-563

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Fig. 6 caption: add “at the higher temperature” to the end of the second-last sentence.

Fig. 6 right panel: Should the integral below the distribution curve be one? Why does there seem to be a difference in the area corresponding to different temperatures?

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