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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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Review of Wetterstedt & Ågren 2010, Biogeosciences Discussions 7, 8699-8722.

General comments

This manuscript is concerned with the response of organic matter decomposition to temperature change, a topic of high scientific relevance and within the scope of *Bio-*

geosciences. The main question addressed is whether the parameters litter quality and efficiency of decomposers respond to temperature change within the framework of the Q-model. This question is important because 1) the Q-model provides a framework that generalizes the structure of other SOM decomposition models, and 2) extends the discussion on the response of decomposers to temperature change beyond simply changes of their growth rates. In addition, the study presents a simple parameterization of the Q-model using the GLUE methodology and data from an incubation experiment, which can be useful as a reference for further studies. The conclusions reached in this study are important and suggest that the efficiency at which decomposers utilize carbon for growth are also temperature dependent.

In general, I found the manuscript well written and the conclusions well supported by the methodology used. However, in some instances the manuscript fails to provide enough detail for a clear traceability of the results (see specific comments). Despite this, I appreciate the effort of the authors for testing model structure as opposed to simply finding the best parameter set to explain the data. With so many model formulations and hypothesis about soil organic matter dynamics, research in this area needs to move towards testing different ideas with consistent methodologies. The GLUE methodology is therefore a good candidate for this task, however, there has been some recent criticism to this approach (Mantovan & Todini 2006, J. Hydrology 330: 368). Not being an expert in the GLUE method, I would like to see a short discussion in the manuscript about the assumptions of the GLUE approach and how they relate to other Bayesian approaches. An interesting outcome of the study, related to the use of GLUE, is the uniformity in the distribution of the Likelihood Measure, which probably would present a peaked distribution with other Bayesian approach. This issue is unlikely to modify the conclusions found in this analysis since uncertainties in the GLUE method tend to be overestimated, but a short discussion on this topic would be helpful.

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Specific comments

1. Why is litter quality q defined in a range beyond 0 - 1 (Table 1)? In Bosatta & Ågren (1999) the activation energy is defined as $n\Delta G^0$ with n as the number of steps required to breakdown a substrate, and $q = 1/n$. A consequence from that publication was that q should be between 0 and 1. Can you clarify this point? Can you also clarify your definition of activation energy as ΔG^0 and not as $n\Delta G^0$ like in Bosatta & Ågren (1999)?

2. What is the function used to allow e to vary with temperature? Was it an Arrhenius function? This is an important part of the modeling scheme but no information is given on how the dependency of e with temperature was implemented. Is it possible to give at the end of the manuscript a recommendation on how to implement the dependency of decomposer efficiency in models?

3. It is not clear from the description in section 2.1. what version of the Q-model was used in this analysis. Did you use an analytical or an approximate solution. Did you use any of the solutions in Bosatta & Ågren (2003)? Which one?

Technical corrections

1. On page 8701, the last paragraph may need some editing for clarity. I would suggest adding a coma after 'response' on line 27. Also in the last line change to 'to analyse'.

2. On page 8705, line 8, replace 'och' for 'and'.

3. Section 3.1. Can you cite Figures in order of appearance?

4. Page 8708, line 6. change 'where' for 'were'.

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