Biogeosciences Discuss., 6, C2318–C2320, 2009
www.biogeosciences-discuss.net/6/C2318/2009/

Biogeosciences Discussions

Interactive comment on "Measuring and modelling continuous quality distributions of soil organic matter" *by* S. Bruun et al.

T. Wutzler (Referee)

thomas.wutzler@web.de

Received and published: 1 October 2009

General comments

The paper has substantial scientific significance in the field of model-data integration in the field of understanding soil organic matter (SOM) cycling at ecosystem scale. The summarizes ideas and prospects of the continuous approach of modeling, which is not used by its full potential by a larger community yet.

The paper highlights the point that representing a continuum of SOM by a distribution instead of multiple compartments has several advantages. The most important ones being a more generalized understanding of the parameters, with the need of fewer parameters resulting in a potentially more robust transfer across environmental conditions

and sites.

The authors address one major drawback of applying continuous models. It has been difficult to estimate quality model parameters by currently available soil fractionation data. The authors argue that this can be overcome by two steps: 1) approximating the theoretical quality Q by a some measurable variable q and 2) designing experiments and improving SOM fractionation methods that explicitly address measurement of q and its continuous nature of the distribution.

The presentation of the theory of quality models has been done concise and very well.

Most of the relevant literature has been cited (one more suggestion below).

The description of the parameter estimation by experiments in part 3 is very general and vague. A few specific examples of experiments would be helpful.

Part 5 of the book is currently rather a listing which resembles other reviews of fractionation methods. Discussion across the methods can be improved at this part.

A major improvement of the paper could be an enhanced discussion of how to disentangle and represent the different stabilization mechanisms, i.e. types of quality, in continuous quality models and experiments (Davidson, E. A. Janssens, I. A. Temperature sensitivity of soil carbon decomposition and feedbacks to climate change Nature, 2006, 440, 165-173).

Specific comments

One drawback of understanding of SOM cycling at decadal time scale is, to my opinion, the lumping of several stabilization factors into a common pool, or in this case a common quality distribution. The differences of in the response of the parameters to environmental conditions is probably different. Hence it is crucial for understanding effects of global change on SOM cycling to disentangle these mechanisms in both modeling and measurements.

The authors mention several possibilities of representing multiple mechanisms on quality in the text (e.g. p9052 l26, p9068 l5). I would be happy to see an enhanced discussion on this topic. Is it better to use one quality and represent the mechanisms by the transfer function? Or is it better to represent mechanisms by several dimensions in the quality? What would the alternatives mean to combining models and the design of the parameter-estimating experiments?

p9050 l13:
The introduction of the simple case of moving along the q is very abruptly. I suggest insert some motivation before and at some point in the manuscript discuss the consequences of this constraint.

p9051 l6:
Could you give an example where it is applicable to have a decomposition rate and other parameters independent of the quality?

p9051 l15:
Is the superposition principle (linearity) required to describe the distribution of isotopes?

p9054:
A few specific examples of experiments would be helpful.

Technical corrections

p9050 l8: typo: one-dimensional

Interactive comment on Biogeosciences Discuss., 6, 9045, 2009.