Biogeosciences Discuss., 6, C3066–C3068, 2009
www.biogeosciences-discuss.net/6/C3066/2009/

Biogeosciences Discussions

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

S. Bruun et al.

sab@life.ku.dk

Received and published: 17 November 2009

Response to Troy Baisden

Thank you for your comment with many good points that are well worth discussing.

It is true that the model that we are presenting is only slightly modified compared with the earlier presentations that you mention. The big difference lies in the fact that instead of using a theoretical quality variable, we are using a measureable quality variable. This obviously has some implications for the simplifications that are proposed to make the model operational.

We have definitely not tried to convey the message that the continuous quality concept has been ignored. What we are trying to communicate is that the integration of the

continuous modelling concept with experimental data is lacking, and that it could be a fruitful avenue of research. That is why we discuss several possibilities for doing the integration.

We agree that there are some attempts to separate SOM into several fractions along a continuous variable, but we do not fell that the data are detailed enough and in any case, no attempts to apply continuous models to them has been presented. We also agree with you that there are some successful attempts to separate soil organic matter into a few operational fractions and modelling these as pools in pool models. One such example is the paper by Baisden and Amundsson (2003) that you quote. With 3 SOM pools and 7 little constrained parameters there is no problem of fitting the fractionation data. Unfortunately, the fact that a 3 pool model can fit your data seems to lead you to conclude that there is evidence for their existence. However, it is not possible to draw that conclusion. With the available data, we cannot prove that there are more than 3 pools, but there may be. In fact there most likely is (see Bruun and Luxhøi (2006) for an empirical example of how observations may lead us to conclude that there are two pools when in fact there is a continuous distribution).

Our point is therefore that a successful application of a model means that the model is useful for some purposes, but it does not mean that we have learned everything about the system and one way to learn more may be to separate continuous quality distributions. We would argue that the demarcation between the three pools that you stipulate in your quote from Baisden and Amundsson (2003) are not as well defined as it may seem. For example, according to you, what distinguishes the active pool from the slow pool is that it yields energy to decompose the active pool and requires energy to decompose the slow pool (but releases nutrients). However, how much energy does it take? Some of the material in the slow pool is likely to take much energy while some is likely to take little. This does not mean that the demarcation is not useful though, only that it is not the full story. As the paper by Baisden Amundsson (2003) is a good example of the usefulness of the pool concept, we have included it and modified the

sentence introducing pool models to read: “Successful attempts to base models on measurable SOM fractions have been advanced (Buyanovsky et al., 1994; Hassink and Dalenberg, 1996; Bird et al., 2002; Baisden and Amundson, 2003; Skjemstad et al., 2004, Zimmermann et al., 2007).”

We do not understand your point about how we should also address concepts that may lead to a distribution of C residences times like those predicted by the continuous quality hypothesis like priming effects. We do not see priming effects as an alternative hypothesis to the continuous quality concept. In fact we mention priming effects and the consequences for the modelling in the paper.

We agree that the paper by Poage and Feng (2004) is useful for illustrating the usefulness of isotopes and have included it in the following sentence: “Such equations for different isotopes can then be combined to produce equations for the isotope ratios; see Poage and Feng (2004) for an application to depth profiles”.

References

Baisden, W. T., Amundson, R.: An analytical approach to ecosystem biogeochemistry modeling, Ecol. Appl., 13, 649-663, 2003.

Bruun, S., Luxhøi, J.: Letter to the editor on "Can incubations be used to measure meaningful pools of soil organic matter?", Soil Sci. Soc. Am. J., 70, 2164, 2006.

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