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Biogeosciences Discussions

Interactive comment on "Application of delta;¹³C and delta;¹⁵N isotopic signatures of organic matter fractions sequentially separated from adjacent arable and forest soils to identify carbon stabilization mechanisms" *by* Z. E. Kayler et al.

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Title: Application of 13C and 15N isotopic signatures of organic matter fractions sequentially separated from adjacent arable and forest soils to identify carbon stabilization mechanisms

Authors: Kayler Z.E., Kaiser M., Gessler A., Ellerbrock R.H., Sommer M

General: The authors examine the distribution of soil organic matter C and N (and their stable isotopes) among operational soil organic matter fractions to better understand stabilization mechanisms. Soils examined included 5 paired forest/arable soils. These data are considered with associated soil chemical and physical measures - including short order range mineralogy, C content, and texture. In addition, the authors compare their findings to the conceptual model described by Kleber (2007), which provides a framework for the main chemical interactions of organic matter molecules on charged mineral surfaces. Overall the data set is a very nice addition to the literature. The topic is appropriate for this journal, and will be of interest to terrestrial biogeochemists in agricultural and forest soil areas. The authors utilize a thoughtful SOM fractionation scheme to elucidate the mechanisms involved in partitioning of the continuum of organic compounds. The findings are interesting – especially between the land use comparison. The utility of these isotope results – especially in understanding the divergent findings in arable and forest sites, could be greatly enhanced by providing more information regarding the inputs and land use history of the arable soils – as this might have significant effects of observed trends in 15N enrichment.

Overall, I recommend for acceptance with revisions. One additional review would be useful. The paper would benefit from revisions that address the following:

1. More information on sources of C and N and their isotopic signatures (13C/15N) among sites and especially between forest and arable soils would have been very useful to interpret possible mechanisms for differences in reported d15N and d13C(i.e., N fertilizers, manures, plant litters, etc). In addition, authors might well consider the effects of tillage in the arable soils on SOM stabilization mechanisms.

2. The number of figures (esp. 2-4) could be substantially reduced, as few significant differences occur. Possibly place data from figure 2 in results text and indicate some additional means/st. errors from figs 3-4? Figure 1 labels could be made larger

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(clearer?) or use shades of grey to further differentiate soil origin.

3. The abstract would benefit from shortening; and at times, more specific in reporting what differences were found.

4. The authors don't comment on the relative yields of C and N in these SOM fractions. Might the extraction yield efficiency also inform this discussion – essentially what is not isolated (free light material/water soluble I am guessing) and does this vary consistently by site? Also the depths of these soils were quite different. How might these differences have influenced the results observed. Some differ by $\sim$ 20 cm.

5. I think a clarification of the SOM extraction method would be useful for readers not experienced in these fractionations, maybe a small figure would help.

6. Overall the manuscript is well written, however a thorough edit would help make the paper more concise and clear.

7. Literature to consider in revised discussion: The role of Ca in SOM stabilization: Olk, D.C., 2006. Soil Science Society of America Journal, 1013–1022. Olk, D.C., Gregorich, E.G., 2006. Soil Science Society of America Journal 70, 967–974.

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