

Interactive comment on “Modeling impacts of management alternatives on soil carbon storage of farmland in Northwest China” by F. Zhang et al.

Anonymous Referee #1

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Nadine Deisel Copernicus Production Office <http://www.copernicus.org/EGU/bg/bg.html>

Dear Ms. Deisel,

Re: Referee Comments on bgd 3, 409-447-2006

Enclosed please find my comments on the manuscript “Modeling impacts of management alternatives on soil carbon storage of farmland in Northwest China”. To stimulate scientific discussion on SOC fractionation, I would prefer to have the comments distributed and published on your website with the permissions from the editor and authors.

Thank you for your attention. Looking forward to hearing from you.

Regards,
Yahui Zhuang
Enclosure.

Referee Comments on bgd 3, 409-447-2006

General comments: This article has the following merits. The findings on impacts of farming management options were not based upon individual field observations, but upon spatially differentiated information of climate, soil properties and agricultural management, covering an area of 3 million hectares of cropland in 107 counties from N 39°25' to N 31° 43'. For model validation, five long-term SOC datasets in China have been employed. To overcome the difficulty of soil heterogeneity, the authors have applied the MSF method developed by the corresponding author himself. The conclusions advocating sustainable agricultural management could have some impact on the relevant experts and organizations in the fields of agriculture and global change. I would suggest accepting this manuscript after careful correction of typing errors.

Specific comments: (I) SOC fractionation Although DNDC model has been revised for many times, but the parameter SOC has been taken for granted without further elaboration. I remember that a couple of years ago I have discussed with Prof. Changsheng Li on this topic. We both agreed that model simulation based on fractionated SOC might give better results. Water-soluble organic compounds with small molecular masses, such as glucose, can be degraded very quickly, while fatty acids with longer carbon chains degrade too but with lower rates, and polymeric compounds such as cellulose degrade slowly only after hydrolysis. Highly condensed polymeric compounds such as humic substances, can persist for thousands and even millions of years under anaerobic conditions. In other words, persistent organic compounds can scarcely be utilized by soil microorganisms. Potentially, there might be millions of organic compounds in SOC. Since DNDC is a process-oriented model, SOC should be fractionated for better simulation. But in the current version, all organic compounds in SOC are not segre-

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gated according to their readiness to biodegradation, and are assumed to be up taken or degraded by soil microorganisms equally. I was a little bit disappointed that in the present manuscript no progress has been achieved in this aspect.

No doubt, there are practical experimental and modeling barriers. Nevertheless, I found that in certain models simulating degradation of organic carbon in wastewater, organic carbon OC can be simply classified into several categories, such as readily degradable OC, moderately degradable OC and persistent OC. In DNDC model, such an approach, in principle, could be incorporated too. SOC could be fractionated into fractions either with different molecular mass ranges, or into fractions according to their solubility in water and in other nonpolar solvents. Then, each fraction could be tested for their biodegradability, using simple and available methods for BOD and TOC determinations. Could we conceive a series of sub-fractions with various values of BOD₅, BOD₇, BOD₁₄, etc. instead of a single SOC value? Each sub-fraction should have a specific degradation rate. The degradation rates of sub-fractions could be normalized with the rate of a certain sub-fraction taken as unity.

For such an approach, no sophisticated instruments are required. Nowadays, semi-permeable membrane filters for various molecular mass ranges are commercially available. Membranes with different polarities can also be prepared. Passing a suspension of soil sample through a cascade of membrane filters, we can get fractions of SOC aqueous solutions for further BOC and TOC measurements.

I would take this opportunity to present my view point, and anticipate to find upgraded versions of DNDC available in the future with some breakthrough in this aspect.

(II) Other aspects: Since the other aspects, such as relevance to BG, novelty, methods and conclusions, have been included in my general comments, I am not going to repeat here as specific comments.

Technical corrections: List of typographical corrections page line erroneous correction
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If you have any questions/suggestions please contact me directly at
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