Biogeosciences Discuss., 12, C8884–C8887, 2016
www.biogeosciences-discuss.net/12/C8884/2016/

Biogeosciences Discussions

Interactive comment on "Effects of climate change and land management on soil organic carbon dynamics and carbon leaching in Northwestern Europe" *by* M. Stergiadi et al.

Anonymous Referee #2

Received and published: 6 January 2016

General Comments: The authors use the CENTURY model to evaluate the potential impact of climate change and land management practices on SOC and DOC dynamics across loamy and sandy soils in forest, grassland, and under active agricultural management in Northern European conditions. The authors construct scenarios that are detailed and highly relevant to the Northern European region. The climate change scenarios are based on studies of anticipated climate changes in this region. The authors examine temperature and precipitation changes separately as well as in combination, to isolate the relative impact of these factors on ecosystem processes. The authors consider realistic future land management changes based on regional standards and policy for fertilizer applications. The authors examine CENTURY simulation of SOC

and DOC dynamics under these different scenarios. SOC and DOC dynamics are both areas of concern under future climate change. This analysis examines important interactions between climate change, land management, and soil C cycling processes. However, this analysis would be strengthened by more explicit and statistically rigorous comparison between measured values and modeled results.

Specific Comments: In SOM research there is increasing focus on simulating DOC dynamics across the soil profile, particularly to address modeling deep SOM dynamics. CENTURY model simulations of carbon leaching has been largely absent from these developments, and is a novel area for this analysis to explore. However, soil depth, clay content, and hydrology are important factors determining DOC dynamics and concentrations across the soils profile, but in this analysis were insufficiently addressed for measured/modeled comparisons. The authors are detailed in describing CENTURY SOM and plant partitioning and turnover rates (section 2.1, p 19632 lines 22-28, p 19633 lines 1-5), but do not describe how the active pool interacts with the water submodel and clay content to generate leached carbon (CENTURY v4.0 Manual). Also, in this analysis CENTURY model simulations only extended from 0 -20cm. Therefore, modeled DOC would only be generated if water flow was deeper than the 20cm layer. This means modeled values of DOC are indicative of DOC emerging from the 20cm layer in this analysis. The authors state "simulated current DOC concentrations also fall within the ranges reported in literature for agricultural and forest sites for soil depths ranging from 15 to 50 cm" (page 19641 – 19642). It is not clear if this measured/modeled comparison is meaningful, given measured depths do not match the 0-20cm of model simulations, as well as lack of information about soil texture and whether measured sites had comparable climate/precipitation/hydrology.

In addition, the authors do a comparison between CENTURY simulations of % SOC and measured values (Table 5), but using several measured values only to 10cm. The implications for the difference between 0 -20cm in model simulations and 0 -10 in measured values is discussed in the text (pg 19641). Measured/modeled SOC com-

parisons for grassland and forest should be for comparable 0 – 20cm depths, for the reasons stated by the authors. The authors are encouraged to either adjust measured values using a function to extrapolate to deeper depths (e.g. Jobbagy and Jackson 2000), or review literature for additional SOC measurements to 0 -20cm depths.

The authors are thorough in discussing modeled results in the context of observed directional changes in SOC levels and DOC under different land types and future change scenarios (e.g. pg 19644, lines 20 – 23). However, they do not directly compare the magnitude of model results versus the magnitude of measured and observed change. More explicit comparison would strengthen the analysis.

This analysis presents in-depth and realistic scenarios for land management and climate change. The manuscript is well structured, with a clear title, concise abstract, and comprehensive references to related work. However, in the Materials and Methods section the authors are encouraged to more clearly present differences between climate scenarios, land management, and soil texture. The authors could consider moving some information in 2.3.1 and 2.3.2 into table form (or into an expanded Table 2), to show the full factorial of scenarios simulated in the analysis. A table to clarify differences in land management across soil texture classes would be a useful addition, since results by soil texture are conflated with differences in land management.

Finally, the authors could consider presenting Figure 4 as a bar chart of net change in SOC% by the end of the simulation period, perhaps grouped by climate scenario rather than by land system/soil texture. This would make change within each scenario easier to compare.

Technical corrections: Pg 19635 line 27- typo, ‘op’ change to ‘of’ Pg 19639 line 21- Statistics were not performed, should not use term ‘significant’ Pg 19643 paragraph starting line 28- This paragraph seems to be referring to ‘all systems with the exception of W+ cc T’, which is then discussed in the subsequent paragraph. If so, the exception should be noted.

Interactive comment on Biogeosciences Discuss., 12, 19627, 2015.