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Biogeosciences Discussions

Interactive comment on "Belowground carbon pools and dynamics in China's warm temperate and sub-tropical deciduous forests" *by* C. W. Xiao et al.

Anonymous Referee #2

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The authors use litter fall, fine root growth and soil data to derive turnover rates of belowground carbon pools in three deciduous forest ecosystems in China. They address an important topic and present their results in a clear and comprehensible way. The manuscript would benefit from a more detailed discussion on uncertainties, particularly with respect to assumptions and methods, and from addressing possible leaks in the elemental budget. Details are listed below.

Site description: I do not understand why low clay content should be a prerequisite for allowing comparisons of SOC pools. Similar clay contents are helpful, but there are too many other drivers of soil C that differ between sites. It just makes data interpretation

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easier. Soil FAO-UNESCO classification. I use the more recent FAO/WRB 1998 but assume that 'mountainous brown soil' is not a regular class according to FAO. Methods 2.2: Does sampling include the litter layer? Please clarify. LF-OC and HF-OC must be spelled out first time and the concept behind physical fractionation to be explained in brief. P. 6344, L 20. Was sieved soil used for microbial activity? P. 6345, L. 2. Curious to see a reference from 1889; is there anything more recent (litter layer type may have changed since then)? P.6346, L. 3. Beginning of sentence should be 'Fine root turnover rate ...' P. 6346, L. 26. Some details on the lignin methods would be helpful as there is a wide array of methods to quantify lignin in soil; not all approaches are reliable. P. 6350, L. 10. 'smaller ' should be replaced by 'shorter' P. 6350, L. 14. Word 'floor' should be added behind 'forest'

Discussion: The smaller C/N in HF-OC from my point of view just indicates a higher share of microbial derived products and I think that parameter alone does not allow making assumptions on the microbial community. Cited LF turnover times may be realistic for temperate croplands, but data from other biomes (eg. Trumbore et al., Schulze et al, Leifeld et al., see references) indicate much longer turnover times for similar fractions. This section needs further elaboration and a closer connection of the measured data with the literature. HF is stabilized no only through microaggregation, but, more importantly, through surface interactions and its turnover time is in the range of decades to millennia. P.6352, L. 2. Stabilization potential is not only driven by the clay content, but equally by mineralogy (e.g. Six et al.). P. 6352, L. 18. Authors argue that site climate for two of the sites is similar. Even under similar regional climate, the stand climate is affected by differences in ET, biomass, shading et.c. I suggest arguing more carefully here.

General: C-budget approach I. The authors assume steady-state conditions in their turnover calculations. The stand age is between 55 and 60 years (secondary forest?) and steady-state is unlikely, particularly for the C stock. A discussion on uncertainties regarding steady-state assumptions is missing. C-budget approach II. Sites have in-

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clinations of between 28 and 32° which may induce erosion particularly of forest litter after heavy rainfalls. Is there any C-export by erosion? C-budget approach III. Input estimates are based on litter fall and fine root turnover using in-growth cores. Without being an expert in that latter technique I suppose that root dynamics in root-free soil will differ from that of an undisturbed soil. How reliable is this technique and how does its results compare to other techniques such as 14C? The paper would benefit from some discussion on that. C-budget approach IV. Litter bags were used to derive decomposition rates of several carbon fractions. Since some of the C leaves the bag as dissolved or even particulate matter, mass loss rates may be overestimated.

References Leifeld, J., Zimmermann, M., Fuhrer, J. and Conen, F., 2009. Storage and turnover of carbon in grassland soils along an elevation gradient in the Swiss Alps. Global Change Biology, 15(3): 668-679. Schulze, K., Borken, W., Muhr, J. and Matzner, E., 2009. Stock, turnover time and accumulation of organic matter in bulk and density fractions of a Podzol soil. European Journal of Soil Science, 60(4): 567-577. Six, J., Elliott, E.T. and Paustian, K., 2000. Soil Structure and Soil Organic Matter: II. A Normalized Stability Index and the Effect of Mineralogy. Soil Science Society of America Journal, 64(3): 1042-1049. Trumbore, S.E., Chadwick, O.A. and Amundson, R., 1996. Rapid Exchange Between Soil Carbon and Atmospheric Carbon Dioxide Driven by Temperature Change. Science, 272(5260): 393-396.

Interactive comment on Biogeosciences Discuss., 6, 6339, 2009.