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Biogeosciences Discussions

Interactive comment on "Fire-derived organic carbon turnover in soils on a centennial scale" *by* N. Singh et al.

Anonymous Referee #2

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General comments: Pyrogenic carbon (PyC) derived from incomplete combustion of organic matter (biomass) is considered a stable C sink in terrestrial ecosystems. This study summarizes available literature data on PyC degradation in soil. The authors used mata analysis and ANOVA statistics for turnover time (mean residence time) calculation and explanation. The study is generally interesting for the readers of Biogeosciences and of high quality. However, it has also some major flaws which I address in the following: 1. There is a discrepancy (at least visually) between the data presented in Fig. 1 and calculated MRTs. From data points in fig. 1 I would expect much longer MRTs especially if taking ALL data presented in fig. 1. 2. From Fig 1. of supplementary material it is obvious that there is a methodological constraint as MRT strongly correlated with incubation time. Therefore, the question is whether short-term incubations are allowed at all to calculate MRTs. From this figure it gets also clear that PyC de-

composition in soil does NOT follow first order kinetics. Therefore, other models should be tested as well which is not possible having only two data points. A solution for this severe problem could be taking all data presented in Fig. 1 using different models.

Specific comments: Abstract: PyC can also derive from incomplete combustion of animal biomass. There is a lot of literature proving millennial turnover of PyC, especially by 14C measurements of charcoal including the presence of archaeological PyC-rich soils (Anthrosols) as also mentioned by the authors in the introduction. This fact should be included into the discussion and conclusions should be adapted accordingly. In addition, there is a recent publication in Science by the senior author and several other reviews (e.g. by Amelung et al and Glaser) contradicting the main conclusion that PyC is turned over in the same order of magnitude of time.

Introduction: P12180 L15: PyC input due to wild fires is negligible when compared to other fluxes within the global carbon cycle. Therefore, please delete this aspect or interpret it accordingly.

P12112 L11ff: This is not true because if PyC had a turnover time of centuries, how could be radiocarbon date charcoal to several thousand years because nothing would be left.

P12181 L26: Delete "many".

P12282 L7: It is well known that PyC consists of at least two differently stable C pools. P12182: You need to prove that these assumptions are true. Otherwise test different models and take the best fit.

P12182 L16: Not a valid justification.

P12183 L2: 600 yrs does not appear in Fig. 1.

P12183 L7: You need to mention that most of PyC in the study of Brodowski was lost within the first sampling date thus assuming an at least two component PyC pool. If only data AFTER the first sampling date were chosen turnover times of at least several

hundred years can be calculated.

P12183 L14: As stated in the text and obvious from fig 1 (Suppl) there is a bias towards short experiment duration. Clear interpretation of this figure is that MRT is the higher the longer the experiment duration is. The question is how this figure can be interpreted and what is the “right” MRT?

P12183 L18: It is NOT comparable to SOM turnover time but being at least one order of magnitude more stable (see also Schmidt et al. 2011 Science).

P12184: L23: Kuzyakov et al. 2009 was not field study !!!

P12185: L7: Contradiction to P12181 L15ff.

P12187 L10: This is not true. Glaser and Amelung (2003) showed that PyC concentrations were higher at wet sites.

Fig. 1: Data indicate a residual PyC after 100 years of about 40-60%. How can turnover time be 100 years in this case? Remember that mean residence time is calculated as time required until ALL PyC is turned over.

Supplementary material: L12: Using first order kinetics using only two data points IS NOT POSSIBLE !!! Maybe by this the discrepancy between data presented in Fig. 1 of main text and short MRTs can be explained.

Interactive comment on Biogeosciences Discuss., 8, 12179, 2011.