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Interactive comment on "On the rebound: soil organic carbon stocks can bounce back to near forest levels when agroforests replace agriculture in southern India" *by* H. C. Hombegowda et al.

Anonymous Referee #2

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This study reports an interesting and unique data set on land use and management changes from forest to agriculture to agro-forestry systems in India. There are few studies on soil carbon (SOC) dynamics after land use transitions from India and also few studies from agro-forestry systems (AFS), covering different AFSs making the study very valuable. The study is written and structured very clear and professional. However, there is one major concern that needs to be considered in order to get this paper in a publishable status. Also some minor remarks maybe considered to improve the paper.

Major remark

The depth distribution of SOC stock changes is a critical issue (Fig. 3) since you found minor differences in relative and absolute SOC stocks changes throughout the soil profile. This aspect required more explanations (p. 11, l. 25 f) and more attention. Within a time period of several decades land use changes should generally affect topsoils more than subsoils since most carbon input occurs close to the soil surface from litter and roots. Poeplau and Don, 2013 Geoderma, e.g., found only 10% of the SOC stocks changes in 30-80 cm depth, also for afforestation with similar age and likely also similar rooting distribution as in AFSs. About 90% of the changes occurred in the topsoil (0-30 cm depth). This is also reported in many other studies (e.g. Degryze et al. 2004, GCB) on land use change effects. The simplest explanation of uniform SOC differences throughout the soil profile are differences in the soil type or soil texture that put the soils to different SOC levels. Thus, differences between land use systems may thus be a result of soil intrinsic variables and can thus not be attributed to land use. If the assumption that the small systematic differences in clay content between the paired sited had no effect on the results (Chapter 3.1) should be checked using SOC loads per %clay from the literature (e.g. Leifeld and Kogel-Knabner, 2005, Geoderma) or using the own model that contains clay a predictor variable (see also comment of referee #1 on this contradiction that need to be solved). Further work is required to disentangle clay content effects from land use effects.

Minor remarks

1. Is there any renewing of AFS? For mango, e.g., it was reported that farmers use the establishment phase differently that the later stages of the plantation (p. 5, l. 15). Is AFS permanent? Is it reconverted to cropland or are trees cut at some time as part of a AFSs renovation process which possibly would effects SOC?

2. Provide the diameter of the probe (p. 6, l. 2) and the number of replicates of bulk density sampling (p. 6, l.5).

3. Mention if any carbonate/inorganic carbon was present in the soils or if soil carbon

is equal to soil organic carbon in this study.

4. What is difference between mass correction (after Ellert and Bettany 1995) and the method you applied with using the forest bulk density for all treatments? (p. 6, l. 12 f). For cropland conversion to AFS the land use system with the lowest bulk density (either cropland or AFS) should be used for a mass correction, not the bulk density of the forest that is not part of this comparison.

5. Chapter 3.1 should become part of the material and methods section in order to start the results section not with methodological assumptions.

6. P. 8 l. 13ff: Did you include any variable for the litter input in the analysis? You mentioned that at some AFS litter was extracted at some not. I propose to estimate whether liter extraction had an effect on SOC stocks in the regression analysis directly by using an estimate for the litter input (not only via basal area) – if available.

7. Please provide a reference that aluminum toxicity plays a role also for pH 4.5, which was the lowest pH in your study. I assume that you need lower pH for toxic effects of aluminum.

8. P. 10. L. 5: How does mineralogy affect SOC at high pH? Rephrase this sentence in order to mention the process/mineral to which this affect is attributed.

9. P. 10. L. 30: How does clay mineralogy affect SOC changes? Rephrase this sentence in order to mention in which way clay mineralogy affect SOC changes according to Powers et al..

Fig 2 and 3: Indicate significant differences with different letters.

Fig 2: Explain in figure caption if you display absolute or relative changes. The arrows are not clear, since they are not clear enough connected to either humid or dry sub-humid data. Two separate arrows are maybe better or no one.

Interactive comment on SOIL Discuss., 2, 871, 2015.