

Interactive comment on “Detecting small-scale spatial heterogeneity and temporal dynamics of soil organic carbon (SOC) stocks: a comparison between automatic chamber-derived C budgets and repeated soil inventories” by Mathias Hoffmann et al.

Anonymous Referee #2

Received and published: 10 October 2016

The manuscript “Detecting small-scale spatial heterogeneity and temporal dynamics of soil organic carbon (SOC) stocks: a comparison between automatic chamber-derived C budgets and repeated soil inventories” analyses 4 yrs of soil organic C changes by uses of flux chamber technique and repeated soil inventory measurements over a crop field. Data set confirms that AC-based C budgets are suitable to reveal small-scale spatial and short- term temporal dynamics of Δ SOC. The paper is well written and interesting and definitely worth to be published in order to i) show a method comparison

C1

and ii) provide evidence on the accuracy of flux vs soil inventory measurement to determine SOC changes over time. I had a number of small remarks I thus recommend (minor) revisions. General comments I think authors should not mix terms up being established by the scientific community. Accordingly I recommend to use Δ SOC for the repeated soil sampling and NBP (net biome productivity) NCS (Net C storage) for annual C budgets of chambers (for references see Schulze et al 2007 and Soussana et al 2007, 2010). Before experiment field site received soil, this increased SOC stock and %soilC. To my opinion authors cannot start Δ SOC estimations from that date on as this has nothing to do with the accumulation of C by the ecosystem functioning. I recommend to skip this section in MM and results and estimate Δ SOC as the difference between 2011 and 2014. M&M section. Beside I got it wrong (L137ff), I found it a bit scary that chambers had no replicate measurements and that authors privileged the topographic gradient. I think this is the most critical point of the study. Accordingly I was wondering how mean \pm SE was estimated for the AC measurments? I was wondering why authors estimated NPPshoot per day and not by uses of degree day which would have been more adapted to physiological biomass evolution and easier to compare between years . This is misleading and has nothing to do with the experiment except some CO₂ exchange from soil which is difficult separate from CO₂ flux. I suggest to set soil inventory Δ SOC as the difference between April 2011 and 2014. The soil sampling part is a bit unclear, -as the depth of horizons are not clear and do vary with ecosystems – recommend to use cm depths -the mixed soil? here I suggest to skip the 2010 sampling. - missing information on the estimation of soil C stocks. Eg did bulk density vary with depth, location?. Was bulk density normalized (for layers, year) before estimation?

Discussion, I awaited more discussion on the effect of ecosystem on NCS. So to say the crop rotation and why is doing better than the other. Having some data analyses on the effects climate, crop species and duration of bare soil . Soil N content was mention in results but not in discussion.

C2

Specific comments L138 . . . were set up at the depression (Sommer et al., 2016) (see 2.2.1).

L141-143 this is misleading I suggest to remove this section from M&M and results. . . the soil inventory Δ SOC is thus april 2011 to 2014!!

L185- 187 "For easy. . . site" remove this phrases

L191 what about chamber heating?

L 206 replace Δ SOC AC by NCS

L231 ". . .of CO2 concentration data as suggested by. . ."end of the sentence is missing

L281 I am not sure that the LAI_C content relation is useful and is of any help in the present manuscript

L288 Calculation of Net Carbon Storage (NCS)

L293ff suggest mention the whole equation as used in literature for NCS (NBP), describing which components were ignored and not.

L311 Horizons Ap is difficult to understand and varies between sites and ecosystems, I suggest to use the depth (eg 0-15cm) instead

L313 soil cores need more details on diameter, depth. . .

L313. . .In December 2014, mixed soil samples were collected from the Ap horizon next to each chamber. . .- WHAT are mixed soil samples?

L348 "NPP shoot between chamber positions and . . ." - not clear what means positions

L368" As a result of soil translocation in 2010, initially m. . ." delete

L379 ""Average annual Δ SOC values for the soil resampling and C budget method are shown in Fig. 6." Difficult to see from Fig 6 suggest to add the numbers in table 1 .

L391 soils (Conant et al., 2010; Xiong et al., 2016). Delete citation as not its place here

C3

L488 "We confirmed that AC-based C budgets are able to reveal small-scale spatial and short-term" not sure this is true with 4 chambers only

Table 1 : Suggest to add a column Δ SOC values (2011-2014) for soil resampling and cumulated C budget (2011-2014). Would be nice to have the crop rotation in the 1st column. What about standard deviation for soil sampling?

Interactive comment on Biogeosciences Discuss., doi:10.5194/bg-2016-332, 2016.

C4