

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 #1

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This manuscript describes a comparative experiment on soil organic carbon stocks. They compare automatic and soil sampling results in order to know if they are equivalent to define the small spatial and temporal variation. The concept and results are novel. This study is interesting and must have involved a great deal of work. While the results merit publication, with respect, I think the paper requires major revision.

This study pointed the need to more information about the different type/technic of soil C storage in order to standardize the results and pointed the advantage and incon-

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venient of them. Nevertheless, added a table will be a good idea to underline these differences and the need to more advances, and the necessity of this study. The methods and statistical analyses seem not totally appropriate. With respect, your discussion need more attention in order to forward your innovative results. Currently, your paper tend to look like a technical report but without enough “technical information”, and I think that it is more than that.

General comments: - Firstly, more information are needed in order to see the real advantage of your methodology. Presently, we are quite lost and the benefit of AC-based C budgets is not enough forward.

- Need more details on the soil information and their effects on the soil C storage process: different soil layers taking into account; what about the roots, which are the main C input in the soil. Why do you clearly underestimate the deep soil in your C budget? Did you have more information about the seasonal variation of the soil chemistry, soil density in link or not with the different plant species? In the abstract, line 43 page 2, you talk about soil properties but nothing after.

- The temporal variation were nicely represented with 4 years of measurement, but concerning the spatial variation, I think that there are some overestimation because of you are only one chamber by topographic step, so no replication by topographic step; and on the other hand, this topographic gradient seems to be too little, with only “difference in altitude 1m within in a distance of approx. 5 m of each other. Page 7 line 140. So for me there are not enough difference to “called” spatial variation.

- It's not clear your hypothesis about the potential difference between the four topographic steps. Could you add some information about that, and confirm it in the discussion?

- Estimation about the ecosystem compartment effect? For Reco, which part of soil and aboveground compartment?

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Specific comments: - Maybe the abstract need to more concise. - P 4, L 67, what kind of land-use? - P4 L 71: I am not sure to understand the third point. For me it is also time dependent. - P6, L 110: with the same land use? - P6, L 110, could you add also the study of Skinner & Dell 2015. - P6, L 127: soil or air temperature? - P8, L 157: So 5 different crops during your study? - P8, L 174: it's a closed system? - P9, L 189: could you use the same unit for volume liter or m3 - P10, L206: I surprised because the C sink is a negative value and a C source a positive value, basically. - P10, L 212: Could you add the equation of your fluxes? and more information about your choice: time length for the measurements, number of measurement by day. - P11, L 241: unit: $\mu\text{mol}^{-1} \text{m}^{-2} \text{s}^{-1}$ => $\mu\text{mol CO}_2 \text{m}^{-2} \text{s}^{-1}$, right?; L 243 : temperature of "air" ? - P12, L 263: could you explain the range 2-21 consecutive days? - P14, L 298: Could you give us a mean of your CH₄ measurements? and what about the N₂O ? If you want to discuss about the C budget, you need to add information about the two others greenhouse gases. - P15, L 324: only topsoil? what about the subsoil ? We know that the subsoil have a high contribution to the soil C stock. - P15, L 335: unit: I think that it will be better: $\text{gC m}^{-2} \text{y}^{-1}$, right ? - P19, L 431: add reference about the gap filling ? your own method or adapted to already published methodology ? - P21, L 465: what about the daily pattern of NEE, Reco and GPP, and so soil C storage? - P21, L 477: Could you add more references? they are lots of studies on the soil C sequestration in pastures in different biomes, inverse to crop land.

Figures - 1: The temporal measurement was nicely represented. But, did you add a schematic representation of the spatial aspect? - 2: I prefer to see SOC in stock (g C m^{-2}) rather than %. Could you had a scale in your picture? and also a cross-section of your site in order to see the different altitude and distance among chamber. - 5: Could you add in the caption the signification of the 4 symbols, and add in the graph a dotted horizontal line for zero. - 6: problem with unit: $\text{gC m}^{-2} \text{y}^{-1}$, right ? Could you add a test (a t-test ?) in order to know if they are difference between the two estimations of C budget in each chamber? Currently, we need more information about the added value of your C budget. Same as for figure 3, 4, 5. It will be nice to know if the chambers are

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significantly different.

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