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Biogeosciences Discussions

Interactive comment on "Integrated management of a Swiss cropland is not sufficient to preserve its soil carbon pool in the long-term" *by* Carmen Emmel et al.

Anonymous Referee #2

Received and published: 21 June 2018

The paper is a very important contribution to the discussion on climate mitigation in agriculture even though it covers data only from one site. The site Oensingen has been monitored since 2003 including eddy covariance and soil carbon stocks inventories. Most important for the net C balance of the site is the import of C via organic amendments and the export with harvest. These fluxes are often ignored or insufficiently quantified. In contrast this study presents the full balance including all fluxes. It is written very well and provides a unique data set and valuable conclusions on cover crops and organic fertilisation effect on the C balance of croplands.

There are only two major aspects that should be considered to improve the paper:

1.) Cover crops are presented (e.g. in table 2 and Fig. 4) similar to other crop types even though they are not similar, since they are only grown during autumn and winter season. This should be made clear to the reader at any point (e.g. by adding "winter season" in figure legends). Also on page 14, in l. 12 I recommend to rephrase to: "Their relatively large C loss to the atmosphere was thus a result of the winter growing season and not of the crop type". On p. 14 l. 3: Do not merge peas and cover crops in one sentence since they are not comparable. P. 15 l. 14: Rephrase to "During the winter season with cover crops there was always a net C loss. This loss. . ..". Add on p. 10 in l. 15 "of net CO2 loss during winter season". I would also recommend changing the order of crop types in all relevant figures and tables and putting cover crops separately at the end. 2.) There is a discussion on organic fertilisers to compensate soil C losses in agriculture since they can be so called external C inputs (see Powlson, Whitmore et al. European Journal of Soil Science 2011). If the organic fertiliser is made of biomass that is mainly produced outside the field side where it is applied, we do not gain a climate mitigation effect. Thus, it would be important to estimate from straw and yield export of the Oensingen site how much of this exported C is fed to animals or mixed with manure and afterwards returned to the field site. Is it a closed cycle? You recommend increasing the use of organic fertilisers (e.g. p. 18. L. 18). However, you do not mention how much organic fertiliser is produced from biomass from the site or maybe available at regional scale. Also the recommendation for more compost application as organic amendments (p.17. l.5) should be encompassed with data on how much compost in regionally available.

Minor remarks P. 1, l.2: "intensively managed" P. 1, l.7: Mention here that NEE derived NBP is not equal to the net C balance since non CO2 fluxes (DOC etc.) have to be included but are often very small. P.2, l.27-30 can be removed since they only contain large lists of existing studies (blowing the reference list) without referring to the content and finding of these studies. P.5, l. 1: The type and company that produced the camera is no required information to understand or potentially reproduce this study. Please remove it. P.5, l.25: Please provide the physically plausible range that was

used as quality criteria (-50 to +50?). P5, l. 31: How was CO2 storage measured or calculated? Please explain. P.7, l. 1: How was the u* filter determined? Which criteria were used to keep it dynamic? P.7, l. 28: Provide the depth for which bulk density was determined. P. 7, l. 30: Explain why soil sampling was interfered by liquid manure application and what could be the consequences for the obtained soil C and N data. P. 8 Eq. 1: Add "+N" with N comprising all non CO2 losses as mentioned on the next page. Is there any estimation of the DOC export flux for the site in order to show that it is small and can be ignored? P. 9, l. 8: Soil-Plant-Atmosphere Crop Model P. 10, l. 3: Did the season starts with sawing or with January? How is it defined? P. 10, l. 8: Voluntary growth??? Fig. 3: Please add the estimated soil carbon density for the topsoil for the 2004 sampling in this figure. P. 12, l. 2-3: Please provide uncertainties for the relative C loss numbers. P. 12, l. 6: The number in brackets "(138. . ." is unclear what is it referring to. Please also consider to compare your mean NBP with data from Kutsch et al 2010 and Schulze et al 2009 or data from cropland soil inventories provided by Ciais et al. 2010, GCB. P. 13, l. 9: More work on the uncertainties of the flux components would very much improve the paper. Could you provide estimates for the uncertainties instead of only stating "they can be assumed to be similar"? P. 15, l. 4: "was again comparable" – comparable to what? P. 15 l. 32: "promised" instead of "assumes" ?! Tab. 3: This is a table which I do not understand. First, Corg is no nutrient and should be removed from this table. Where do the amounts of solid manure and manure come from? Is it annual? If yes, the unit should be Mg ha-1 a-1. P. 18: l. 7: Please take into account the uncertainty of the numbers and do not provide them with one digit (since they cannot be determined with such a high accuracy).

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