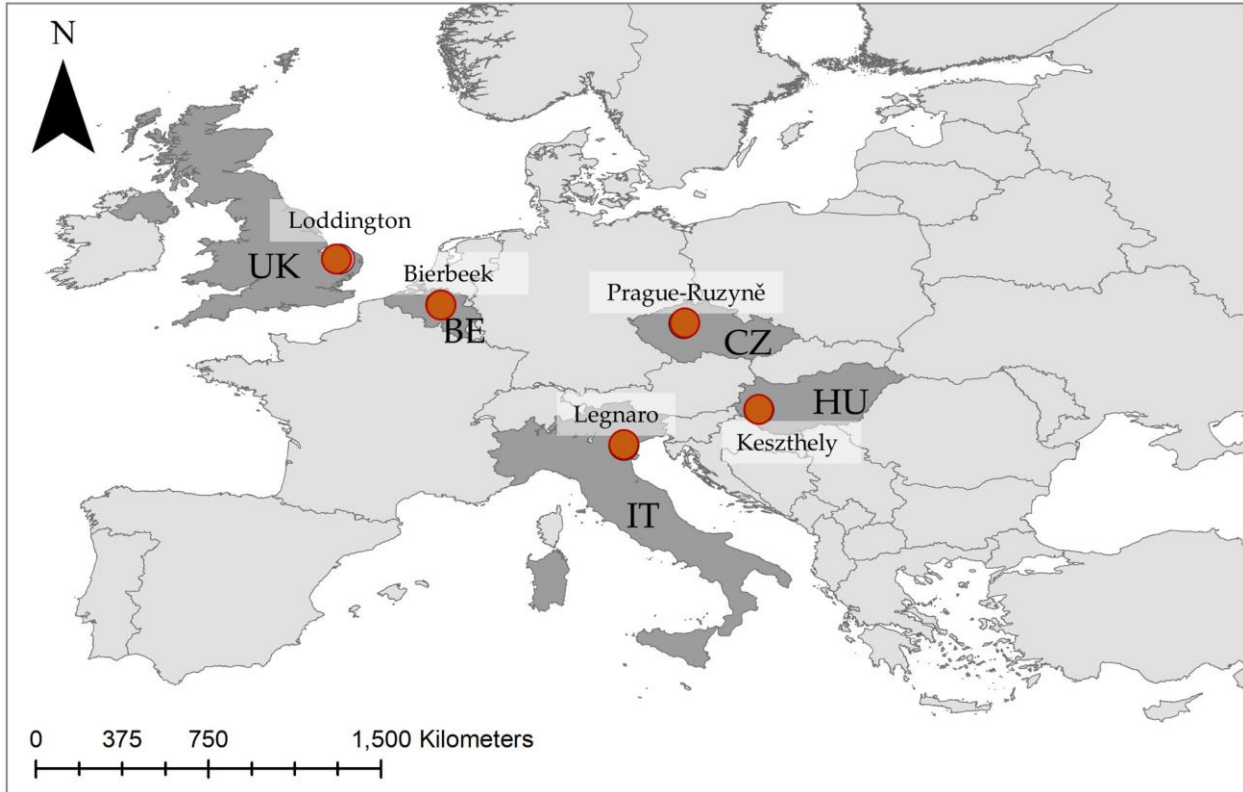


We thank the reviewer for the detailed and constructive feedback. The remarks are useful to improve the readability of the manuscript, shorten all the sections and focus more on the important aspects of the research. Below we address all comments in detail. The comments by the reviewers are in red; our reply is in black

The study presented by Panagea and co-authors summarizes the outcomes of the analyses of topsoil structural stability as determined by soil aggregates, and related soil organic carbon under different soil managements that are proposed beneficial for soil (structural) quality. The authors made use of a European network of long-term field experiments, which allows them to cover a wide range of region-specific management practices, as well as pedo-climatic conditions. The approach is very good and the authors collected a valuable dataset. I would think that the authors should highlight even stronger the European gradient, which is both west-east and north south.

Thank you very much for appreciating the value of the dataset. A map will be included in the text to visualize the European gradient of the research as also suggested by Reviewer 2. Indeed, mentioning the coordinates in a table is not so informative for a reader. The statement in the Site description section will be changed: “The long-term experiments were set up independently from one another with different objectives and under different environmental conditions. Nevertheless, they offer the possibility to explore a wide range of representative management practices and pedo-climatological conditions across Europe”



The manuscript is generally nicely written and understandable. Some sentences are long and should be split into two. For example, ll. 344 – 346 should be split into two sentences, one stating the outcomes of the study and the second one highlighting that this has also been observed in other studies. Please avoid long sentences containing too much information.

The specific sentence was rephrased and shortened as well as several other sentences were shortened or split to make the manuscript easier to read, also considering the comments of Reviewer 2.

The description of the methods is understandable and straightforward. I also very much like Figure 1, which nicely summarizes the methods described by the authors in subchapters 2.2 – 2.4.

Thank you! We indeed tried to summarize all the different methodologies in a clear straightforward way.

Throughout the manuscript, the authors make some hints on long-term and short-term effects of the management practices, but do not mention the age of the respective experiments and for

how long the respective practice has been applied to the individual field sites. Please add this information and include it in the interpretation of the data.

The years each experiment was running at the time of our sampling campaign, were added in Table 1 and used also in the discussion to indicate the duration of each experiment and give an indication of its effects.

In the discussion, the authors put a lot of effort in discussing the impact of management strategies on SOC in general and on the soil profile. This is of importance, for sure, but it moves the attention away from the real intention of this study, i.e. the OC fractions associated with different soil aggregates (as stated in the title). This section could be shortened with only mentioning the most important studies (see below).

Following also the recommendations of Reviewer 2, the discussion section will be shortened and focused more on the effects of the practices on the changes of organic carbon fractions among the different aggregates' sizes.

Please find some minor comments below:

Minor comments

I. 273: h-1 = ha-1:

Typo corrected

II. 288 – 290: not necessarily what has been proposed in the Introduction and hypotheses. Please add this to the text .

Considering also the comments of reviewer 2 to reduce the length of the discussion and focus more on the important points this sentence will either be removed or rephrased to be more focused on our initial scope and hypotheses.

I. 300: I suggest to remove “with these mechanisms” – it does not become clear if mechanisms means practices or what exactly they relate to:

Expression removed as suggested.

II. 300 – 303: this is true only for conservational managements – conventional tillage, for example, is not known to decrease mineralization as it leads to disturbances. Please re-phase this part and make clear which practices you refer to.

This part has been rephrased and shortened to follow the recommendations to focus on the core messages.

I. 311: the choice of references is not clear to me: to my knowledge, neither Blanco-Canqui & Lal (2008) nor Haddaway et al. (2017) included SOM distribution in aggregate fractions in their analyses. However, the study of Haddaway et al. (2017) is built upon a methodological framework for meta-analyses on the impacts of soil management on SOC stocks in boreo-temperate regions. This framework was then further used in the meta-analyses performed by Meurer et al. (2018). So which point do the authors want to make here? From the choice of references it is not clear if “common methodological framework” relates to the SOC measurements taken in the field, or the compilation of studies involved in analyses (for this, please see Haddaway et al. (2015) and Söderström et al. (2014)

At this point we were referring to the controversies in literature when it comes to tillage research and SOC. Indeed, the structure of the sentence is not clear. Thank you for providing us with relevant literature which can make our statement stronger. We will rephrase this section.

I. 313: I suggest to remove “alternative to inversion tillage”, as it is not fully clear what the authors intent to say with that. Just leave it with “alternative practices” or different practices”:

Changed to “different soil cultivation practices”

II. 320 – 321 & 346 – 347 & 400: please mention the hypothesis – remind the reader. The same applies to I. 319 (s&c) and I. 322 (mM).

The structure will be rephrased to remind the reader to the initial hypothesis.

I. 323: please remove “especially in CZ and HU_2” or explain a bit better what is meant here.

Expression removed

II. 327 – 332: at this point, it would be interesting to discuss if this is a methodological issue, or if the other studies simply did not further study the composition of the macroaggregates, as has been done by the authors

The fact that we did not observe differences in the macroaggregate mass does not have to do with the further study of their composition. Our initial hypothesis based on previous research was that we would expect a significant reduction of the mass as well as the carbon content of the macroaggregates caused by inversion tillage. We proceeded to further study the composition because we did not observe any important changes in the mass but only in their carbon content for the majority of the experiments. We will add a sentence in this paragraph explaining the possible reasons. We tried hard to have as uniform sampling, measuring and analysing conditions as possible across the different experiments in 5 countries. Our conclusion could possibly be linked to the time of sampling and the aggregation seasonality, which favoured the formation and preservation of large macroaggregates at expense of macroaggregates.

II. 341 – 343: this is an important outcome and it should be further elaborated: what exactly is the benefit of large macroaggregates in relation to “good soil structure”?

The dynamics of large and small macroaggregates are of great importance for soil structure and carbon sequestration, as the formation and stability of the microaggregates which are important for long-term C storage are regulated by their quality and life cycle. A rapid turnover of macroaggregates reduces the formation of microaggregates within them and the stabilization of C within these microaggregates. Also, the soil aggregated distribution controls the presence of macro-pores that influences the flow of water, particularly near the soil surface and the existence of large macro aggregates is associated with better pore structure, optimum movement and storage of gases, water, heat and nutrients, biological activity, and exchange processes. These will be discussed in this section. Better stability during longer and intensive rainfall leads to better infiltration and less erosion and the same time to better penetration by the roots.

I. 355: here, the humification coefficient should be explained in more detail. I assume that the authors mean the amount of C that remains in the soil?

As a humification coefficient, we refer to the fraction of organic residues that are converted to more resistant soil organic matter. As we have not referred to that before and does not fall within the scope of this research, we will rephrase the sentence in order to keep the same message but without the specific terminology.

II. 377 – 380: this is certainly true on average and depending on which studies are included in the analysis. Some studies shows that the effect of reduced tillage on SOC stocks in deeper depths might be even negative. See for example individual studies shown in Fig. 1 in Meurer et al. (2018).

Thank you for providing this interesting research. We will include both in our discussion and in the introduction where we will mention that reduced tillage may even lead to a negative change of SOC in the deeper depths.

II. 422 – 427: this is an important point! In addition to the impracticability at field scale, potential negative environmental impacts following the high doses of organic fertilizer application should briefly be discussed here.

We will add a sentence mentioning the possible negative effects of high doses of organic fertilisers such as leaching or accumulation of nutrients with subsequent negative effects on plants, microorganisms, soil, and water.

I. 450: requires:

Typo corrected

I. 472: please be more specific with what is meant by “more time”.

Our methodological design included one-time sampling and thus we cannot specify the duration of the life cycle required for a stable soil structure to be built. Here with “more time” we mean to allow the soil structure to build by not intensively disrupting through tillage. We will try to rephrase and explain.

Literature referred to in the text:

Meurer KHE, Haddaway NR, Bolinder MA, Kätterer T. Tillage intensity affects total SOC stocks in boreo-temperate regions only in the topsoil – A systematic review using an ESM approach. *Earth-Science Reviews* 2018;177:613-622.

Haddaway NR, Hedlund K, Jackson LE, Kätterer T, Lugato E, Thomsen IK, Jørgensen HB, Söderström B. What are the effects of agricultural management on soil organic carbon in boreo-temperate systems? *Environ Evid.* 2015;4(1):1.

Söderström B, Hedlund K, Jackson LE, Kätterer T, Lugato E, Thomsen IK, Jørgensen HB. What are the effects of agricultural management on soil organic carbon (SOC) stocks? *Environ Evid.* 2014;3(1):1.