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Interactive comment on “How accurately can soil organic carbon stocks and stock changes be quantified by soil inventories?” by M. Schrumpf et al.

Anonymous Referee #2

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The authors report detailed results of 12 investigated sites from the CarboEurope project. The topic is well within the scope of BG and highlights findings. The paper is well prepared, the overall structure and details provided are clear. The conclusions drawn are consistent with the results presented. I propose this paper for publication in BG. I have some minor comments regarding the following aspects:

- some parts of the discussion contain a lot of repetitions which can be removed to make the discussion section more concise. This holds in particular for chapter 4.2, 4.3, and 4.4.
- the paper is quite lengthy, and provides measurements very detailed (2 large tables, 9

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figures). Therefore, I recommend to skip figure 8, as this figure doesn't provide further important information.

The title implies that soil inventories are involved. The CarboEurope is rather young in contrast to many soil monitoring networks in Europe. Therefore, I miss the link to results of soil monitoring networks in Europe (see Saby et al. 2008 for a summary). I suggest to link the result of this paper to some extent with the aspects raised in the Saby paper regarding the possible monitoring set up to detect changes in soil carbon.

Details: p.1 line25: is 10 cm also valid for grassland and forest? p.5 line 1: for the reader it is not clear from the introduction (see p. 4, line 9-14) why this is the hypothesis. If you have reasons from those papers cited please shortly mention them. p. 5 line 24: for comparison with other studies it helps if you provide the size of the monitoring plots in m² or ha. I see here also the link to the "usual size of monitoring sites in Europe" reported by the ENVASSO project mentioned above (Saby et al 2008, Soil Use and Management). This would help to compare your results with those reported in the paper of Saby et al. (or better in the report from the ENVASSO homepage). There are soil monitoring networks with benchmark sites of size 100m² and others with > 1 ha. The latter are confronted of course with much larger spatial variability. In that context the results of the CarboEurope project reflects the possible MDD for OC for a sampling design with a certain plot size, N core samples, fixed depth, no bulked samples. Other monitoring studies with other sampling designs will report other MDD ranges. Therefore, I suggest to restrict the findings of this paper clearly to the sampling design used.

p.6 line 13 ff. : the soil types are provided in Table 2, but in the interpretation of the results and discussion they don't appear any more? I assume that the pedogenetic horizons of a Podzol or even Phaeozem contribute to the findings reported in the tables and figures.

p.7 line 24: I don't understand that sentence, please rephrase p.8. Eq.4: β_0 , β_1

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and epsilon are not explained p. 8 Eq. 5: for the first term also $\text{Var}(\epsilon)$ instead of text can be used p. 8 Eq. 6 & 7, the index ϵ , s , and j is not given

p.19 line 21: for interpretation: does the soil type of Laqueuille and the past fertilization management explain this large C pool?

p. 11 line 8: referring to figure 5. The measured relative contribution is not explained in the method section, what is the unit?, why is the contribution of the covariances negative. This would help the reader to understand figure 5 better.

p. 12 line 8 : please add: ...using 100 soil cores at a monitoring sites of $x \text{ m}^2$

p. 13 line 9-11: Please check the unit of the last column in Table 2. Is the MDD here in another unit? Later in figure 7 you provide deviations, here the absolute units are $-100 \dots 100 \text{ g OC/m}^2$?

p. 14 section 4.1: for a comparison of the C stocks of grassland or arable soils the past nutrient management and soil type is also quite relevant.

p. 16 line 28-32: you find in literature quite some papers dealing with PTF for BD, most of them include organic matter and clay content as predictor variables. The specific PTF's are better / less successful depending on the soil texture classes.

p. 18 line 9: I assume that the numbers given in Table1 refer to regional studies, i.e. the MDD was divided by the sqrt of site numbers. In case, this is a pooled MDD for monitoring sites and not comparable with the MDD of one monitoring site.

Figure 7: please explain ESM in the figure caption

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