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Interactive comment on "Comment on "Soil organic stocks are systematically overestimated by misuse of the parameters bulk density and rock fragment content" (Poeplau et al., 2017, SOIL, 3, 61–66)" *by* Eleanor U. Hobley et al.

C. Poeplau

christopher.poeplau@thuenen.de

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1. Generally, the proposed additional equation of Hobley et al. does exactly equal the equations proposed to calculate SOC stocks (7, 8, 9) in Poeplau et al. 2017. It is the mass balance approach (Fine soil stock- FSS - includes bulk density of the whole soil as well as depth of the respective increment) and we argue in the same direction: volume of rocks is not needed to correctly calculate SOC stocks. We are thus questioning if this comment does add clarity to the whole topic or if readers get even more confused because the discussion is turning in circles.

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Again:

Equation viii proposed by Hobley et al.:

SOC=C_finesoil$\times$(1-massproportion coarse fraction)$\times$bulkdenity$\times$depth

equals our equations 7 and 8 (Poeplau et al. 2017):

FSS=mass_finesoil/volume_sample $\times$depth_i

SOCstock=SOCcon_(fine soil)$\times$FSS

Since FSS can also be written as:

FSS=(1-massproportion coarse fraction)$\times$bulkdensity$\times$depth

2. The criticism, that the proposed simplified set of equations (7, 8, 9) would only be possible for single-layer samples but not for subdivided samples is wrong, since FSSi can be calculated for as many layers as needed, of course (FSS0-10, FSS10-20...).

3. The argument, that rather coarse soil mass should be measured, while measurement of fine soil is more prone to errors (line 13-17) due to losses of dust is out of focus and beyond the scope of the paper Poeplau et al. 2017: 1. It is not clear, if the error of the coarse fraction is not equally large (e.g. fine soil particles that stick to stones or especially roots). 2. This is a methodological issue of sieving and weighing soil and if anybody has the observation that a significant fraction of fine soil is lost via dust (which is soil specific), fine soil mass can still be easily obtained by total soil mass minus rock fragment mass. The paper Poeplau et al 2017, however, was on the calculations of SOC stocks, i.e. the use of parameters in the equations.

4. It is also explicitly mentioned in our paper (page 62, directly after Eq.6), that if rock fragments fraction is not the volume but the mass fraction, then M3 resembles M4 with equation 6 (by the way, this is IPCC standard). Although the equation proposed by Hobley et al. is thus not explicitly written out, it is mentioned in the text.

5. We disagree, that the volume proportion is mathematically incorrect (as stated in line 9). A proportion is a proportion, may it be mass or volume. If the term 'mathematically incorrect' refers to the whole equation 5, then yes, it is incorrect, and that is what our paper is all about: Showing possible incorrect ways to calculate SOC stocks and helping to avoid them in the future.

6. What remains from the short comment from Hobley et al. is the criticism on proposing 2.6 g cm-3 as a value for rock density. Indeed, this is an approximation of a rock density and this approximation is likely as wrong as the assumption that the rock fraction contains no organic carbon as done by Hobley et al. (line 23) and also in our paper. The message of our paper, just as the message of Hobley et al. is, that rock volume and also rock (and root!) density is actually not needed to calculate SOC stocks when using the mass balance approach (see Poeplau et al. section "Recommended equations to calculate SOC stocks"). However, our approach was to include as many cases (soil sampling methods, data availability. . .) as possible. There might be cases, in which the fine soil is sampled for example with a thin auger, while the rock fragment fraction was estimated on a profile wall. In this case, this estimate is a volumetric one. Then, the bulk density of the fine soil is measured from the auger sample, but the sampled layer has to be reduced by the volume of the rock fragment fraction. This is what M4 does (combining bulk density of the fine soil with a reduced volume of the layer. It is true, that assuming a certain rock fragment density can introduce uncertainty, and we would have been wise to state that as well. What we stated is that e.g. the source of error for neglecting roots is not further discussed, which goes into a similar direction. The equation viii proposed by Hobley et al. is similarly prone to errors: Often it is not clear (e.g. when obtained from archives or literature), what the given bulk density is referring to: bulk density of the fine soil or bulk density of the total soil. In particular in soil with large rock fragments or a large coarse fraction bulk density is often measured only for the fine soil. With the equation set we provided in Poeplau et al. 2017 we insured that any mix up and misuse of bulk density data is not possible.

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7. Thus, there are several equations used to calculate SOC stocks that are simply wrong and it was the objective of our paper to point this out. However, there are also several equations that are correct (may it be M3 with mass proportion of the rock fragment instead of volume proportion as written in the text of our paper or in equation viii of Hobley et al., may it be M4, or may it be equations 7, 8 and 9 in our paper). The choice of a specific set of equation depends on sampling strategy and/or data availability. Assuming that stone density in M4 is correctly estimated (or measured!), all approaches come to the same result. Thus, it is not correct that the equation proposed by Hobley et al. “will yield the most precise estimate of C stocks”(p.2 l.23) compared to the other equations.

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