

## ***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.***

**EU Hobley**

[nellie.hobley@wzw.tum.de](mailto:nellie.hobley@wzw.tum.de)

Received and published: 26 March 2018

As pointed out by all reviewers, it is nice to see that a lively debate about the correct calculation of SOC stock is underway. The reviewers and authors have pointed out some valid points, but despite the suggestion that the debate be closed (Referees 1 and 2), there remain a few points of clarification.

Firstly we wish to note that we did not state that the volumetric proportion is incorrect (Poeplau response), but that its use is incorrect. This statement is correct.

Secondly, when we approached the authors in June 2017 to suggest we prepare a joint publication on this, as suggested by Referee 2, they stated that they did not think it was necessary.

Chiefly, Poeplau et al. state in their paper that M4, which they use as the 'correct' standard for comparing, is 'the closest approximation to reality'. They also state in their response that this is the same as the IPCC method (why then, did they not use the IPCC method as their gold standard for comparison?). M4 is however, not entirely equivalent to the equation (viii) derived in our comment, which is illustrated by comparing the errors of the two methods (see pdf supplement for the error equations and their derivation).

The equation M4 of Poeplau et al. has more sources of error than the equation (viii) in our comment and M4 should therefore be avoided. This is in line with applying the law of parsimony (Occam's razor) to the problem of SOC stock calculations, which states that when presented with competing answers to a problem, one should choose the one which makes the fewest assumptions. As pointed out by the reviewers, there are numerous sources of error in SOC stock calculations, including ones which have not been considered here, and we as scientists must always aim to minimize or eliminate them.

On this note, equation 9 of Poeplau et al. has the least theoretical error, although the practical error associated with sampling to a specific depth remains, so that's is simplicity is partially deceptive. The authors are indeed correct in their assertion that this can be used for multiple depth samples. Equation 9 from Poeplau et al. is therefore an attractive option, though care must be taken that the calculation of the fine soil stock is not derived from the equations presented in their M4 due to the high associated errors of this method.

Of key concern - and not addressed here - is the calculation of SOC stocks in stony soils, as here an accurate estimation of rock content is highly difficult. Estimating rock

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content from the profile face is highly error prone, because 2D surface areas are not representative of irregular 3D structures, such as rocks. Therefore, estimating rock content from the profile face is not volumetric, as stated by Poeplau. Taking larger volumes of sample in larger cores to determine the bulk density of the whole soil would help to alleviate this issue, but would be associated with more field and laboratory work. A systematic study into this issue, similar to the systematic evaluation of sources of error when up-scaling to SOC analyses to landscape stocks (Goidts, van Wesemael & Crucifix, *Europ. J. Soil Science*, 2009, doi: 10.1111/j.1365-2389.2009.01157.x) could help to resolve the issue.

Please also note the supplement to this comment:

<https://www.soil-discuss.net/soil-2017-23/soil-2017-23-SC2-supplement.pdf>

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Interactive comment on SOIL Discuss., <https://doi.org/10.5194/soil-2017-23>, 2018.

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