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Interactive comment on "Modelling dynamic interactions between soil structure and the storage and turnover of soil organic matter" *by* Katharina Hildegard Elisabeth Meurer et al.

Anonymous Referee #3

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Meurer and colleagues describe a modified version of the ICBM model which is intended to describe a feedback between SOC formation and decomposition and its effects on bulk density and pore size distribution. While the premise of the study is very interesting it falls short in proving that the feedback between micropore space and SOC decomposition is needed to describe SOC dynamics.

I would ask the authors to clarify and work on the following points:

- Please do a more thorough literature research: Before Federer et al. (1993) a couple authors have used equations similar to the Federer one, maybe even your Equation 20 (Adams, 1973; Rawls, 1983). These are just two examples - probably you can work

your way backwards from here. Tranter et al. (2007) provide a good overview of the literature and show how soil texture affect mineral soil bulk density.

- It would be interesting for the reader to see how much of bulk density changes is due to the difference in density between minerals and soil organic matter (mass effect), and how much due to changes in porosity (difference in porosity between minerals and soil organic matter?). Figure 7 suggests that the microporosity effect is minimal and the increase/decrease in bulk density is solely driven by the decrease/increase in SOC. Please provide some numbers how important SOC changes are for changes in microporosity.

- You set F_prot a priori based on literature values. I think you have to provide more background to the reader how they were derived. SOC is then decomposing at a speed of 10 percent in micropores. Is this well constrained by experiments?

- You use the term 'warm-up'. Please correct to spin-up.

- Please provide a complete list with all symbols and abbreviations. The reader can get lost in the amount of equations otherwise.

References Adams, W., 1973. The effect of organic matter on the bulk and true densities of some uncultivated podzolic soils. Journal of Soil Science 24, 10-17.

Federer, C.A., Turcotte, D.E., Smith, C.T., 1993. The organic fraction–bulk density relationship and the expression of nutrient content in forest soils. Canadian Journal of Forest Research 23, 1026-1032.

Rawls, W.J., 1983. ESTIMATING SOIL BULK DENSITY FROM PARTICLE SIZE ANALYSIS AND ORGANIC MATTER CONTENT1. Soil Science 135, 123-125.

Tranter, G., Minasny, B., McBratney, A.B., Murphy, B., McKenzie, N.J., Grundy, M., Brough, D., 2007. Building and testing conceptual and empirical models for predicting soil bulk density. Soil Use and Management 23, 437-443.