

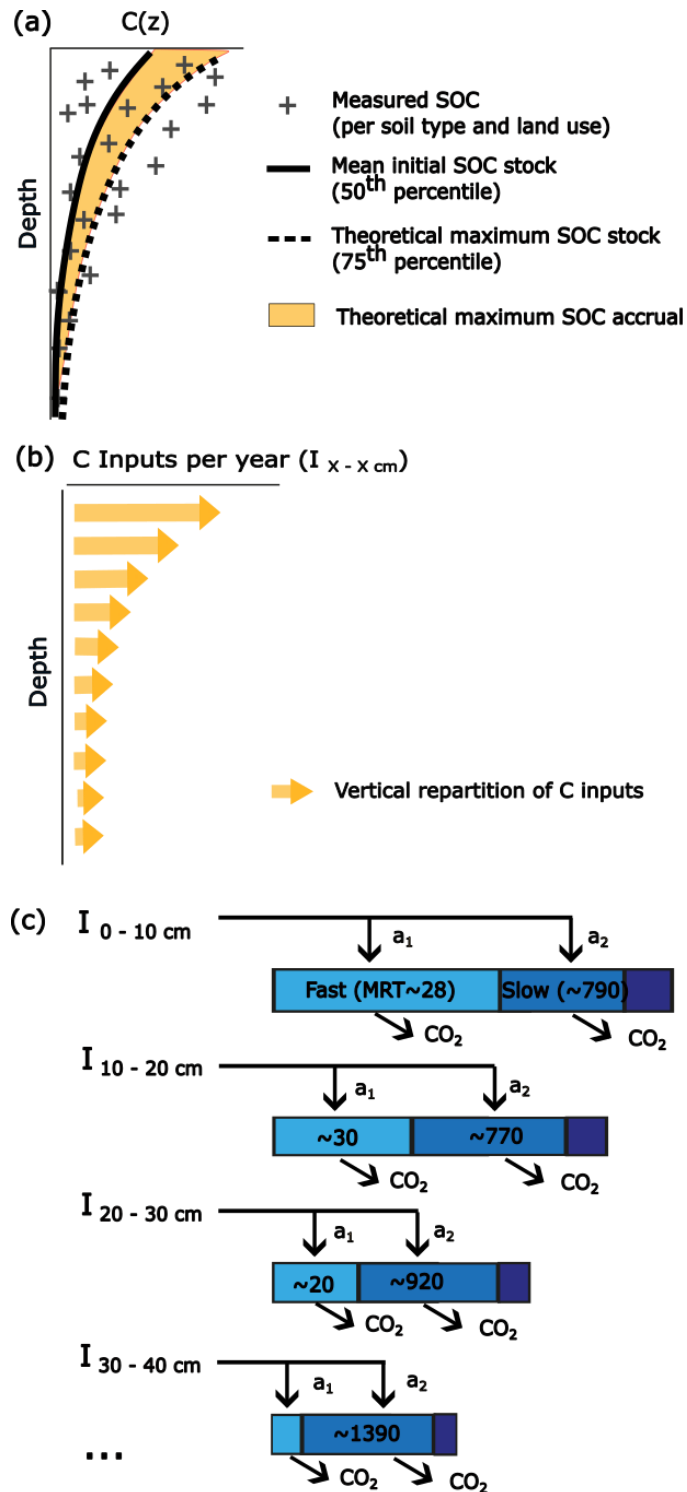
This manuscript reports a study that simulated organic C accrual over 25 years in eight soils with contrasting properties of North-eastern France. The authors compared the Hassink equation and a novel data-driven approach to estimate soil organic C stocks and maximum soil organic C additional storage capacity. They found that the Hassink approach leads to unrealistic estimates and that the simulated soil organic C accrual over 25 years was five times lower than the maximum storage capacity.

The study has interest, and to the best of my knowledge, well conducted, although some assumptions need to be validated or better justified (see below). Also to the best of my knowledge, the results are well discussed and the conclusion are well supported. However, the study needs to be better introduced and some aspects of the approach need clarification.

We thank you for your positive reception of the manuscript, and will try to answer your specific questions below:

My specific comments:

1. 46. This sentence is unclear. What do you mean by “the upper percentiles of the total carbon content in a large dataset”? **The approach will be made clearer in our new figure 2 shown below. The theoretical maximum SOC stock corresponds to the 75th percentile curve of the carbon content dataset.**



Suggested New Figure 2 : Summary of our approach: (a) estimation of initial and theoretical maximum SOC stocks from the measured data; (b) estimation of vertical repartition of C input for the different scenarios considered; (c) Functioning of the depth-dependent three-pool model (fast-cycling pool, slow-cycling pool, inert pool). a = allocation factor ; MRT = Mean Residence Time. MRT values vary with depth as per Balesdent et al. (2018) and are corrected for temperature, humidity, pH, texture and CaCO_3 (see Methods).

1. 50 The Hassink method needs to be introduced. **Following comments from Reviewer 2, we will remove the Hassink approach from the main text. This will allow us to refocus on our main objective: the determination of realistic SOC accrual targets attainable within 25 years.**

1. 50. It is unclear what data-driven approach the authors are referring to. This should be better introduced and explained. **This approach will be referred to as the theoretical maximum SOC accrual approach. It will be better illustrated in the new version using the proposed New Figure 2.**

1. 64. Additional to what? Please clarify. **SOC additional storage capacity refers to what can realistically be added to the current SOC stocks, in our case within 25 years.**

1. 75. The last sentence seems to be disconnected from the rest of the paragraph. **We apologize if the logic was difficult to follow. In the new version, we will improve our definition of our C input scenarios by linking them more explicitly to realistic ranges found in the literature (details in response to General Comment 2 from Reviewer 2). This should clarify this paragraph.**

1. 78. The model needs to be briefly introduced here. **We will provide a more thorough definition of the model in the introduction and Material and Methods section (illustrated by Figure 2, see above). Please also see our reply to General Comment 3 from Reviewer 2 for details.**

1. 81-84. This text is unclear. **See our reply to Comment 1. 75 above.**

1. 107. What do the authors mean by data points? **Each soil profile considered has several points of measurements at various depths, allowing us to plot SOC as a function of depth in the different soil types and land uses (See Figure 2). These are referred to as data points.**

1. 109. Sampling was conducted between and 2019. Do different starting points affect modeling results? **We assume, since land use has not changed since 1830 in the region of study, that the soil profiles are at steady state, and that sampling from 2009 to 2019 will not impact modelling results. This aspect will be made clearer in the new version of the paper.**

1. 130. The use of this pedotransfer function to estimate bulk density would need to be validated with data from this study. **This has been done for the data points where bulk density measurements were available (we compared different existing pedotransfer functions and selected the one that best estimated the measured bulk density values). We will mention this in the new version of the paper.**

1. 178-180. These estimates need justification and validation. **This section, and mentions of POM and MAOM, will be removed in the new version of the paper.**

1. 307. “for reasons that will be detailed further in the Discussion section” can be removed.
This will be removed.