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Interactive comment on “Modelling soil organic carbon stocks in global change scenarios: a CarboSOIL application” by M. Muñoz-Rojas et al.

Anonymous Referee #3

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This is an interesting modelling study in which regional SOC predictions are presented for southern Spain. The topic fits within the scope of the journal. It is remarkable the valuable dataset that this study presents in terms of observed C values. Also, the future predictions and their spatial representation are challenging outputs. The paper has some issues that should be discussed by authors and incorporated in future versions of the manuscript.

GENERAL COMMENTS

In the Introduction section, a brief description about the Mediterranean systems and their role in a climate change scenario could be interesting. This would help readers not familiarised with these systems to understand the importance of the paper and the consequences of climate change in Mediterranean systems.

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The first objective of the paper states: “to test and validate the CarboSoil model in climate change scenarios”. This is confusing. The validation of the model should be made according to current climate data. Once validated, the model can be used for future predicting purposes.

In the Material and Methods section, it should be clear stated if CarboSoil is either a simulation model or a tool. Also, it should be stated which type of model is. Since it seems that the model has not been published yet, more information about the model would be interesting to show. In my opinion Fig. 2 is not adding some much information to the paper. Thus, I would replace it with a new figure. Probably a conceptual diagram showing how the model works would help to understand better the model.

It is not clear for me what authors consider as “study area”. Why is not Valencia described in the study area section as it is made for Andalucia? I think it should be included since it was used for validation purposes.

Please include the range of ETo values in the study area.

Regarding the SOC observed values, when was the sampling performed? Were all the profiles sampled at the same time? If not, please indicate the time period. It would be interesting to see the proportion of soil profiles sampled for each land use class.

In the Results section, Table 4 reports observed values and mean predicted values for each climate scenario. According to the explanation given in section 3.1, this table should be reporting observed SOC values and the predicted values for the current climate conditions instead. This dataset (predicted values from the current climate scenario) could be used for validation purposes. I do not think that predicted values from climate change conditions may be validated with current observed data.

The section 4.1 does not report any discussion to the data obtained. This section is a summary of similar studies performed in Europe. I recommend that authors eliminate this section from the Discussion.

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The section 4.2 needs more discussion. It would be interesting to see discussion about the different SOC change predictions obtained between land uses and between soil types.

The model reports SOC changes in different soil layers. As reported in the results section, soil depth had a significant impact on SOC changes under climate change conditions. This finding should be more detailed in the Discussion section since it is an interesting finding.

Regarding section 4.3, a key source of uncertainty is that the model is not able to simulate the effect of CO₂ increase on C inputs and thus on SOC turnover. This issue should be discussed in the manuscript and how this limitation affects the final results found.

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