Biogeosciences

Discussions

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Interactive comment on "Drivers and modelling of blue carbon stock variability" *by* Carolyn J. Ewers Lewis et al.

Anonymous Referee #2

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The manuscript 'Drivers and modelling of blue carbon stock variability' reports on the main drivers of sedimentary OC stocks (ecosystem – geomorphological – anthropogenic) in the top 30 cm of blue C ecosystems (tidal marshes, mangroves and sea grass meadows) across the state of Victoria (Australia). In addition, the authors used different general linear mixed-effects models to predict the spatial distribution of topsoil OC stocks of tidal wetlands in this region. The authors used a dataset they previously constructed (Ewers Lewis et al. 2018) of 287 sediment cores down to 30 cm depth to perform their analyses. The main results of the study show that ecological drivers (i.e. ecosystem type and dominant vegetation species) best explain the variability in C stocks, better than geomorphological and anthropogenic drivers. In addition, the authors calculate the regional topsoil C stock in tidal wetlands in Victoria to be 2.31

million ton C while identifying 'regions of interest', storing a substantial portion of total C in the studied region.

The manuscript is well-written and reads smoothly. The introduction provides a good overview of different factors controlling sedimentary OC stocks in vegetated coastal ecosystems that have been identified in literature. The material and methods section gives a clear overview of the study site, the data used and how the different models have been constructed, aided by a figure visualizing the workflow. The results section describes the most important results in a concise way and the discussion section frames the results with respect to existing literature. Overall, this manuscript provides an interesting approach to calculating sedimentary C stocks in blue C ecosystems at a large spatial scale and is well-worth publishing.

General comments

My main concern with the current manuscript is that it addresses topsoil C stocks, while it reports on 'blue C stocks' throughout the manuscript, without referring to the topsoil aspect. Emphasizing this aspect is, however, important: it is well known that sampling depth can have a large effect on conclusions drawn on relative differences in C stocks between coastal sediments at different locations or in different ecosystems. For example, depending on ecosystem-specific conditions, C stocks are known to decrease substantially with depth below the surface in certain ecosystems, while in others C stocks remain relatively constant with depth. Therefore, I would invite the authors to stress this aspect more throughout the manuscript: (i) the title would be more informative by including that the study concerns topsoil C stocks and (ii) the discussion should include a section where the implications of only considering topsoil samples is discussed.

Although I greatly appreciate that the authors have provided a statement that data is available upon request, I would like to ask the authors to consider publishing the data together with the manuscript, or making it available through an online repository, so

references to the data can be made. Open data is becoming increasingly important and has the potential to greatly advance the field of wetland biogeochemistry.

Specific comments

L83: allochthonous C can also come from terrestrial or estuarine sources

L149-150: would be good to provide a justification of why only the top 30 cm has been sampled

L154-155: would be good to report on the uncertainty associated with the use of spectroscopic techniques to estimate the 'C contents' of the samples. Any idea about the magnitude of this uncertainty? How were C stocks calculated? Were depth profiles of bulk density collected as well? Please briefly explain this, as this is important for the interpretation of the uncertainty on your results.

L237: I would refer to table S4 here; this will help the reader to understand how the models were constructed

L244: it's not clear from the text how the 'averaged models' were obtained and what these exactly are, please explain this in more detail

L298: it is not clear what you mean with 'intercept'

L333: Would be good to provide a measure of uncertainty on the total calculated C stock, similar to the standard deviations you report on the calculated numbers further down in this paragraph.

L336: Please briefly explain how the standard deviations were calculated. What do they exactly represent? Only the spatial variation within these ecosystems, or also uncertainties related to the model procedures used?

L411: I would suggest changing this title to 'Modelled topsoil blue C stocks'

Tables and figures

C3

Table 2 and 3: it would be good to refer to where the description of the global models can be found (Table S4) in the caption (after '(global model 11, 5, 2 and 8)')

Table 4: I would change the caption to: '[. . .] and calculated C stocks [. . .]'

Table 5: I would change the caption to: 'Calculated blue C stocks [. . .]'

Figure 4: Please explain in the caption what the error bars represent (standard deviation?) and how they should be interpreted.

Technical corrections

L40: remove 'our'

L250: variable => variables

C4