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Biogeosciences Discussions

Interactive comment on "Scotland's Forgotten Carbon: A National Assessment of Mid-Latitude Fjord Sedimentary Carbon Stocks" *by* Craig Smeaton et al.

Craig Smeaton et al.

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General comments This is the important study to estimate the national scale carbon stock of mid latitude fjords. Although this estimation is a case study in Scotland, the methodology using seismic and biogeochemical data and the upscaling approaches are valuable and suggestive for estimating globally the carbon inventories of coastal waters. The upscaling methods contain uncertainties but the authors evaluate the uncertainties by IPCC protocol. I believe that this study is worth published in Biogeosciences.

*We thank the reviewer for the very helpful review, which highlights the significance of

the national stock estimates and rigorous methodology adopted.

However, there are some points which should be addressed for publication. In my understanding, the authors compared the total quantity of sedimentary C calculated for five representative fjords by two upscaling approaches alongside detailed estimates of C stocks of each of the five fjords to check the accuracy of two upscale methodologies. However, I cannot find any tables and figures about this point. I recommend adding a table or figure to certify the accuracy.

*An Excel file detailing the statistical tests and results was has now been attached to the submission further detailing the methodology and providing greater clarity; as noted in response to reviewer 1 – a note in the revised text makes reference to this new, supplementary table.

Specific comments

Line180: What is Fresh/Tidal ratio in Table 1. How to calculate them? *The fresh/tidal ratio represents the ratio of supplies of fresh and tidal water as found in Edwards and Sharples (1986). Edwards and Sharples (1986) details the method used to calculate this ratio simply; fresh/tidal ratio = runoff/inflow

To add clarity Fig.1 caption now includes the reference to Edwards and Sharples (1986). Edwards, A. and Sharples, F.: Scottish Sea Lochs: A Catalogue. Scottish Marine Biological Association/Nature Conservancy Council, Oban, 1986.

*Line305: Please refer to "table 3". Reference to Table 3 has been added

Line307: In postglacial sediments, the contribution of IC is similar to that of OC. What is the origin of IC? *Generally the geology of the west coast of Scotland is igneous and metamorphic in nature therefore the main source of IC will be calcifying organisms (e.g. Foraminifera). In order to clarify the nature of the geological setting and its significance for sediment IC, a new sentence has been added into section 2 of the revised manuscript. Line 275-303 discusses that the fjords with highest IC content are also the

most marine influenced (fresh/tidal ratio), this paragraph highlights that the source of the IC are marine calcifying organisms.

Line337: “changing environmental change”. *The sentence now reads: This suggests that these systems have the capacity to adapt to future environmental change

Line339: Please update the reference. If possible, please add the discussion about the origin of stored OC in the fjords. *Reference has been updated. Globally it has been estimated that approximately 66% of OC held in fjords is terrestrial in origin (Cui et al. 2016). In the Scottish context only one compressive study has taken place (Smeaton and Austin, 2017) which focused on Loch Sunart, it concluded that 44% of the OC held within the loch was terrestrial in origin. We believe that to fully include OC source contributions within this study would overstretch our current understanding of the Scottish fjord system and that this will require further and extensive field sampling (i.e. beyond the scope of this study). Line 285 has been updated to reflect our current understanding.

Figure 6: What is the meaning of shaded area? Is there any data in Maerl Beds and Biogenic Reef in Fig. 6A, B? *The shaded areas signify the broad environmental context. These shaded areas split the plot into three section 1) study results; 2) Living vegetation; 3) Soil; 4) Marine C stores. In order to simplify these plots, the background shading has been removed from the revised manuscript plot for Figure 6. Maerl and biogenic reef data are included in panels A and B of figure 6, but the total quantity of C stored in these environments and there areal coverage is small in comparison to the other data sets – this means that they do not readily appear on the plot (they are present). Only when normalized by area are they visible on the plot (i.e. panel C).

Technical corrections Line254: available “to” test *Typo has been corrected

Line295: by Little loch Broom? *My changed to by

Line317: remove “) ” *“)” removed

Figure 6: There are mistakes in the color of fjords.

*The colouring of the fjords in figure 6 is consistent throughout. Panel B of figure 6 does not have the same two tone colouring as it is only referring to area not the OC and IC content. We believe the colouring of this figure is consistent and easy to follow. Vegatation -> Vegetation? Figure has been altered to vegetation

Please also note the supplement to this comment:
https://www.biogeosciences-discuss.net/bg-2017-360/bg-2017-360-AC2-supplement.zip

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