

Biogeosciences Discuss., referee comment RC2
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Comment on bg-2021-157 by Associate Editor

Nicolas Brüggemann (Referee)

Referee comment on "Quantification of blue carbon in salt marshes of the Pacific coast of Canada" by Stephen G. Chastain et al., Biogeosciences Discuss.,
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The paper reports data on 'blue' carbon stocks and 'blue' carbon accumulation rates from seven salt marshes at the west coast of Vancouver Island, BC, Canada. These seven salt marshes cover a total area of 47 ha. The authors differentiated between high and low marsh through identification of indicator plant species. They took in total 34 cores of the organic (peat) layer down to the underlying sand or gravel bed. In 10 cases the cores did not penetrate into the sand, clay or gravel layer. Eight cores (four from high and four from low marsh) were dated using ^{210}Pb . The authors found an average total C stock to the base of the peat layer of $67 \pm 9 \text{ Mg C ha}^{-1}$ (mean \pm SE) for all cores, which was less than one third of the globally averaged estimate of 250 Mg C ha^{-1} for salt marsh C stocks. In contrast, the average base of peat carbon accumulation rate (CAR) was $184 \pm 50 \text{ g C m}^{-2} \text{ yr}^{-1}$, and in the high marsh even on average $303 \pm 45 \text{ g C m}^{-2} \text{ yr}^{-1}$, which was about five times higher than in the low marsh areas. It has to be noted, though, that these CARs were based on four dated columns only per low and high marsh. In the discussion part, the authors put their findings into perspective of data from other salt marsh ecosystems along the Pacific and Atlantic coast of North America, and claim that they have addressed the knowledge gap regarding the carbon accumulation potential of these ecosystems. Finally, they compare the carbon accumulation of their salt marsh system with that of Canadian boreal forest and conclude that the carbon accrual rates are much higher in the salt marsh, but acknowledge that the salt marshes cover approximately only 0.016-0.1% of the area covered by boreal forests in Canada and that their absolute magnitude of carbon accumulation is only minor.

While the work appears to have been conducted in a scientifically sound way, and also the data have been well evaluated and compared with the literature, the representativeness of the studied system remains vague. The authors have taken 34 peat deposit cores in a range of about 25 km in an area that is subject to negative relative sea level rise due to

uplift of this part of the coast. They attribute the below average carbon stocks of their salt marshes, amongst other reasons, to this relative sea level drop. But they do not detail to which extent this is representative or not for the vast Pacific coastline of North America, not to speak of the Atlantic coast. Also the effect of tidal range (the be more precise, its local differences) on the partitioning of marshes in 'high' and 'low' marshes, which obviously has a large effect on carbon accumulation rates and total C stocks, has not been addressed. That means, the authors did not put their 'mesotidal' system into perspective of other parts of the NE Pacific coast. They only wrote "We expect that these mesotidal estuarine marshes, often constrained in size by surrounding topography, are typical of the marshes found on the Pacific coast of British Columbia" (L510-511). How is the situation in systems with higher or lower tidal range than the one encountered here? In a nutshell, the authors should address the open question regarding the representativeness of their system in more detail.

Specific comments / questions:

L136-137: How long were the cores stored under refrigeration?

L207: How representative were these eight dated cores for your whole system (four for the high marsh, and four for the low marsh)?

L 485-488: Here you write "Our Clayoquot Sound data represent only a small area of a single region of the west coast, but if we assume our CAR estimate of $184 \pm 50 \text{ g C m}^{-2} \text{ yr}^{-1}$ from Clayoquot Sound approximates the average for all tidal salt marshes in Canada,...". But the question is whether this generalization of your findings is justified. And if so, on what basis / with what assumptions?