Review of bgd-2015-534

Key biogeochemical factors affecting soil carbon storage in *Posidonia* meadows

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Overview

This study describes variable organic carbon preservation rates and stocks across a depth gradient in a *Posidonia sinuosa* meadow in Western Australia. The study is a timely addition to the literature on blue carbon, and adds a much needed element of functional understanding to the issue of carbon preservation in seagrass meadows. The manuscript is well written and the methods employed are robust. More detailed comments on the manuscript are given below.

Depth profiles

Am I right in assuming that data reported for sediment properties and C_{org} are depth integrated values for each site? (maybe this needs better explaining in the methods). If this is so, then it changes interpretations of these contributions across the water depth gradient. I am curious to know whether the contributions of seston and seagrass varied with depth in the sediment profiles. I would suspect that the relative contribution of seston would decrease with depth in the sediment as it is generally more labile than seagrass detritus. The result of more seston detritus across the water depth gradient is generally consistent with our observations, and most likely relates to reductions in bed stress with depth.

Comparison with one bare sediment "control"

OK, I'm a biogeochemist and am not too picky about ecologist-style statistical designs, but one core taken from one bare sand site 2km away? Can the authors at least provide some justification why this is adequate (e.g. can they confirm that there is absolutely no variation in sediment properties according to depth or location).

Biogeochemical factors

The manuscript has one stated aim to "highlight key biogeochemical factors affecting C_{org} storage in seagrass soils that need to be accounted for when attempting to produce regional or global estimates of C_{org} storage in seagrass meadows". Unfortunately, there are no real measures of indicators of these factors made, and the discussion around potential factors is sometimes fairly vague (e.g. page 18925 lines 25 – 30).

Morphological factors

I feel it is a shame that the authors didn't measure any morphological attributes of the seagrass across the depth gradient, since much is made about the effect of these attributes in both trapping seston and contributing to the C_{org} pool. I understand that the authors refer to previous work at the site by C. Collier, but maybe it would be useful to reproduce a more detailed summary of seagrass morphology from this work than what is provided (e.g.

page 18925 lines 4 - 5). This would make it much easier to relate the results of this study to other systems and seagrass species around the world.

Wind wave energy and bed shear stress
It would be nice to have some description of the environment with regards bed shear stress. I notice that the conceptual model (Fig 6) suggests that hydrodynamic energy increases with water depth. Is this due to tidal currents? Probably best to define what is meant by "hydrodynamic energy" , and if wave energy is not important explain why. Generally I would expect much higher bed shear stress at shallow depth due to wind wave action. At least part of the seagrass morphology (e.g. below ground biomass) is likely to be significantly influenced by this bed stress gradient, which presumably has implications for the results of this study. I think this issue needs more comprehensive treatment, given that physical energy is one of the three factors considered.

Decay rates
Could other factors such as bed shear stress and bioturbation impact on the estimations of decay rates? My guess is yes, so it would be good to see a little more comprehensive discussion of this.

Comparison with other studies
I think it would be good to place the results of this study into context with other studies (e.g. seagrass morphometrics, C_{org} and grain size properties) so that results have a more global relevance.