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Biogeosciences Discussions

Interactive comment on "The response of seagrass (*Posidonia oceanica*) meadow metabolism to CO_2 levels and hydrodynamic exchange determined with aquatic eddy covariance" *by* Dirk Koopmans et al.

Anonymous Referee #1

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The authors report metabolic measurements in Posidonia oceanica meadows using the technique of eddy-covariance of O2. This is the first publication of such technique in P. oceanica meadow and confirm that this marine community is highly productive as previously shown by numerous studies during the last three decades.

The authors also made primary production of P. oceanica measurements at a CO2 vent site that are compared to a reference site, in the context of ocean acidification. They conclude that the primary production of P. oceanica is lower at the CO2 vent site and attribute this to phosphate binding to iron emitted from the vent. While this interpreta-

tion might make sense (although in contradiction with studies of Cymodocea nodosa and other seagrasses at similar CO2 vent sites), I'm uncomfortable about drawing conclusions on the comparison of a single measurement at a single CO2 vent site with a single measurement at a single reference site. It would have been convincing if there was replication of different sites, as there are numerous reasons why two "snapshot" primary production measurements between 2 sites might differ. Carefully replicated measurements might have shown a different result for such a comparison. Even at a single site over a Posidonia oceanica meadow, strong variations of primary production over an order of magnitude occur through a range of temporal scales (from day-to-day to year-to-year).

L261-262: For a meaningful comparison between the CO2 vent site and the reference site, the GPP values should have been normalized by P. oceanica biomass (productivity). Biomass could be lower due other factors such as hydrodynamics (exposed vs sheltered) or substrate or different grazing pressure. Also, biomass strongly changes seasonally and with depth. It is unclear if the measurements in the CO2 vent site and the reference site are really comparable with regards to the timing of the seasonal cycle, and also with regards to other factors affecting primary production such as light availability. Yet on a normalized basis by mass of P. oceanica, the GPP could be equivalent or even higher at the CO2 vent site.

It might be worth mentioning that Cymodocea nodosa biomass (Mishra et al. 2018) and productivity (Apostolaki et al. 2014) seem higher at the vicinity of Mediterranean volcanic CO2 seeps. This seems to also be the case of a variety of seagrass species (Cymodocea serrulata, Cymodocea rotundata, Halodule uninervis, Halophila ovalis, Thalassia hemprichii, and Syringodium isoetifolium) in volcanic CO2 vents in Papua New Guinea (Takahashi et al. 2016)

Minor comments

L161: Specify detection limits, precision and accuracy for nutrient analysis.

L163: Specify the estimated accuracy and precision of TA and DIC measurements.

L165: Do the actual TA measurements show that the values were invariant in time as assumed in the computation of DIC from pH ?

L165: How well did the computed DIC compare to the measured DIC ?

L221: can you put the “importance of seagrass for CO2 sequestration” in perspective with regards to the global carbon cycle ? The global estimate of seagrass net community production is 21-101 TgC/yr as given by the synthesis of Duarte et al. (2010). This number is negligible compared the global anthropogenic CO2 emission of 10,000 TgC/yr (as given by the latest IPCC report).

References

Apostolaki et al. (2014) Seagrass ecosystem response to long-term high CO2 in a Mediterranean volcanic vent, Marine Environmental Research, 99, 9-15, DOI: 10.1016/j.marenvres.2014.05.008

Mishra et al. (2018) Population dynamics of Cymodocea nodosa in the vicinity of volcanic CO2 seeps, in press, www.researchgate.net/publication/323944206_Population_dynamics_of_Cymodocea_nodos

Takahashi et al. (2016) The effects of long-term in situ CO2enrichment on tropical seagrass communities at volcanic vents, ICES Journal of Marine Science, 73, 876–886, doi: 10.1093/icesjms/fsv157

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