

Interactive
Comment

Interactive comment on “Tidal controls on trace gas dynamics in a seagrass meadow of the Ria Formosa lagoon (southern Portugal)” by E. Bahlmann et al.

Anonymous Referee #3

Received and published: 19 November 2014

The manuscript offers new and necessary insights into the understanding of trace gas dynamics in coastal ecosystems affected by tidal cycles. The strong influence of tides on CO₂ and CH₄ fluxes, reported in this study, are noticeable and worth publishable, with important implications in sediment-water and water-air fluxes of green house gases.

However there are some points to consider (in order of importance) before publication in BG:

1) Some concerns arise when considering the design of the dynamic flux chambers used for the measurements. This has been a recent delicate issue that should be de-

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Interactive Discussion

Discussion Paper



tailed and discuss carefully. The authors are aware of these concerns and an extended explanation of the methodology is given, but some clarifications should be added. I basically agree with the comments, regarding this issue, of Anonymous Referee #1.

2) Regarding the VOC results: I don't really see the point in delivering all the VOC information in the paper, unless there is a better and deeper discussion of the results. In my opinion, the results are shown in such a way that interpretation is not straight. COS, DMS, propane and butane are expressed as relative "enhancement" to the averaged flux, which makes it hard to compare with the rest. I suspect this is because they are not present in the standard used and hence no absolute magnitude can be computed. In any case, I suggest the authors keep the halocarbons data but remove the S-Compounds and Hydrocarbons data. Indeed, if they finally decide to remove also halocarbons data and just focus on CO₂ and CH₄ fluxes I would still suggest its publication. In that case, I definitely suggest a section in the discussion where the biogeochemical mechanisms potentially modulating these fluxes debated.

3) The results are discussed with detail but I miss in the discussion or conclusions an expanded view of significance and repercussion derived from the unexpected CO₂ and CH₄ results. There is a tentative up-scaling calculation using their CH₄ flux data and a global seagrass coverage area. I don't really believe in this kind of global up-scaling estimations. Seagrasses encompasses a huge range of different ecosystem conditions that do not necessarily mirror Ria Formosa lagoon conditions. Instead of calculating global emissions, I would recommend to discuss and compare the trace gases emissions measured with those of other seagrasses worldwide. Also, how is climate change affecting Ria Formosa lagoon tidal cycles? Discuss possible effects on changes of trace gas emissions over the lagoon due to predicted tidal changes.

4) Figures and text can be improved. See specific comments below. Some sentences are too long and not easy to follow. I recommend to check on the writing (some extra commas and points would not hurt) and try to make shorter and more clear statements. Also carefully check the acronyms used. Some of them are not defined (DIC) and some

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[Interactive Discussion](#)

[Discussion Paper](#)



are not placed properly in the sentence (NCP). Double-check also the chronological order of the references within the text.

Specific comments:

P10573, L11-12. This is a false statement. The development of benthic chambers for underwater incubations is far older than 2006, and have been used for the purpose of both trace gas and nutrient fluxes. The authors should be aware and refer to publications other than Silva et al. 2008 and Barron et al. 2006 (e.g. Nicholson et al. 1999, Larned 2003, Ferron et al. 2009).

G. J. Nicholson, A. R. Longmore and W. M. Berelson. Nutrient fluxes measured by two types of benthic chamber. *Marine and Freshwater Research* 50(6) 567 – 572, 1999.

S. T. Larned. Effects of the invasive, nonindigenous seagrass *Zostera japonica* on nutrient fluxes between the water column and benthos in a NE Pacific estuary. *Marine Ecology Progress Series* 254: 69–80, 2003.

S. Ferron, S, F. Alonso-Perez, T. Ortega, J. M. Forja. Benthic respiration on the north-eastern shelf of the Gulf of Cadiz (SW Iberian Peninsula). *Marine Ecology Progress Series* 392: 69-80, 2009

P10573, L16-17. Provide a reference for that statement. Suggestions: Armstrong 1979, Larkum et al. 1989.

W. Armstrong. Aeration in higher plants. *Adv. Botanical Res.* 7:225-332

AWD Larkum, G. Roberts, J. Kuo and S. Strother. Gaseous movement in seagrasses. In: Larkum AWD, McComb AJ and Shepherd SA (eds). *Biology of Seagrasses*, pp 686-722. Elsevier, Amsterdam.

P10573, L29-P10574, L4. References in each of the problems stated should be added.

P10576, L26-27. You indicate that the lines were sampled for 5 min. Indicate also how often the sampling was performed.

BGD

11, C6864–C6868, 2014

Interactive
Comment

Full Screen / Esc

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Interactive Discussion

Discussion Paper



P10577, L20. You say “High time resolution”, but how high is that. If you clarify that in the methods (see previous comment) it is not necessary to state it here again.

P10581, L1-4. Too long sentence. Please use commas, re-phrase or use two short sentences instead of a long one.

P10581, L10-12. In the sentence “Variation in the . . .” : this statement is true only of you consider lineal variation. Add “lineal” between “ a” and “change”.

P10581, L17-18. References should be added.

P10584, L3-6. It is impossible to appreciate that in the figure 2 and hence is hard to follow this sentence and some further discussion. I suggest that y-axes are re-scaled in Fig 2 accordingly.

P10584, L8-10. Too long sentence. Add some commas (after “emission”, “methane peak”, and “pore water”), or re-phrase.

P10584, L13. I could be wrong, but I don’t think DIC acronym has been described. If necessary please do so.

P10585, L14-18. Re-phrase using shorter sentences.

P10585, L18-24. I recommend to remove this paragraph. In my opinion is too speculative. Seagrasses encompasses a huge range of different ecosystem conditions that do not necessarily mirror Ria Formosa lagoon conditions. Instead of calculating global emissions, I would recommend to discuss and compare the trace gases emissions measured with those of other seagrasses worldwide. Also, how is climate change affecting Ria Formosa lagoon tidal cycles? Discuss possible effects on changes of trace gas emissions over the lagoon due to predicted tidal changes.

P10586, L26. Change the order of “(NCP)” right after its description. Place it after “production”.

P10586, L5-10. Too long sentence. Please re-phrase with shorter statements.

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P10588, L20. Change the word “show” for “suggest”

Figure 1. I recommend adding Cin and Cout for clarification

Figure 2. a) I recommend adding the actual tidal change, as tide changes are gradual, such as light intensity. The way it is shown now it simulates an ON/OFF false scenario.

b) I recommend to re-scale CH4 flux Y-axis to better appreciate the changes during tidal changes.

c) Consider removing the Temperature.

d) Add units in the legend.

Figure 3. I recommend adding the actual tidal change, as tide changes are gradual. The way it is shown now it simulates an ON/OFF false scenario.

Table 2. and Figure 4. I suggest considering the possibility of removing S-Compound and Hydrocarbons data. See general comment above.

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11, C6864–C6868, 2014

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Interactive Discussion

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