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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 #1

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General Comments:

The authors implement aspects from prior chamber designs into a novel configuration that appears to allow several advantages in measuring sediment fluxes. These include high resolution measurements of CO_2, CH_4, and VOC as well as the capability to remain deployed over several tidal cycles. The authors present some noteworthy results that may have important implications in our understanding of sediment-water-air fluxes from intertidal regions.

The use of dynamic flux chambers requires careful design considerations and testing to ensure that chamber behavior meets several core assumptions. The authors' design includes the added complexity of unmetered water of unknown chemistry entering and leaving the chamber. The absence of any chamber performance data under controlled conditions raises several questions regarding whether the authors' results were representative of natural fluxes or heavily influenced by unforeseen effects of the chamber design.

Specific Comments:

P10574 L1-3: The authors briefly list several ways in which chamber based measurements can lead to unrealistic fluxes, but provide no references and no mention of confounding mechanisms in the discussion. The authors do reference Gao et al. (1997) and Meixner et al. (1997) later in Methods, but these are very different designs than that presented here. These references list several obligatory tests that must be done before dynamic chamber results can be accepted on a scientific level. First, it must be verified that advective flux is negligible relative to diffusive flux, i.e. that the calculated sediment flux does not vary with changing airflow. Second, a 'chamber blank' must be carried out to quantify non-sediment fluxes. The latter could be substantial given that water of unknown chemistry can enter and be equilibrated with the atmosphere inside the chamber.

P10574 L8-9: The authors present no evidence for this statement. Yes, bubbling air through a small volume of water would increase turbulence, but that does not mean it is more representative of natural conditions than a static chamber, particularly when non-linear relationships are involved.

P10575 L18: Because the frits are 12 cm above the sediment surface, I expect that there would be a notable change in water turbulence and air-water-sediment transfer velocity when the water rises above or drops below 12 cm. Can the authors comment on this?

P10576 L26: The sampling regimen needs some clarification. Line 26 notes that each of three lines were sampled consecutively for 5 min, but P10578 L8 describes results

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on 5-10 min intervals. This gives the impression that chamber samples were collected every five minutes, with less frequent atmospheric sampling. Also, was the inlet air to the chamber pumped from the 2 m line, the 4 m line or some other intake?

P10577 Results: A time-series figure showing Cin and Cout would help explain some of the authors' results. Was Cin relatively constant, with most of the fluxes driven by variability in Cout? Could flux estimates have been affected by rapid changes in Cin and subsequent equilibration with the chamber water? Estimated or observed water depth would also be worth plotting here.

P10583 L 5-8: The change described by Werner et al. (2006) was in the horizontal flow velocity and only in the top 2 cm. I expect that the horizontal flow velocity characteristics inside a chamber that is pressed 5 cm into the sediment could be very different.

P10583 L 18-29: Without an analysis of chamber aerodynamics, it cannot be determined whether the static air in and near the sediment was an artifact of the chamber design. Also, did the spike occur before any flood water had entered the chamber?

P10585 L 13-16: Can the authors suggest any reason for the disparity between their results and those of Deborde et al. (2010)?

P10585 L25: Refer to the comments of other G. Abril regarding CO2-based metabolism estimates.

P10587 L1: There are several other ways that bubbling atmospheric air through the chamber may affect fluxes. The gas concentration and temperature in the chamber water will be at near equilibrium with the air. This could introduce artificial gradients and thermal perturbations, as mentioned only briefly in the introduction. Because this is reportedly one of the first studies to measure fluxes using an aerated chamber, the authors must provide a thorough discussion of the new caveats associated with this method.

P10588 L25-27: I'm not sure this statement can be supported without some sort of

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comparative control, i.e. simultaneous measurement of fluxes using a static chamber or periodic measurement of dissolved gas concentrations outside the chamber.

Technical corrections:

P10573 L12: References out of order.

P10573 L22: Gao and Yates (1998) is not in reference section.

P10573 L22-23: References out of order.

P10574 L25: Change drawn to pumped.

P10583 L10-11: Sentence is hard to read, it would help to reword or split into two sentences.

P10587 L10: Change difference to different.

P10587 L10: Change ‘can currently not’ to ‘cannot currently’.

Figure 2: It would be easier to see the CH_4 fluxes if the plot were scaled such that the peaks were removed, as was done for the CO_2 fluxes, with the values beyond the plot scale listed directly on the plot. There appears to be a few gaps in the CO_2 flux data during the change from tidal immersion to air exposure. Can this be explained? It should be noted whether the temperature shown in figure 2 was measured inside or outside the chamber. If both were measured, it would be a worthwhile comparison.

Interactive comment on Biogeosciences Discuss., 11, 10571, 2014.

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