

Dear Dr. Subke,

we are grateful for your helpful comments on our manuscript. We agree with your suggestions to shorten the manuscript. In particular, we completely revised the section “Flux pattern from seagrass meadows” (Diurnal cycles, Tidal effects, and seasonal dependence) as well as the conclusion. We hope that the manuscript is now appropriate for publication.

Please find below our detailed corrections:

*Many thanks for the revised manuscript and response to referee comments. I am satisfied that you addressed the referee comments appropriately. However, there is some editing yet to be done before the paper is acceptable for publication.*

*I agree with the referees that the data are worth publishing as data on halocarbon fluxes are rare, even if it is difficult to conclusively compare the two seasons, or scale up from these results. However, given the limitations in the experimental approach, where two campaigns from different seasons are presented, and only limited variation in environmental conditions within campaigns, you have to be careful with direct comparisons between “spring” and “summer”, or with extrapolations for an entire year. I appreciate that you want to get a simple figure to make the point that the fluxes from seagrass beds are not globally significant, and overall the ranges are reasonably conservative.*

*However, the discussion as a whole is length and there is a lot of speculation about potential sources and sinks, where I think you could be briefer.*

We agree with your suggestion and shortened the section 4.2 (Flux pattern from seagrass meadows) concerning diurnal cycles of  $\text{CH}_3\text{I}$  and  $\text{CHBr}_3$ .

*The conclusions are also much too long. The purpose of this section is not to repeat all that your have previously discussed. Re-stating a key finding is ok, but you should aim to truly conclude what your study has shown, i.e. what the implications are, and what is needed for future research. This should be in one, max. two short paragraphs.*

We agree with your suggestion and completely revised and shortened the conclusion. It is now:

We presented the first detailed study of halocarbon fluxes from seagrass meadows. The data were obtained from a subtropical mesotidal lagoon in southern Portugal. The fluxes of halocarbons were highly variable with increased fluxes when the seagrass meadows were submerged. Distinct emission peaks occurred in the certain moments when lagoon waters were just arriving or leaving the sampling site. For  $\text{CH}_3\text{Cl}$  and  $\text{CH}_3\text{Br}$  we observed a diurnal dependence on the fluxes with increased emissions during midday/afternoon and deposition fluxes during periods of low radiation. Generally, diurnal variations (during air exposure), atmospheric mixing ratios, and emission rates of halocarbons were minor in spring than in summer, suggesting a seasonal dependence. Monohalomethane emissions from seagrass meadows fall in-between those from temperate salt marshes and mangroves. For  $\text{CHBr}_3$ , seagrass-based emissions are distinctively below those of macroalgae. On a global scale, seagrass meadows are rather a minor source for halocarbons but will have an imprint on the local and regional budgets. This holds in particular true for subtropical coastlines where seagrass meadows belong to the most abundant ecosystems. In these regions, where strong vertical motions occur, seagrass meadows may be significant contributors to deliver halocarbons to the stratosphere.

Stable carbon isotopes of halocarbons were used to identify possible sources in the lagoon. Results suggest that  $\text{CH}_3\text{Cl}$  more originates from the water column and/or seagrass meadows than from adjacent salt marshes or abiotic formation processes. Atmospheric and aqueous  $\text{CH}_3\text{Br}$  in the lagoon was substantially enriched in  $^{13}\text{C}$  pointing towards degradation processes and re-emission into the atmosphere. Furthermore, we presented isotopic data of  $\text{CH}_3\text{I}$  and  $\text{CHBr}_3$  from the water phase.

Future studies should focus on emission from seagrass-based systems from different regions in order to refine the global relevance. Likewise, since magnitudes of fluxes are often species-dependent, budgets calculations will certainly benefit from a more detailed view on different seagrass species. Furthermore, while this study focused on halocarbon dynamics from seagrass meadows on the level of

the benthic community, it is worthwhile to identify the specific sources in these ecosystems. The sediments being capable of acting as both a sink and a source, should be further studied. Though our results suggest sediments being a weak producer on a per area basis which corroborates other studies from e.g. salt marshes (Manley et al., 2006), they may have a significant impact in view of their high area coverage in coastal zones exceeding by far all other macrophytic systems (see Duarte et al., 2005).

*Detailed comments:*

*p. 2, l. 20 – 23: Is it sufficient to cite these papers, rather than refer onwards to “references therein”? I suggest using this only where the paper itself is not sufficient to substantiate your argument.*

We agree with your suggestion and skip the “references therein”, since the cited publications are enough to substantiate our statements.

*p. 2, l. 30: comma after “systems” Done*

*p. 3, l. 3: comma before “seagrass” Done*

*p. 3, l. 11: delete “generally” Done*

*p. 3, l. 17: comma after “results” Done*

*p. 3, l. 21 – 26: These sentences (starting with “To complement”) are not necessary. Were deleted*

*p. 3, l. 30: “an area” Done*

*p. 4, l. 5: “a quarter” rather than “one fourth” Done*

*p. 4, l. 7: Are pers. Comm. Needed to estimate an area (and given that you already cite a reference)? The cited personal communication was deleted*

*p. 4, l. 21: delete “to” after “West” Done*

*p. 4, l. 23: Delete “Firstly” Done*

*p. 4, l. 25: delete “bottom” Done*

*p. 5, l. 5/6: “is described in detail elsewhere”. Was changed*

*p. 5, l. 11: delete “rather” Done*

*p. 5, l. 13: Bracket before “Bahlmann”, and not before year. Was changed*

*p. 5, l. 15: insert “of” after “volume” Done*

*p. 5, l. 17 and p. 6, l. 12: “Supplemental Material”. Was changed*

*p. 6, l. 13: Do you mean “adsorbed”, rather than “enriched”? Was changed*

*p. 6, l. 16: “on site” (or “on-site”) Was changed*

*p. 6, l. 22: This description for CH3I determination is not clear. Unless it is explained in the Supplemental Materials (in which case these should be referenced here), it requires more explanation.*

Was clarified in the manuscript and in the Supplemental Materials.

p. 7, l. 6: delete “The principle is as follows.” Done

p. 7, l. 7: replace “the desired” by “a”. Done

p. 7, l. 8/9: “The difference of mixing ratios of compounds of inlet and outlet air along with the flushing rate... calculation.” Delete final sentence. Was deleted

p. 7, l. 13: Should be “pmol mol<sup>-1</sup>”. Delete “ppt”, as this is sometimes used for “parts per thousand”. Was changed

p. 8, l. 9: comma after “lagoon”. Done

p. 8, l. 21-23: Don’t simply repeat values presented in tables, unless you make a specific point about them. We skipped this sentence

p. 9, l. 15-19: This is a little confusing, as you have not presented any isotopic data. I suggest including this observation of shifts in isotopic abundance with concentration to later when you present isotopic results (p. 11/12). Sentences were shifted accordingly

p. 10, l. 1: delete “to each other”. Done

p. 10, l. 1-3: I suggest: “There were no significant correlations between...” Was changed

p. 10: l. 3-5: “... solar radiation and halocarbon fluxes were poorly correlated...” Was changed

p. 10, l. 6-10: Present statistics to show that these estimates are in fact significantly different from zero!

The statistical evaluation using Mann-Whitney-U-Test revealed that all halocarbons fluxes, except those from CH<sub>3</sub>I, were statistically different from zero (p<0.05). This was clarified in the manuscript.

p. 10, l. 14-17: You don’t present these data, so delete sentences here and reference the source in the discussion when you put results of this study into context. Done

p. 11, l. 8/9: Sorry, I can’t make sense of this sentence.

Sentence was rewritten: Secondly, at tidal maximum we observed deposition fluxes for CH<sub>3</sub>Cl and CH<sub>3</sub>Br and deposition fluxes or very weak emissions for CH<sub>3</sub>I and CHBr<sub>3</sub>.

p. 11, l. 10: comma after “period”. Done

p. 12, l. 4: comma after “chamber”. Done

p. 12, l. 6: better: “... were similar during both campaigns (-51 +/- 2 % and -56 +/- 2 %, respectively), and independent...” Done

p. 13, l. 7: “the net halocarbon production” Done

p. 13, l. 11/12: “in, rather than “into”, and “but not” rather than “rather than for”. Done

p. 13, l. 18: “... interact are complex, and it should be noted...” Done

p. 14, l. 5: delete “especially”. Done

p. 14, l. 10: delete “Possibly”. Done

*p. 14, l. 25: I would prefer it if you referred to :the spring campaign”, as your observation don’t actually allow you to make robust statements about seasonality – it should be a comparison of two campaigns, with the seasons they were in as context. “spring campaign” was inserted*

*p. 14, l. 26: delete “certain”. Done*

*p. 14, l. 30: delete “remarkable” Done*

*p. 14, l. 32: “... quite unexpected, as in general...” Done*

*p. 15, l. 22: “not” rather than “hardly”. Done*

*p. 15, l. 24: “short-term change in...”. However, how can a short-term change response explain a sustained emission – just as for the pressure argument, this would result in a pulsed response. I suggest shortening the paragraph and avoiding excessive speculation.*

We agree with your suggestion and skipped the sentences accordingly

*p. 15, l. 31/32: delete “incoming” (as for the ebb flow it would be “out-going”...). Also delete “actually” and “however”. Done*

*p. 15, l. 30 to p. 16, l. 2: I agree that you need more data on radiation at the sediment surface to make this speculation. Do you have sufficient data covering different times of day at high tide to rule our possible correlation between inundation and daytime? Again I suggest keeping speculations quite brief.*

Unfortunately, we do not have enough data to finally proof our assumption. Therefore we agree with your suggestion and deleted the sentence.

*p. 16, l. 8/9: “generally”, rather than “general”; delete “even” and “assumedly”. Done*

*p. 16 l. 15 to 32: The comparability of sites and conditions you discuss here is very limited – please shorten.*

We shortened the whole section concerning the seasonal dependence. It is now:

There are considerable differences between the results from spring and summer campaign. We observed elevated mixing ratios for all halocarbons in ambient air as well as higher water concentrations for CH<sub>3</sub>Cl, CH<sub>3</sub>I, and CHBr<sub>3</sub> compounds in summer (Table 1). This observed signal of general increased halocarbon production in the lagoon during summer might be attenuated by enhanced degradation in the water phase and sediments at higher temperatures. Nevertheless, given the calculated sea-air flux there is only little evidence for a pronounced seasonal relationship in halocarbon volatilisation to the atmosphere from the lagoon water. While the fluxes of CH<sub>3</sub>Cl appeared to be enhanced in summer, those of CH<sub>3</sub>Br and CH<sub>3</sub>I seemed to be quite similar between spring and summer. CHBr<sub>3</sub> emissions were actually higher in spring than in summer due to higher water concentrations.

Comparing the data obtained from air-exposed sites during the two campaigns, the fluxes in summer were strongly enhanced by factors of 16 (CH<sub>3</sub>Cl and CH<sub>3</sub>Br), 2 (CH<sub>3</sub>I), and 5 (CHBr<sub>3</sub>). Moreover, the halocarbon fluxes showed a distinct diurnal cycle during summer but not during spring. The differences of ambient conditions between the campaigns with lower air temperatures and lower solar radiation in spring may have contributed to the differences in the emission patterns of halocarbons. That these environmental conditions can substantially influence the magnitude of fluxes was reported from other ecosystems such as salt marshes (Blei et al., 2010; Manley et al., 2006). However, further studies covering the entire seasoning are necessary to fully unravel the annual halocarbon emissions from seagrass meadows.

*p. 17, l. 3: delete “certain” Done*

*p. 17, l. 3/4: Clarify that you refer to  $^{13}\text{C}$  when stating isotopic mixing ratios. Was clarified*

*p. 17, l. 6/7: "Apart from" rather than "Beside the", and delete "wide-" before "abundant". Done*

*p. 17, l. 14: What are incubations you refer to? Chamber closures? This must be clarified. Was clarified*

*p. 17, l. 24: "from" rather than "built by". Done*

*p. 18, l. 16/17: "These decomposition mechanisms correlate positively with seawater temperature". The sentence needs a reference!*

*We cited King and Saltzman, 1997 (J. Geophys. Res.-Oceans, 102, 18715-18721)*

*p. 19, l. 2/3: delete "certain" and "Actually". Done*

*p. 19, l. 4: comma after CH<sub>3</sub>I. Done*

*p. 19, l. 15: "than" rather than "as". Done*

*p. 19, l. 27: "a" before "per". Done*