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Interactive comment on “Does *Juncus effusus* enhance methane emissions from grazed pastures on peat?” by A. Henneberg et al.

A. Henneberg et al.

anders.henneberg@bios.au.dk

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Anonymous Referee #2:

The authors present a study which addressed the question if aerenchymatous *Juncus effusus* might provide hot spots of methane emissions from peatlands overgrown with grasses.

1: The study is well designed and well presented. The most negative point about the whole study is that based on the design it is less than obvious that *J. effusus* plants have the proposed function. It is well known from rice fields that the other aerenchymatous grasses can do so. It is also well established that *Juncus effusus* has an aerenchyma. Thus, it is not so evident what is really new about the finding that other factors override

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this potential effect of *J. effusus*.

2. More detailed work on single plants showing that they really transport methane from soil through the aerenchyma would have made the study more solid.

3: Thus, it would much more help if the authors would highlight in the discussion and abstract why the presented data are a mandatory step to integrate this effect in the methane emission models.

4: p 8472, ln 1, '...were taken...' p 8476, ln 4 better '...waterfilled pore volume at...' p 8478, ln 24-26 awkward wording. Please, rephrase.

5: Figure 3, Why are no error bars being presented?

6: Figure 5, Remove the graphical legend from each panel, but add the name/number of the replicate in each panel

Author comments:

We thank the editor and all referees for their thoughtful comments and suggestions for our manuscript. On the basis of these comments, the manuscript will be revised and improved. Below are our replies to the individual comments from referee #2.

1: The study is a follow-up to observations during 14 months (Petersen et al., 2012; full citation in Discussion paper) of CH₄ emissions from micro-sites with *J. effusus* largely independent of variations in GWL and temperature on two different grassland sites (this observation was re-confirmed in this study for the Mørke site). Very few studies have specifically addressed the effect of aerenchymatous plants on CH₄ emissions from drained peatlands with a low potential for emissions, and our results did confirm that *J. effusus* can mediate CH₄ emissions in some situations. While it is true that our hypothesis, that *J. effusus* in general is a hotspot for CH₄ emissions in grasslands, was not confirmed, we believe this study shows a need to identify the conditions where aerenchymatous vegetation can lead to CH₄ emissions in these areas.

BGD

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2: The fact that individual aerenchymatous plants can transport CH₄ has been documented in many papers (noted in the Introduction), and that *J. effusus* specifically can do so was described in detail in our previous paper (Henneberg et al., 2012; full citation in Discussion paper). Under field conditions such effects are more difficult to demonstrate, but can be expected based on several previous studies. As noted in the point above, the major information gap we are filling is demonstrating such an effect in infrequently flooded agricultural pastures, in contrast to the permanent wetlands and rice paddies where this effect has been previously documented.

3: The areas investigated here (drained peatlands) are generally considered as insignificant CH₄ sources, and our results highlights that there is a potential for CH₄ release from *J. effusus* tussocks in these areas. We have also described how the importance of this effect can vary between sites of different soil type and hydrology. We acknowledge that the results from this study cannot be used directly in CH₄ emission models at this point (as stated in the Abstract, p. 8468, l. 19, and the Conclusions, p. 8481, l. 23). Clearly additional investigations of the abundance and effect of aerenchymatous plants on CH₄ emissions from drained peatlands, as modified by soil conditions, is needed before this effect can be quantified and included in CH₄ emission models. But we believe this manuscript will provide a good starting point for future research on the topic. These points will be stated more clearly in the revised Introduction and Discussion.

4: The sentences highlighted will be rewritten

5: The soil gas diffusion probes were developed and built in connection with this study to enable monitoring of trace gas concentration profiles from undisturbed soil above and below the water table. Only three sets of probes were available at the time of this study, and therefore no within-site replication was possible. However, the consistency of temporal trends in CH₄ concentration indicated that reliable data were obtained.

6: The figure will be modified as suggested.

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