

Interactive comment on “Zero to moderate methane emissions in a densely rooted, pristine Patagonian bog - biogeochemical controls as revealed from isotopic evidence” by Wiebke Münchberger et al.

Anonymous Referee #1

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This is a carefully done study about the production, oxidation and emission of CH₄ in Patagonian bog, the results are of considerable interest and the paper is well written. However, some points need clarifying and certain statements require further justification. 1. the authors should not ignore that acetogenesis might be important in anaerobic environments when H₂ partial pressures are high and temperatures are low. Acetogens can outcompete methanogens at low temperature, as many acetogens seem to have a higher growth rate at low temperature than most methanogens (Kotsyurbenko et al., 1996, 2001). If acetogenesis process is active in the bog, the $\delta^{13}\text{C}$ value of

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acetate in the porewater will be largely decreased because of the substantial fractionation during acetate production from CO₂ and H₂. And resultantly, the ¹³C value of CH₄ will also be lower and resulted in larger apparent isotopic fractionation factor (α) between CO₂ and CH₄. Therefore, it's difficult to determine the relative importance of acetoclastic versus hydrogenotrophic methanogenesis pathway without the ¹³C value of acetate in this study. 2. In the first page, line 26-28, it's stated that: "Below the rhizosphere. . . . CH₄ was predominantly produced by hydrogenotrophic methanogenesis". In fact, data in Figure 4def showed that the hydrogenotrophic pathway had higher contribution to CH₄ in the pool, while the acetoclastic pathway must play relatively more important role for the CH₄ production below the rhizosphere of *Astelia* Lawn. This is consistent with the supply of labile organic carbon from the root exudates of *Astelia*. To sum up, I think it's difficult to conclude that CH₄ is mainly produced from the hydrogenotrophic pathway below the rhizosphere of *Astelia*. 3. It's stated that mean root lifetimes of *A. pumila* has been estimated to be ~3-4 years. So, whether the production and oxidation of CH₄ will be strongly affected in case of the turnover of large amounts of roots? 4. Please check Table 3, the data in the last three columns are in wrong places.

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