

Interactive comment on “Carbon dioxide and methane exchange of a patterned subarctic fen during two contrasting growing seasons” by Lauri Heiskanen et al.

Anonymous Referee #2

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General comments: This is an impressive study that should be published with minor revisions. The problem addressed is important – what are northern wetlands contributing to the global atmospheric greenhouse? Heiskanen et al. have carried out a very detailed two-year carbon dioxide and methane budget study of a representative 70N wetland in Finland, that will give considerable insight into similar wetlands worldwide across the Arctic and sub-Arctic. The study is very thorough and well presented, clearly written and well illustrated. I would however suggest the addition of a brief final section on the wider applicability of the results, to explain and make explicit what the implications are for our understanding of the impact of strong future warming and climate change.

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Specific comments: 1. The manuscript is littered with acronyms, from the abstract all the way through (TT, SM, F, LIA, etc). They are all either standard abbreviations or explained on first contact but I get very lost. Please could a table be added listing all the acronyms, and maybe reminders in the figure captions. 2. Page 2 line 46 – ‘if anoxia occurs’ ? – maybe better as ‘where anoxia occurs’. 3. Page 3 line 90 maybe more detail on the vegetation. In particular, is it all C3? Or are there C4 plants like *Atriplex* species present?. 4. The temperature dependence of respiration flux is taken from Lloyd and Taylor 1994 (P7 L233), and the temperature dependence of methane flux from Kim et al 1999 (P9 L282). Are these assumptions valid? - or is there information in the present study that can add to the older work? In particular, Kim et al were looking at rather different phragmites wetlands, in temperate settings, in Nebraska (43 degrees N whereas Kaamanen is 70N), perhaps more analogous to warmer sub-tropical and tropical systems and with more C4 metabolism present. 5. Page 16 line 440. The CO₂ flux being the same for both graminoids and forbs. Is that assumption secure? My question relates to my earlier question about the possible presence of C4 plants? – Are there any C4 plants like *Atriplex* species present? (and indeed are they likely to become more common? 6. For future work it would be nice to have some isotopic data. 7. Page 23 Line 636. It would be good here to have a paragraph or two that is more speculative (or perhaps in warning): we know that the climate in the Arctic and sub-Arctic is warming fast and changing – what is going to happen? Can this very detailed study give us any pointers to what is going to happen? The work in the paper is careful and well reported, but it needs to be given its wider context – Heiskanen et al are experts – what can they tell us about where these mires are going?

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