

Review of *Annual greenhouse gas budget for a bog ecosystem undergoing restoration by rewetting* by Lee et al. (second revision)

In this review I have focussed only on the appropriateness of changes made in response to my previous two reviews. In general the authors have made appropriate changes to address my previous comments. Most of my new comments listed below are of a more minor nature and I do not wish to review this manuscript again.

David Campbell, 22 April 2017.

### **Minor comments**

Line 149. "Longer gaps in CO<sub>2</sub> and CH<sub>4</sub> fluxes were filled ..."

Line 155. Valid data for EC-2 being for just 32% of the year. This needs more careful explanation and consideration. Later on it is implied that most of the missing data were for winter periods. Please provide a very brief summary of missing data by season. How does this affect the annual estimate? See also comment on Fig. 7.

Line 159. CO<sub>2</sub>, not CO<sub>2</sub>. Replace "(e.g." with "(i.e."

Line 161 "(GEP)" is unnecessary here. Suggest delete.

Line 168. "r<sup>2</sup> decides..." Replace "decides" with "determines".

Line 2016. What approach was taken for gap filling CH<sub>4</sub> fluxes (or constraints on this approach) for parts of the year with large amounts of missing fluxes? See comments for Line 155, where the distribution of missing flux data not fully described, but implied that winter fluxes largely absent.

Line 326. Missing word "effect of missing".

Section 4.3.1. Please include uncertainties for annual flux values in this text, or refer to relevant table.

Line 275. "early in the growing season".

Line 296. Cited annual NEE of -804 g C m<sup>-2</sup>. This is a highly unlikely annual value. I do not have the time to check on all these references but suspect that there will be issues with methods or extrapolation to annual values. Could the authors please ensure that they consistently use the literature, e.g. don't mix chamber and EC studies, or at least note where very low confidence exists in some of these values.

Line 303. Please remove quote marks around Mer Bleue. This is a proper noun.

Line 304. Add "... than Burns Bog" or similar at the end of this sentence.

Line 305. 'dissolved organic carbon (DOC) export ...'

Line 309. The headspace equilibration technique is not used to estimate DOC concentration. Please read the AGU poster abstract (that three of the authors of this paper are listed on as co-authors!) for the method used.

Line 309. Lateral flow? Suggest change to "lateral water export".

Line 372. Goodrich et al. (2015) were looking for a mechanism for elevated CH<sub>4</sub> fluxes occurring after rainfall events at a certain time of year, when the water table was within a narrow depth range. I

don't think rain events can be cited as a suppression cause based on this reference. Please check carefully.

Line 380-384. What about the annual flux reported by Goodrich et al. (2015)? 29 and 21 gCH<sub>4</sub>-C m<sup>-2</sup>yr<sup>-1</sup> (EC, not chamber).

Line 385 and Figure 7. I suggest that this figure be modified to show just summertime diurnal variation because: 1) annually-composed ensemble can mask season-specific diurnal variations; 2) apparently much of the wintertime data were missing (more needs to be said about this as noted above).

Section 4.5 title. Suggest replace "exchange" with "balance".

Line 410. Replace "long-term" with "annual".

Line 412. "e.g. sustained step-change ....". I don't understand what this means. Please clarify.

Line 413. Please replace "were proposed" with "have been proposed".

Line 425. "Annual CH<sub>4</sub> emission was" (this was a single year study).

Line 430. Why exclude DOC flux? If it is because DOC flux was not measured in the subject year, then consider providing two NECB values, one without and one with estimated DOC.

Lines 433-436. I find this quite unsatisfying. "So what"? What useful message are we to take from this? A deeper philosophical discussion earlier would have helped, that questioned IPCC-type approaches as applied to restoration of long-term C sink ecosystems such as peatlands. What is the point of concluding with these diametrically opposing GWP estimates?