Interactive comment on “High greenhouse gas fluxes from grassland on histic gleysol along soil carbon and drainage gradients” by K. Leiber-Sauheitl et al.

Anonymous Referee #1

Received and published: 21 October 2013


The work of Leibner-Sauheitl et al. addresses a highly important aspect of evaluating GHG fluxes from organic soils, namely the role of soils with intermediate C contents. Such contributions are highly welcomed. The authors have used static chamber methods to measure emissions of CO2, N2O and CH4 at intervals of two weeks or less in a full year study. Modeling based on temperature and PAR as driving variables was used to derive annual CO2 budgets. The authors show that high NEE fluxes occur from the studied soils and that emission of N2O and CH4 are negligible, which corroborates previous studies. The proposed title in this respect is somewhat misleading and should be changed to signify only high CO2 fluxes rather than collectively high GHG fluxes.

Overall, the current manuscript is generally well written, though some sections in the methods description could benefit from being somewhat more explicit. Some concern with the manuscript in the present form is the lack of quality checks of the models applied and the lack of presentation of basic measured data. Also, the authors interpret their findings in relation to the mean annual groundwater table (GWT) and emphasizes that their results ‘confirms the rule that peat mineralization generally increases linearly when the water table lowers’. I think this conclusion is challenged by the fact that the authors study ecosystem respiration rather than heterotrophic respiration and, indeed, biomass in the present study seems to correlate much stronger to Reco, GPP and NEE than the mean GWL.

Whereas I am favorable for including the manuscript in Biogeosciences, I think the manuscript should be improved prior to publication. I have made a number of suggestions and comments that are intended to assist the authors in this work.

p. 11284 Line 14-16: clarify statements that GHG balance is independent of water table level and that GHG emissions are linearly related to water table

Such loss of peatland... the dominant land use on peat soils in... Note both cited studies represent laboratory studies with artificially changed GWL. Also note that Aerts and Ludwig (1997) generally found higher CO2 emission from soils with high GWT – only as a response to weekly oscillating GWT did they measure higher CO2 emission. Line 23: ‘Histosols...’

For consistency use ‘deep’ rather than ‘profound’ Line 4: the Danish report uses the value 12%, rather than 15% Line 16: please also consider the role of vegetation in this statement

Histosols p. 11286 Line 2: for consistency use ‘deep’ rather than ‘profound’ Line 4: the Danish report uses the value 12%, rather than 15% Line 16: please also consider the role of vegetation in this statement

Histosols p. 11286 Line 2: for consistency use ‘deep’ rather than ‘profound’ Line 4: the Danish report uses the value 12%, rather than 15% Line 16: please also consider the role of vegetation in this statement

Histosols p. 11286 Line 2: for consistency use ‘deep’ rather than ‘profound’ Line 4: the Danish report uses the value 12%, rather than 15% Line 16: please also consider the role of vegetation in this statement

Histosols p. 11286 Line 2: for consistency use ‘deep’ rather than ‘profound’ Line 4: the Danish report uses the value 12%, rather than 15% Line 16: please also consider the role of vegetation in this statement

Histosols p. 11286 Line 2: for consistency use ‘deep’ rather than ‘profound’ Line 4: the Danish report uses the value 12%, rather than 15% Line 16: please also consider the role of vegetation in this statement

Histosols p. 11286 Line 2: for consistency use ‘deep’ rather than ‘profound’ Line 4: the Danish report uses the value 12%, rather than 15% Line 16: please also consider the role of vegetation in this statement

Histosols p. 11286 Line 2: for consistency use ‘deep’ rather than ‘profound’ Line 4: the Danish report uses the value 12%, rather than 15% Line 16: please also consider the role of vegetation in this statement

Histosols p. 11286 Line 2: for consistency use ‘deep’ rather than ‘profound’ Line 4: the Danish report uses the value 12%, rather than 15% Line 16: please also consider the role of vegetation in this statement

Histosols p. 11286 Line 2: for consistency use ‘deep’ rather than ‘profound’ Line 4: the Danish report uses the value 12%, rather than 15% Line 16: please also consider the role of vegetation in this statement

Histosols p. 11286 Line 2: for consistency use ‘deep’ rather than ‘profound’ Line 4: the Danish report uses the value 12%, rather than 15% Line 16: please also consider the role of vegetation in this statement

Histosols p. 11286 Line 2: for consistency use ‘deep’ rather than ‘profound’ Line 4: the Danish report uses the value 12%, rather than 15% Line 16: please also consider the role of vegetation in this statement

Histosols p. 11286 Line 2: for consistency use ‘deep’ rather than ‘profound’ Line 4: the Danish report uses the value 12%, rather than 15% Line 16: please also consider the role of vegetation in this statement

Histosols p. 11286 Line 2: for consistency use ‘deep’ rather than ‘profound’ Line 4: the Danish report uses the value 12%, rather than 15% Line 16: please also consider the role of vegetation in this statement

Histosols p. 11286 Line 2: for consistency use ‘deep’ rather than ‘profound’ Line 4: the Danish report uses the value 12%, rather than 15% Line 16: please also consider the role of vegetation in this statement
...according to a Michaelis-Menten type of equation modified by...’. No need to cite Menten and Michaelis (1913) here.

11292 Section 2.5 It seems only the calculation of individual fluxes is mentioned; information on how annual sums were derived should be included Line 1-5: This paragraph belong to section 2.3 Line 15: did you use the appropriate AIC with small-sample correction? Line 19-20: Point (d) - so it could be argued that reverting to robust linear regression caused severe underestimation? How often did this occur?

11293 Line 8-11: Please specify why these medians of square roots ‘demonstrates a sufficient accuracy of flux measurements’.

11295 Was there any dynamics in the Nmin contents? Since Nmin was measured on every gas sampling occasion data in Table 1 could be given with the SE estimates and n.

Section 3.2 Results for model performance are missing. Was the NEE model successful?

11296 Line 1-5: Give reference to relevant figure for description of dynamics Line 19: Give also r for the correlation between GPP and Reco Line 23: refer to Table 3, rather than Fig. 3, for this statement

11297 Section 3.3 and 3.4 These sections are too succinct and should give better info on seasonal trends or observation of peak emissions. Line 10: How was it whether annual emissions or uptake of N2O was significant? Line 13-14: Table column reads 3.3 to 8.6 (rather than 3.1 to 8.2 as cited in text)

11298 Line 23: Klemedtsson et al. 2005 is cited for influence of CN ratio on methane emission; but to my knowledge this reference only concerns nitrous oxide emissions? Line 24: use ‘are in accordance with’ rather than ‘confirms’

11299 Line 13-16: can you quantify this statement on robustness of the interpolations?

Conclusions The conclusion collectively speaks about GHG, but results are based on the importance of CO2 fluxes. I suggest to limit the statements to the role of CO2. Line 24: ‘...emit as much CO2 as grasslands on histosols.’

Table 1 As footnote for Site column, I suggest something like “Subscripts in site designations refer to low (<15%), medium (15-35%) or high (>35%) soil C content and mean annual water table depth (cm)”. This info, I think, could be repeated in all four tables. Mean WTL column and footnote c: Use notation ‘GWL’ as in the rest of the manuscript (rather than ‘WTL’) Specify that Nmin is given as an average and include SE and n.

Table 2 Give means and SE with same number of decimals To avoid confusion, specify
in footnote a why sum of cover can be >100% (here up to 155%) ‘Cover values are indicated to nearest 5%’

Table 3 Specify the nature of the variability reported; is it mean ± sd for the three chambers per site or is it an sd estimate based on the bootstrap/monte carlo procedure?

Table 4 Give means and SE with same number of decimals and specify for measures of variation as in Table 3

Figure 2 Include the measured data used for modeling (and verification) as points in this graph; this will not only show which measured data are available, but it will also indicate the model performance.

Figure 3 This figure is optional; I think it is referred to only at p 11296 in a paragraph where Table 3 is more appropriate.

Figure 4 Correlation between GWL and annual net C balance seem not to be so strong; net C balance would be the indicator of changes in the soil C pool caused by heterotrophic mineralization

Interactive comment on Biogeosciences Discuss., 10, 11283, 2013.

C5967