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Interactive comment on "Carbon dioxide flux and net primary production of a boreal treed bog: responses to warming and water table manipulations" *by* T. M. Munir et al.

Anonymous Referee #1

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The study 'Carbon dioxide flux and net primary production of a boreal treed bog: responses to warming and water table manipulations' provides interesting and useful data on the response of the peatland CO2 exchange to warming and water table treatments, considering effects from micro-topography. A major strength of this work is that it highlights the contrasting short term (few years) vs. long term (>decade) responses to water table draw down. Another very valuable aspect of this paper is the separate presentation and discussion of autotrophic and heterotrophic respiration fluxes for a peatland ecosystem. Thus, I believe that this work could make a great contribution to the literature. However, at present the manuscript lacks clarity a various places and there are few concerns outlined below which I would like to see addressed before the

manuscript can be considered for publication.

Page 12938, Line 6: tree root respiration was not actually measured but instead derived from measurements of ecosystem respiration and trenched (i.e. root-free) plots. I suggest rewording this sentence accordingly.

Page 12938, Line 9: Here and at other places the authors use the term 'C balance' when they actually refer to the 'CO2 balance'. Since non-CO2 C fluxes via methane emissions and DOC export can be substantial and need to be included in the C balance in peatland ecosystems, I encourage the authors to avoid using the term C balance unless all these non-CO2 fluxes are actually included.

Page 12938, Line 11: . . .warmest 2013, the. . .

Page 12938, Line 12-13: '. . . the experimental site. . .and the drained site. . ..' At various places throughout the manuscript I find that a 'the' is missing when referring to the sites.

Page 12938, Line 14: What does 'although' refer to? Its use does not seem to have a logic connection in this sentence.

Page 12938, Line 18: Given that NPP is one of the key objectives listed in the paper title, I suggest to present quantitative NPP data in the abstract.

Page 12939, Line 1: clarify if you refer to autotrophic, heterotrophic or ecosystem respiration here

Page 12939, Line 18-19: because of a CO2 fertilization effect of due to the changes in temperature and water cycle? Clarify.

Page 12940, Line 11-13: This observation is likely confounded by the simultaneous development of vegetation biomass. E.g. A day with 20 degC in April would have likely still resulted in a low CO2 flux. I suggest revisiting this statement.

Page 12942, Line 22: remove 'to'

Page 12943, Line 1: remove 'severely sensitive' or explain what is meant by that and on what criteria this judgment is based on?

Page 12943, Line 3: replace 'C balance' with 'CO2 balance'

Page 12943, Line 23: mention the water table depth below surface for the control site

Page 12946, Line 4: how are the chambers 'corrected for transmittance'?

Page 12946, Line 10: outside or inside the chamber? If outside then the PAR measurements overestimate the inside PAR by 12%? Clarify.

Page 12946, Line 23-28: I cannot find the logic or point in this section, what does 'therefore' refer to and how does the nighttime CO2 flushing effect (commonly observed in automated chamber systems) relate to the arrangement of the daytime manual measurements conducted in this study? Reword and clarify.

Page 12947, Line 5-10: I disagree. One should be able to see a linear CO2 concentration increase by diffusion if the chamber volume is large enough and the sampling duration adequate. I don't understand how the 'manipulation of the spontaneous CO2 fluxes across the soil-vegetation-continuum' should affect the linear increase caused by diffusion. Surely, at some point the increased concentration in the headspace will slow down the diffusion rate but if the area and chamber volume are chosen well then this effect can be avoided. Even if the diffusion rate slows down at longer measurement times one could use the data from the initial linear phase only. A better or clearer explanation and justification for the choice of an exponential equation is needed here.

Page 12949, Line 5-17: 1) Please clarify what these Rr plots are, do they include both the trenched and control plots? If this acronym only refers to the trenched plots and the surface vegetation was only removed only there but not at the intact control plot where respiration from ground vegetation was included then the difference between Rr and control plots would not equal tree root respiration but to that of tree root + vegetation respiration. 2) It seems odd to call the trenched plot Rr (Respiration roots) if this is

actually the plot that does not contain any roots, 3) specify the timing of the trenching. Usually this is must be done the autumn before the measurement year to avoid the initial burst in decomposition of cut off roots to result in overestimation of the flux from the trenched plot, which might occur if the trenching was done in spring just prior to the measurement season.

Page 12951, Line 4: how did the authors come up with this value of 17%?

Page 12955, Line 14: 'did not increase'

Page 12955, Line 23: Introducing the new term 'canopy-layer biomass' is confusing, why not simply call it 'aboveground tree biomass' which is also the respective term used in the following text.

Page 12958, Line 19: the unit needs some temporal component, e.g. per growing seasons (gs-1). Also, when comparing the total sums of fluxes between the two years, do these represent the same growing length or is an adjustment with season length necessary?

Page 12958, Line 20-23: Avoid discussion elements in the result section

Page 12959, Line 15ff: I suggest including an estimate of error or uncertainty around these values to support the comparison among treatments and years.

Page 12960, Discussion: To make the discussion section better readable and structured I suggest to subdivided it into subtopics e.g. 4.1 weather effects, 4.2 water table effects, 4.3 OTC warming, etc Page 12964, Line 25: How is the response of trees to warming considered and incorporated in this discussion?

Page 12965, Line 10: I suggest mentioning the values reported by Moore et al 2002 for comparison.

Page 12966, Conclusions: No results should be repeated in the conclusion section, instead it should consist of broader implications and conclusions (i.e.' take home mes-

sages')

Page 12967, Line 19ff: The discussion of aerated peat thickness and water use efficiency in the conclusion section is out of place. If the authors have data on these aspects they could be presented and discussed earlier in the manuscript.

Page 12978, Table 4: how was growing season defined? Based on air temperature thresholds?

Page 12983, Figure 5: Should the legend say CO2-C as suggested in the Figure caption?

Interactive comment on Biogeosciences Discuss., 11, 12937, 2014.