

## ***Interactive comment on “Dynamic C and N stocks – key factors controlling the C gas exchange of maize in a heterogenous peatland” by M. Pohl et al.***

### **Anonymous Referee #3**

Received and published: 20 February 2015

#### General comments

The manuscript describes the results of a multiyear field study dealing with the carbon gas exchange of maize in a heterogeneous peat land. The results from this study will contribute to a better understanding of the environmental controls of the carbon exchange above cultivated peat lands and improve the upscaling from such sites. I recommend publishing of the manuscript after minor revisions.

The concept of dynamic C and N stocks is presented in the abstract as a hypothesis. I would suggest to present the validity of this concept as a major result of the study. One of the surprising results of this study is that the AR soil having the lowest SOC turned

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out to be a source for CO<sub>2</sub> to the atmosphere, while the two other soils comprise a sink. To me the potential reasons for this finding do not become clear from the discussion. On page 16150 line 24 the authors state that the soils contain a large stock of decomposable carbon. How was the decomposable fraction of organic carbon in the soils estimated? Given that the GWL has a pronounced effect on the carbon turnover, is it possible that the groundwater itself interacts with the respiratory CO<sub>2</sub> or acts as a source for CO<sub>2</sub>?

For a reader not familiar with the statistics used here it is difficult to follow the outcome of the statistical analysis. To my perception the manuscript would benefit from a more broad description of the statistical method. Moreover phrases such “xy% of the variability can be explained by ...” would be helpful.

In figure 3 the NEE are extrapolated to SOC<sub>dyn</sub> levels of 0 kg C yr<sup>-1</sup> for groundwater levels ranging from -1.6 to -0.2 m y<sup>-1</sup>. This suggests somehow that soils containing no SOC would act as a source for CO<sub>2</sub> what is rather implausible. I suggest to limit the regression model to the data field covered by the measurements and to stress out the limits of the regression model in the manuscript.

#### Specific comments

Page 16136 l. 8.: I wonder how the dynamic carbon and nitrogen stocks control methane emissions as methanogenesis is expected to take place under suboxic conditions and thus below the GWL. Do the authors think that the methane flux is mainly controlled by methanotrophy above the GWL? This should be specified.

Page 16139. L.13: Please remove “also”.

P. 16143 l. 18ff.: I wonder whether changing moisture inside the chambers is an issue for the flux measurements. Can the authors comment on this?

Page 16144, l 16. Some information on the uncertainty is given in the Supplemental material. However it would be fair to provide an estimate of the uncertainty in the

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manuscript.

p. 16145 line 3. Is this the total number of datasets or the number of datasets per sampling site?

Page 16147, l. 1ff: The authors state that exceptional high methane emissions occurred during periods of flooding or high GWL. To my perception flooding or high GWL are linked to strong precipitation and thus to climate variability. In contradiction to this the authors state on page 16148, l. 23 that climate played a minor role in determining annual methane fluxes. Could the authors clarify this?

Page 16147, l. 13: How large was the uncertainty. See also previous comment. Page 16148 line 2ff: For a reader not familiar with the statistics used here the meaning of significant or "highly significant" as frequently used in chapter 3.3 is not apparent.

Page 16149 line 28: I may be wrong but the statement NEE being always positive for  $\text{SOC}_{\text{dyn}} < 4.3 \text{ kg}$  refers to the regression model. In a more generalized sense it implies that carbon free soils could act as a source for  $\text{CO}_2$ . Is this statement substantiated by flux measurements carried out under these conditions?

Page 16154 line 5: Please replace and by and.

Figures: Figure 1: This figure needs some rework. It is difficult to differentiate the different sites from the color-coding. Further I can only find data for two soils in the two lower panels of figure 1. Please remove the a in the brackets at the end of the figure caption.

Figure 3: Please check the legends of figure 3. Why is SOC given in  $\text{Kg C yr}^{-1}$  and why is the groundwater level given in  $\text{m yr}^{-1}$ ?

Supplement: Fig. 2 Please provide a description of legends in the figure caption. What is RWI and what is the time scale?

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