Anonymous Referee #3

General comments

The authors focus their study on CO_2, as mentioned in the title, but they mention methane emissions from time to time. It is clear that methane is important to have a realistic carbon balance, but it is not the focus of this paper. I suggest to leave it, or to mention it only in the discussion.

Reply: Methane emission is now removed from the manuscript.

The discussion part as a whole could be improved, since there is some confusion between results and discussion. In particular, section 4.5 shows a sensitivity experiment which has been mentioned in the Methods section, but not in the Results section. It should be presented before being discussed, as it is a rather important sensitivity test. I also feel a summary of the discussion is missing.

Reply: The drained vs. undrained sensitivity test is now first introduced in result section (Sect. 3.5) and then discussed in discussion section (Sect. 4.3).

Specific comments

13354, line 25: Please, define WTD in the text.

Reply: Done.

13355, line 25: What do the authors mean with "certain level"? Are there quantitative measurements to define it?

Reply: The critical water table depth (WTD) (meant by "certain level") was reported to be peatland specific and may vary with peat type and vegetation. However, a range of values for the critical WTD (0.4-0.9 m) as reported in different literatures are now included in the text (line 65-69).

13364, line 25: When the authors talk about the 44 years of simulation, actually they mean 40 years of spin up time, and 4 years of simulations. I suggest to use this terminology for sake of clarity.

Reply: Done.

13366: Does this change in the WTD change also the water exchange between the hollow and the hummock surface? How does the hydrology react to this change?

Reply: The change in external water table depth (WTD_x) from 0.45 m below the hollow surface (0.60 m below the hummock surface) to 0.15 m above the hollow surface (at the same level to the hummock surface) created such hydraulic gradient between modelled water table depth (WTD) and WTD_x which only allowed subsurface lateral recharge to happen and completely stopped subsurface lateral discharge. However, when standing surface water exceeded the storage capacity of hummock and/or hollow surface, run-off occurred. The surface water exchange (run-off / run-on) between hummock and hollow in the model (Manning's equation) was driven by slope given as a model input. The sub-surface exchange of water (Richard's equation) between a hummock and a hollow layer was driven by hydraulic gradient, hydraulic conductivity and thickness of each layer.

13368: The authors mention "carryover effects" from the hydrology of year 2002, but the major discrepancies between model and observations as reported in figure 2 appears towards the end of the season, and it is not clear why. Could the authors be more clear about it?

Reply: Modelled R_e was systematically larger than EC-derived R_e at the onset of the rainy season (November) during 2002 and caused lower modelled vs. EC-gap filled NEP (Figs. 1-2) (Table 2). Despite a similar measured vs. modelled soil water contents and air-filled porosities, gap-filled CO_2 effluxes were much smaller than the modelled CO_2 effluxes during the rainy

season (Fig. 1). Though modelled CO_2 fluxes for the same hydroperiod indicated better model agreement with EC-measured fluxes (Fig. 1) (Table 2), 75% of total hourly fluxes during that hydroperiod being gap-filled contributed to lower modelled vs. EC-gap filled NEP (Sects. 3.1 and 4.2).

13369, line 12. Both in the text and in the Fig. 6 caption you mention the significance of the quadratic fit. Which method did you use? did you try to fit other curves?

Reply: It was a goodness of fit test. The purpose of the test was to examine whether there was a similar modelled WTD vs. modelled GPP and R_e, and observed WTD vs. EC-derived GPP and R_e. Only linear and quadratic curves were fit. Quadratic curves were chosen over linear curves for higher goodness of fits. The goodness of fits (R^2) are now added to the graphs (Fig. 8) and described in the text (line 503-520).

13377. A very important issue in DGVMs is about upscaling the results of complex, small scale mechanistic models. I think this is a point worthy to be discussed, even briefly. How representative are the results of a point scale model for an ecosystem scale perspective?

Reply: The current results from our point scale modelling reasonably represented the WTD effects on NEP measured over a flux tower with homogeneous patch in terms of plant functional types (PFT), land use (forest) and disturbance (drainage). However, the current point scale modelling can be up scaled to an ecosystem level with inputs for PFTs, soil physicochemical properties, land uses and disturbances (now briefly discussed in the conclusions section; line 884-895).

In general, the final part of the conclusions should be moved to a more comprehensive and summarizing discussion part, or subsection, including a more extensive summary of limitations and assumptions. A better discussion of further work is also needed. For example, the authors

claim that the results could be useful to the REDD+ scheme, but they do not mention how the results at a point scale can be linked to a larger scale project.

Reply: Summary and limitations of the study as well as utilities of current modelling for large scale management policy making are now discussed briefly in conclusions.

13379, line 5: Please, define REDD+.

Reply: Done.

Figure 6: It would be useful to give more information about the statistical tests performed to get these results. Is it a goodness of fit test?

Reply: Yes it was a goodness of fit test. The R^2 values for the curves are now added to the graphs (Fig. 8)

Figures 1-4: It would be better to insert the year of the simulations on the x axis of the plots, rather than just mention it in the caption.

Reply: Done (Figs. 2-5).

A minor technical point. References to the auxiliary materials are kind of confusing. In particular, references to the equations in square brackets cause confusion when in the same paragraph the author discuss concentrations, e. g. [M] and [O2S].

Reply: The references to the equations are now put within the round brackets () instead of square brackets [].