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Biogeosciences Discussions

Interactive comment on "Climate and site management as driving factors for the atmospheric greenhouse gas exchange of a restored wetland" *by* M. Herbst et al.

Anonymous Referee #1

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——————————— General comments:

Overall, the paper presents a very nice set of CO2 and CH4 measurements. The argument is nicely made that these can be regarded as a full GHG budget for this restored wetland site, which has interesting management activities. The quantitative aspects of the paper are confusing and weak in areas, which makes it difficult to assess the major conclusions regarding the role of management activities. The paper does not present enough evidence that environmental factors (specifically air temperature, soil temperature, water table depth, and soil moisture) could not play a large role in controlling the CO2 and CH4 fluxes. The argument that the management activities

are the dominant controlling mechanism is descriptive and is difficult to follow in a quantitative sense. The paper has the potential to make a valuable contribution of a new and interesting data set. Before publication, the analysis should be expanded to be more thorough on environmental correlations (and other aspects brought up in the specific comments). After which, the potential conclusions regarding the influence of management activities on GHG fluxes in restored wetlands will be interesting and likely important.

——————————— Specific comments:

Page 9030 line 10 - Use the definition of the global warming potential in a more rigorous sense to make it clear over which time horizon the two are equivalent.

Page 9030 line 17 - The conclusion of the abstract is weak. It should be reworded pertain to how this study contributes to the gap in knowledge.

Page 9036 line 4 - Please say whether the empirical parameters are site specific.

Page 9036 line 12 - "Most commonly used" is confusing. In what sense does it differ from others? Maybe just say "according to the GWP definition used in this study". Include the time horizon here.

Page 9037 line 11 - Fall is also colder in 2010 - please mention in text as well. It seems that this period is important because the slope of the cumulative total GHG flux becomes positive during this period.

Page 9038 line 20 - The timing of soil moisture availability to the soil microbial community may have differed dramatically between the years despite a similar distribution of rainfall because some fell as snow. Moisture input with the enduring 2010 snowpack must have been delayed and dramatic compared to the other years. Whether there was an effect on soil moisture should be considered and discussed.

Page 9039 line 1 - Were correlations with soil moisture, soil temperature, and air temperature explored? It's not clear from the data shown that the remaining fluxes were

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not correlated with meteorological forcing. For instance, Figure 5 shows a strong correlation of CH4 fluxes with soil temperature. The effect of this correlation should be discussed for the time series shown in Figure 4.

Page 9040 line 10 - "Most of the steepest parts of the cumulative annual CH4 flux curves coincided with periods of grazing (Fig. 4)." This is not obvious to me. Is there some way to show this quantitatively? It seems to correlate with season more than management activities. The arguments in this section are fairly weak and not obviously substantiated by the data shown. Is there indication of a contribution to the CH4 fluxes from rumination? One indication would be large concentrations of CH4 that are correlated with the location of cattle. Some management activities seem to correlate with changes in the fluxes, but not in all cases. Showing proof that meteorological variables weren't influencing fluxes would lend more weight to the arguments that management activities were the most important factors.

Page 9039 line 21 - The difference between a low and high water table does seem significant. I'm not sure that the periods with and without grazing are a significant distinction because they are correlated with temperature - cattle were grazed only in summer and fall months when temperatures were warmer anyway. If the trend is not significant when tested statistically, this relationship should be discounted. It should be mentioned if there is a statistically significant difference between the fitted curves. Is the year to year CH4 flux increase statistically significant?

Page 9040 line 9 - You might give a reason why it is appropriate, or at least not inappropriate, to use that uncertainty estimate as well.

Page 9042 line 14 - Are there proposed mechanisms for the "unexpected" release that would inform your study?

Page 9043 line 13 - But could there be an water table effect depending on the timing of its recharge? The differences in snow between the years might affect this.

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Page 9044 line 21 - There is no july and august control group without management to test the effect of the water table on CO2 exchange. Please include a temperature sensitivity analysis. This paper should much more clearly present the argument that climatic variables are not more important than management activities.

Page 9045 line 1 - There are clear differences in temperature and in the timing of soil moisture input. I do not see where it was shown that this is not significant.

Page 9045 line 7 - Please illustrate this statement with an example from Figure 5 because it is not straightforward to the reader what you mean. There is a shift in ch4 fluxes from low to high water table, but also can be a significant increase in CH4 fluxes with an increase in temperature (especially at high WT and high temperatures).

Page 9046 line 16 - Based on the location of the cattle and the height of your tower, would you expect to be able to measure their rumination emissions?

Page 9047 line 25 - "mostly depending on site management and extreme weather events, but less depending on gradual climatic variations." If you mean in your own study, please make the discussion on the difference between gradual climatic variations and extreme events more obvious. If you are referring to the Dreosler study, please clarify this.

Page 9057 Table 3 - Should be described in more detail in the paper body.

Page 9060 Figure 2 - You have already defined the method for how this the GHG flux was calculated, so I think it's more appropriate not to include them here because you would need to also include info on the GWP and the time horizon again. I would just mention that the GHG flux includes both CH4 and CO2 in CO2 equivalents. This could be a shortened version of the sentence on Page 9038 line 1.

———————————— Technical corrections:

Page 9030 line 2 - "was" instead of "could be"

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Page 9030 line 5 - "which was restored" instead of "being restored"

Page 9030 abstract - Introducing 'full' budget in first sentence is confusing. I suggest introducing in line 9 - "However, interms of the full annual...". Also, use a consistent verb tense throughout.

Page 9030 line 14 - This second-to-last sentence is long and confusing. Please reword.

Page 9030 line 23 - "essential" does not make much sense in this case.

Page 9031 line 10 - It does not seem not appropriate to cite the "Fluxnet" network, and not others, especially because it is not particularly relevant to this study. I would discuss the flux networks generally, but you could cite examples like Baldocchi et al., 2001. Same comment for mention of "Fluxnet" in lines 17 and 18.

Page 9031 line 20 - Sentence is too long. Spell out 20 yr when used in this sentence.

Page 9032 line 3 - Redundant to say "such as" and "e.g."

Page 9033 line 23 - No quotes needed on "Skjern Meadows". Same comment for "Ramsar Convention"

Page 9033 line 10 - "which turned this community into the most abundant one" - wording is awkward

Page 9034 line 11 - What is a "true" pumping speed? Please define/clarify.

Page 9034 line 20 - Should read "comprised of soil temperatures"

Page 9035 line 4 - Omit "being"

Page 9037 line 10 - Use numeric "2" instead of "two"

Page 9037 line 23 - What does "daily peak emission rates" refer to? This could mean the maximum emission rates observed in a given day or the maximum daily rates observed each year. Please clarify.

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Page 9038 line 1 - I would change this first sentence to state what was done, not what could be done.

Page 9038 line 11 - "Regardless of these differences" in GHG flux totals. Mention GHG again to make the contrast with carbon here.

Page 9040 line 23 - I would use "budgets" not "balances". Please add to the sentence "less sensitive than...". I am not sure what you area comparing to here. Shorter time frames?

Page 9041 line 9 - Please use consistent terminology in the comparison. You have used "full atmospheric GHG budget" before, so I would mention this again to contrast (instead of just "the atmospheric budget"). Then use the same terminology. Is there a real difference between "full" and "total"? Can you use "full" again? Perhaps this point should be mentioned briefly in the abstract.

Page 9042 line 6 - "Do almost" is awkward.

Page 9042 line 9 - Split sentence - it is too long.

Page 9045 line 5 - Define " switch-on-off "

Page 9055 Table 1 - Last row should read "Annual" instead of "Total".

Page 9056 Table 2 - The units are confusing in this table. Is there a difference between Gm-2 and gm-2? Please add vertical lines to clarify which columns include data pertinent to the header columns (e.g., CO2 vs CH4 data).

Page 9061 Figure 3 - It would be much easier to interpret the figure if the management and meterological variables were color-coded to match the cumulative CO2 flux data. I would switch the order of years for those variables to 2009 to 2011.

Interactive comment on Biogeosciences Discuss., 9, 9029, 2012.