Biogeosciences Discuss., 9, C4739–C4742, 2012
www.biogeosciences-discuss.net/9/C4739/2012/

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.

M. Herbst et al.

mherbst@gwdg.de

Received and published: 15 October 2012

Authors' Comment to Reviewer 2

Reviewer 2: Some general comments. To come to an overall conclusion I would be interested to know which of the two GHG has the most impact on the total GHG budget, which one has the largest variability and what are the drivers are of this variability. The drivers of the variability are largely discussed in the manuscript. However it would be interesting to answer the first two questions explicitly in the text. Additionally it would be of great interest to see some kind of quantitative measure to relate the management to the GHG-fluxes. A footprint weighted index which represents the amount of grazing

cow days per day could maybe help to clarify the variability in the CH4 fluxes.

Response: We would like to thank reviewer 2 for the constructive comments. The requested information about the relative impact of CO2 and CH4 on the total GHG balance and the magnitude of their variability is somehow already part of Table 2, however we agree that it would be helpful to state this explicitly in the text, too. This will be done accordingly in the revised version. For the quantitative aspect of the management influence on the GHG fluxes we refer to our answer to reviewer 1. The topic of cows and footprints and their effect on the CH4 flux variability was discussed in an earlier paper (AgrForMet 151 (2011), 841-853) and, in our view, would not need to be repeated here.

Specific comments:

Reviewer 2: P9031 L 17 insert 'grassland' between managed and sites

Response: Good point. Will be changed accordingly.

Reviewer 2: P9034 L 16 How good is the correlation between the H2O measured by the LI-7000 and the LI-7500?

Response: When both instruments were working well and when it was not raining, the correlation between the H2O fluxes from two instruments was good (R2 = 0.95), however the LI-7000 fluxes were on average about 20% lower than the LI-7500 fluxes. Potential impacts on the Webb correction and thus the CH4 flux will be briefly discussed in the revised version.

Reviewer 2: P9035 L 26 insert Reichstein et al, 2005 reference for gapfilling

Response: We will replace the Moffat reference by the original Reichstein reference.

Reviewer 2: P9036 L5 could you mention model performance (eg r2)?

Response: R2 was 0.65 for periods with high water table and 0.19 for low water table.

Reviewer 2: P9036 L5 Please mention how large the storage term is.

Response: This not easy to answer, since the storage term varies greatly over time, for example with changes in turbulence. The time scale makes a huge difference too, and for example over 24 hours the storage term was often very close to zero. On a half-hourly basis, the average absolute CH4 storage term, for example, was about 2 nmol m-2s-1 in the first half of the year and just below 4 nmol m-2s-1 in late summer when fluxes (and concentrations) were largest. These figures are still very close to the resolution limit of the instruments for turbulent fluxes, which demonstrates that in a windy area like the Danish west coast the storage term is of minor importance. We will mention this very briefly in the revised version.

Reviewer 2: P9037 L24 It is interesting to see that the peak emission increased over the years. Is there a pattern in these emission? Can this be related to grazing? Or after grazing? Rain events?

Response: Some pattern becomes visible in the new figure we added to the revised manuscript version (see our comments to reviewer 1), and according to this figure both grazing and time of rewetting of the top soil by autumn rainfall may have had some role in determining the peak emission rates. However, other effects like gradual processes of plant and microbial succession following wetland restoration may be the more likely reasons for the increase, and this is already discussed in section 4.4, fourth paragraph.

Reviewer 2: P9038 L7 please explain a bit more about the way you calculated the uncertainty of the fluxes. Which uncertainties did you consider? Gapfilling? U*? random uncertainty?

Response: Some of this information was actually provided on page 9040, section 4.1. From the first paragraph of that section it can for example be seen that we did consider both random uncertainty and gap filling, but not U*. Nevertheless we will add a sentence to this paragraph where we will justify our overall estimate of 15% for the total error.

Reviewer 2: P9039 L15 What about the role of plant mediated transport?

Response: This can indeed have played an important role as we discussed on page 9046, second paragraph. We believe that this topic belongs into the Discussion section, rather than into Results, and would therefore prefer to leave it in section 4.4.

Reviewer 2: P9039 L22 What is this 'clear' functional switch based on? Is there a water table threshold?

Response: Yes, the first two studies cited on page 9045 provide evidence for such a threshold at a water table position around 10 cm below the surface. We will discuss this in more detail in section 4.4 of the revised manuscript.

Reviewer 2: P9045 L1 I think it is a bit strong to say that there is no interannual variability in seasonal courses of temperature and water table height (looking at table 1). Especially because the temperature response of Fig 5 is exponential, so a small change in temperature has a potential large impact on the fluxes.

Response: Since a similar comment was made by reviewer 1, we carried out a thorough sensitivity analysis which is described in our answer to reviewer 1.

Reviewer 2: P9045 L28 please add that cows were only present during a short period of the year.

Response: This is indeed an important point that will be added in the revised manuscript version.

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