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Interactive comment on "Autotrophic fixation of geogenic CO_2 by microorganisms contributes to soil organic matter formation and alters isotope signatures in a wetland mofette" *by* M. E. Nowak et al.

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Dear referee,

Thank you for your comments on our manuscript. We tried to address all your comments. Your comments were very constructive and helpful and we think that they highly improved the original version of the manuscript. Find below answers to your comments.

Comment 1: We used δ13C values of autoclaved controls as background value. All autoclaved controls showed zero enrichment after labelling, compared to not autoclaved

samples. The not autoclaved samples showed already enrichment up to +80 ‰ in unfumigated extracts, although enrichment was always higher after fumigation (see page 18, line 18-21). This is most probably caused by formation of secondary metabolites of the microorganisms that were synthesised from labelled CO2 and excreted, presumably acetate. However, the δ13C value of autoclaved samples represents not the natural abundance δ13C value of the microbial biomass, because autoclaving disturbed the sample and made also plant material extractable. Natural abundance δ13C values of microbial biomass are presumably more negative than the values obtained from autoclaved samples and also more negative than bulk SOM.

Comment 2: It is true that the reference soils show an ageing with soil depth as indicated by decreasing radiocarbon signatures. However, interestingly, there is no change in δ13C values. This means, that δ13C values are not changed with increasing decomposition stages in these soils, as it is observed in other soils, where there is usually an increase in δ13C values with depth. Theoretically, it is possible to apply the model from eq. 9 to the reference soil. This we have done in the attached plot (plot 187). The results show, that measured δ13C values for both reference soils are more positive in the first 5 cm, whereas they should increase with depth according to the model. However, in both soils δ13C values show the opposite trend and get more depleted with depth. One has to consider that the processes which is assumed responsible for the shift in the mofette model is different than for the prediction for the reference soil in figure 187. In the reference soil the model assumes that Δ14C is mainly determined by amount of incorporated geogenic CO2, whereas radioactive decay is of minor importance compared to geogenic CO2 and can be corrected with 14C decay derived from the reference soil. Model in figure 187 shows implies that there is no linear relationship between aging of organic matter (as implied by Δ14C values) and δ13C values. An increase in δ13C values with increasing decomposition of the organic matter is therefore not supported by the relationship of Δ14C and δ13C values in the reference soil. CO2 fixation might be an explanation for this, because it adds depleted carbon via microbial biomass to the soil and might "shift" δ13C back towards more negative values.

Comment 3: Indeed, there is some evidence that carbon dynamics are lower in the lowest depth of mofette 2. All soils in the floodplain are subjected to fluctuating water levels. However, in the mofettes these fluctuations are attenuated, because within the central part of the exhalation water table is elevated by the upstreaming CO2. Mofette 2 is considerable bigger than mofette 1 and the CO2 discharge is somewhat higher (see answer 8 to referee #1). Mofette soil 2 is therefore likely watersaturated throughout the whole year, in contrast the all other soils, although we have no direct evidence for that, because we did not measured the water level throughout the whole year. However, we have indirect evidence, because during the sampling campaign in September, it was not possible the gain soil cores from the lowest depth with our auger (this is the reason, why the last data point in table 1 is missing). Permanently waterlogged conditions might lead to much lower C turnover and the model-correction of radioactive decay with Δ14C from the reference soil might not be valid. This means that the modelled δ13C values is biased toward too positive values.

Comment 4: This is actually a very good point, we include this in the text.

Editorial comment:

p.14556, line 2: We think that the formulation we used leaves sufficient space for interpretation.

p. 14559, line 25: Ok, we checked and used the uniform therm Form I and II RubisCO

p. 14562: Ok, this was rephrased according to the referee‘s suggestion. p.14564, equation 3: We checked the equation and compared to other published versions. It is correct.

p. 14564, line 20: Ok.

p. 14567, line 13: We changed the paragraph according to referee #1.

p.14570, line 1 and 3: ok, this was corrected.

p. 14572, line 19: This is true, for clarity we included solely values, which were obtained after fumigation. Values given in table 2 should illustrate the enrichment of the microbial biomass compared to the background values.

p. 14576, line 1: Ok

p. 14577, top paragraph: We think it is better to show both, the 14C decay corrected and uncorrected data. The decay uncorrected data illustrates the overall depletion if 13C-SOM values compared to vegetation values. The decay corrected in turn show, that after calibrating the model, depletion is still occurring where we measure the highest abundance and activity of autotrophic microorganisms. Therefore, both , decay corrected and decay uncorrected values are complementary.

Last comment: The numbering of the figures was changed according to their appearance in the text.

Interactive comment on Biogeosciences Discuss., 12, 14555, 2015.

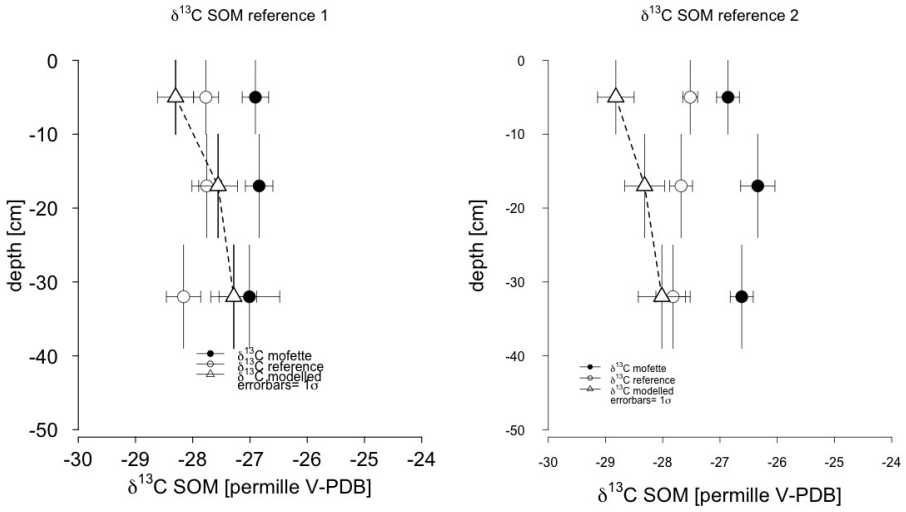
δ13C SOM reference 1
δ13C SOM reference 2
depth [cm]
0
-10
-20
-30
-40
-50
-30
-29
-28
-27
-26
-25
-24
δ13C SOM [permille V-PDB]
δ13C mofette
δ13C reference
δ13C modelled
errorbars= 1σ

Fig. 1.