Biogeosciences Discuss., 8, C247–C252, 2011
www.biogeosciences-discuss.net/8/C247/2011/

Biogeosciences Discussions

Interactive comment on "Mineralisation, leaching and stabilisation of ^{13}C-labelled leaf and twig litter in a beech forest soil" *by* A. Kammer and F. Hagedorn

Anonymous Referee #1

Received and published: 16 March 2011

The study of Kammer & Hagedorn addresses the pathway of labelled litter (leaves & twigs) applied to two different soil types in a temperate forest in Switzerland. The main result of the study, as pointed out by the authors, are similar mineralization rates of leaf and twig litter. This is surprisingly and in contrast to most soil C models, which assume fine woody litter to mineralize slower than leaf litter. Further, the authors conclude twig compared to leave litter being less important for soil C storage, as DOC leaching from twig litter in the upper soil cm is reduced and it is less accessible to soil macrofauna, therefore less incorporated in soil organic matter. The manuscript is well written and the data nicely presented.

However, I have several issues which need clarification. In brief, the authors provide no or only minimal reflection on how the applied methods might have influenced their findings. Such as, the calculation of d13C of soil respiration by applying a Keeling plot with a simple mass balance using only two data points (most studies use at least 5!), the labeled litter originating from an CO2 enrichment experiment (several studies have shown decomposition rates of litter grown under elevated CO2 to change), the amounts of litter applied were much larger than average at the study site (probably causing reduced litter-soil contact and thereby altering moisture) & the decomposing roots in the trenching plots (increasing microbial activity and probably soil N content).

Please see specific comments below.

Abstract

l3 soil C stocks

l11 delete 'only'

l14 centimeters not centimetres

l21 Why don't add the findings on C twig-litter mineralization being in contrast with assumptions of most soil C models?

Introduction

'major' not 'mayor'

1046 l25 As I understood, only the Rendzina overlies calcareous bedrock.

Methods

1046 l23 Can you talk about plots, meaning they are independent, when they were within a radius of 10 m?

1048 l13 When were the soils trenched? Please provide date.

1047 l18 Which year?

1048 l14 With an plastic foliar 30 cm deep you only prevent lateral but not root ingrowth from below.

1048 l15 Could dead and decomposing roots from the trenching of the plots have influence the results by increased microbial activity due to more N and C available, as well as higher soil water content due to reduced plant water uptake?

1048 l21 Calibration of gas analyzer?

1048 l25 Was the lid sealed to prevent CO2 from leaking?

1048 l25 Instead of an estimate you could also give the results of [CO2] chamber - [CO2] ambient (+SD).

1049 l1 Please make clear that the glass vials are first closed with a septum and then evacuated. Have they been refilled with N2?

1049 l4 How many days were the samples stored before analysis?

1049 l8 Keeling plot with simple mass balance equation: Most studies use a minimum of 5 samples during CO2 build-up and then apply a Keeling plot to estimate d13C-SR, you need only two samples. With this approach you are assuming, d13C next to the soil collar being CO2 atmosphere (see also Steinmann et al. (2004), Oecologia), and not contaminated by SR or human breath. The slightest error in ambient samples will lead to a substantial error in your d13C-SR. If d13C ambient varies by 1 permil, respired d13C will change by $\sim$1 permil. Moreover, with your approach you can't give any error estimations on your d13C-SR (intercept). Indeed, as your litter-labeling signal is not very strong, small variations in d13Cambient, could lead to substantial errors in estimating d13C-SR. However, as you are comparing treatments, and are probably less interested in absolute d13C-SR the implications for your study are eventually to be small. Please provide an explanation. For an error estimation you could for example use d13C of atmosphere measured at monitoring stations or apply a keeling plot overall measurements separate for each treatment and campaign.

1049 l14-l26 How many suction plates?

1049 l21 What do you mean with lower side? downhill?

1049 l24 Please add 'labeled' before litter

1049 l25 How many replicates? One litter bag per plot?

1051 l1 Sample treatment before microbial biomass extraction?

1051 l21 Is this also true if root respiration may be present? The difference in bare soil d13C between cold and warm season (Fig 2) suggest influence of root respiration. No differences in d13C-SOC between soil types?

1051 l25 How about respiration of macro soil fauna? You estimate about $\sim$30% of leaf litter was allocated by macro soil fauna in the soil and decomposed. Might this has affect the d13C signal?

1052 l6 Would not a repeated measure anova or a linear mixed effect model be more appropriate to account for the repeated sampling design?

Results

1053 l 14 Give the statistical test and provide t or F-values. P-values alone are meaningless.

1053 l16 'labeled litter' instead of '13C-depleted litter'?

1053 l20 better 'litter microbial biomass', increases readability.

1053 l24 add 'of the experiment'

1053 l20-25 Here you are not differentiating between soil types? Why? Please mention also in Table 2. Please also give the number of samples in Table 2.

1054 l4 add 'of SOC' to d13C

1054 l11 Change 'CO2 release' to 'CO2 efflux'.

1054 l12 see comment 1053 l 14

1054 l13 Please don't switch back and forth between soil CO2 efflux and soil respiration or even heterotrophic soil respiration (Fig 1 and 3). Stick to one expression, I would recommend soil CO2 efflux, as in your study the sources of soil CO2 effluxes are differing between treatments e.g., (litter, no litter) and partly trenched soils. Correspondingly, I would not use 'the soil respiration'. I also would not use heterotrophic soil respiration, with a shallow trenching, open to the bottom you will definitely have roots invading your plots.

1054 l16 Why are the d13C values of the two soils combined in Fig. 2? Provide reasoning.

1054 l18 Please give d13C values for soil CO2 efflux for both soils.

1054 l21 But not significant? Also the differences in bare soil d13C-SR vs. soil+ litter d13C-SR seem to be not significant (Fig 2)!

1054 l24 Why? Was air temperature high or litter very wet at this day? Do you have litter temperature/moisture measurements?

Fig 1 No differences in temperature between plots? Why don't you show the temperature measurements separate for each soil type? Is 10 cm really the best depth to give when you are interested in litter decomposition?

Fig 2 The d13C values of bare soil CO2 efflux (cold season) are with about -24.5 permil quite different from d13C of SOC (-26.7-27.8 permil). Does this reflect a measurement error caused by your simplified form of the keeling plot?

1055 l9 Are these estimations of litter loss influenced by the amount you gave? Recalling from the Methods, you gave about 2 x more leaf litter and about 7 x more twig litter than average for the study site.

1055 l14 How was litter-derived DOC calculated? Did you know the d13C of through-

fall?

1056 l12 I can't see the spring effect on DOC in Figure 3.

1056 l12 please change sentence to 'This is indicated by the large difference of d13C in DOC (litter layer) between the cold and the warm season.'

Discussion

-Any effect of elevated CO2 on litter quality and decomposition? Several studies report slower decomposition of leaves grown under elevated CO2. -Would your results have changed if litter and twigs would have been combined? -As you gave larger than usual amounts of litter, the contact of the litter with the soil might have been reduced, altering oxygen availability, moisture and decomposition. -Also, I am wondering how the framing of the plots might has affected decomposition rates by increasing temperature and moisture? Any control measurements?

1058 l12 'cm' not 'mm'

1058 l19-26 This should be shortened and more consistent. First you state leaf litter contributes <20% to SR, then you give an actual number (10-12% for leaves and 4-6% for twigs).

1058 l26 Please explore how decomposing fine roots might have affected the contribution of leave litter mineralization to SR.

1061 l20 Could the faunal community be adapted to the average amount of litter (you gave $\sim$2 times more), and thereby can't increase their activity linearly with increasing amounts of litter? This might explain the with other studies comparable lower removal of leaf litter by soil fauna.

Interactive comment on Biogeosciences Discuss., 8, 1043, 2011.