Biogeosciences Discuss., 10, C3738–C3740, 2013
www.biogeosciences-discuss.net/10/C3738/2013/

Biogeosciences
Discussions
Open Access

Interactive comment on "The impact of extreme summer drought on the short-term carbon coupling of photosynthesis to soil CO_2 efflux in a temperate grassland" *by* S. Burri et al.

Anonymous Referee #2

Received and published: 25 July 2013

My overall assessment is that this study has been well performed and that the work is worthy of publication. The science was well implemented, the analyses and display are fitting and complete, and the writing is good. I have a few questions regarding interpretation outlined below but generally agree with what has been presented.

Abstract: It would be appropriate to mention here the inferred shift in allocation of fresh assimilate to roots under drought conditions.

General Comments/Questions:

The precipitation exclusion effectively removed summer precipitation and lowered soil water content in the upper 23 cm of soil. However, a significant fraction of roots active

in water uptake could easily reside below this level in the soil where the soil moisture remained similar between control and treatment plots. Please discuss how this might influence your interpretation of the fumigation – tracer experiment.

The major findings and key interpretations rely importantly on the estimate of community-level biomass above- and below-ground. Fig 3 shows clear differences between root excess atom fraction as percent, but these disappear when translated to the community-level because the treatment plots have twice as much root biomass (Table 2). Though the below-ground biomass is not significantly different at the stringent p-level of 0.01, the means are still very different and this is what was applied to estimate the key result of 13C excess in shoot and root biomass at the community level (Fig 4). This raises the following questions, the answers to which could alter the paper's interpretations and conclusions: How would your interpretation of allocation patterns change if, given the lack of significant differences in belowground biomass between control and treatment plots, you pooled these data to provide a single mean belowground biomass across the two and used this mean to estimate 13C excess at the community level? Would the apparent lack of 13C excess at the community-level persist (as reported) or would the elevated root excess 13C shown in Fig 3 lead to quite different conclusions? How was root biomass density sampled? Section 2.3 provides some mention but could be more complete. It appears that this key variable was not well sampled. Why was root biomass so much higher in the treatment compared to control plots?

The drought-induced decline in 13C excess appears consistent with what would be expected from soil water stress and would be nicely corroborated by data showing the alleged decrease in assimilation rates but these data have not been shown in this paper. Can that be included?

Section 4.2. The finding that belowground delivery of fresh assimilate was similar in control and drought treatment plots, if not higher in the droughted plots, despite lower assimilation rates inferred for the droughted plots appears to suggest a rapid change

in allocation strategy that increased root production to forage for water. It would be nice to see a slightly expanded discussion of this interpretation here, drawing on other literature and also slightly further exploring the contradiction with what was seen for the beech saplings. Some of this discussion appears in 4.3 – would it make sense to merge some of this?

Section 4.3. A puzzle seems to emerge in that belowground allocation of fresh assimilate was similar in control and drought plots whereas respiration of fresh assimilate was lower in the drought plots. By what mechanism would you speculate plants are able to influence this reduction in soil-respired fresh assimilate? Does it imply that grasses have a sort of valve controlling how much fresh assimilate is delivered to fungal symbionts and bacteria close to roots that consume exucate as opposed to its own root production?

Fig 4. The letters indicating results of multiple comparison do not appear to be consistent with the stars indicating significance. How can the significance level be p<=0.01 while the letters are a and ab for example for shoots 13C excess at nighttime on day 0? With only two groups (control vs. treatment), how can you have a and ab? I would have expected only a and a or a and b to be used.

Minor Corrections: Fig 3: treatment symbols do not appear as grey in my copy but rather as open (unfilled or white) circles. consider modifying the figure label to match.

Table 2. SE is given in parentheses not brackets.

Interactive comment on Biogeosciences Discuss., 10, 11671, 2013.