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Biogeosciences Discussions

Interactive comment on "Carbon flux to woody tissues in a beech/spruce forest during summer and in response to chronic elevated O_3 exposure" *by* W. Ritter et al.

W. Ritter et al.

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Author reply to comments of Reviewer #2

We thank the anonymous reviewer (Reviewer #2) for his constructive review that helped us to improve our paper and to present our findings more clearly. We were happy that the reviewer found our ms to "deliver important new insights on different responses in C allocation to respiration" and that after incorporation of few points he "can fully recommend this paper for publication". We considered his specific comments as follows (please find the revised version of our ms as a supplement):

Reviewer #2: A general issue with labelling studies is the fact that the strength on 13C-

signal of different components will always depend on the rate of 13C-uptake. As the two species (and probably also the same species under different ozone treatment) may display different stomatal conductance and photosynthetic rates, it might be likely that the total 13C uptake differs between treatments. Thus, it has to be considered to what extend this may influence the observed dynamics and fluxes in delta13C of respired CO2 and calculated fractions. If measurements of photosynthetic rates and stomatal conductance during the labelling period are available, this important information should be added. If not, there is a lot of information available for these two species and the ozone effects from earlier experiment. Thus, I think there should be enough information to at least theoretically consider how uptake rates might have differ between species and treatments and to add a discussion section regarding the consequences in terms of the interpretation of the results.

Author reply: Photosynthetic rates and stomatal conductance were not assessed during our labeling experiment. Previous measurements at the study site "Kranzberger Forst" found the photosynthetic performance of spruce to be slightly negatively affected by 2xO3. In general, adverse effects on photosynthesis of beech were more pronounced although not being large. Distinct variations occurred amongst years and crown positions (Matyssek et al. 2007, Nunn et al. 2005, 2006, Warren et al. 2007). For that reason, it is difficult to speculate about differences in 13C-uptake rate or total 13C uptake between species/treatments during our study as suggested by the reviewer. Nevertheless, the reviewer is correct that reduced label uptake may be reflected in the fraction of labeled carbon (fE, new) calculated for stem and coarse root respiration. Since beech is more sensitive to O3 that spruce, this effect is more likely to be found in beech. Hence, a corresponding section using the information from previous experiments has been added to the discussion as suggested. As photosynthetic data are not available during our experiment, we tried to be brief in this point to not be too speculative. In terms of general species differences and different responses to 1x O3 and 2x O3, the fraction of labeled carbon (fE, new) accounts for those differences by the initial delta13CE values (day 0) that are used for the calculation. In a similar way, day-to-day

variations are accounted for when calculating fE, new.

Reviewer #2: The statistics displayed in the tables show that the differences between the ozone treatments are often not significant. Thus, in the description of the results a bit more clarity is needed whether differences are significant or not (particularly in 3.1. and 3.2.).

Author reply: Changed accordingly. Please find our improvements in the sections 3.1 and 3.2 of the revised paper.

Reviewer #2: Introduction: The two sentences referring to Teskeys' work seem out of place and I would suggest moving them to the discussion. Alternatively, more explication will be necessary here to give this section a clear line of thought. Same recommendation goes for the discussion (page4145) where this aspect (influence of xylem CO2) needs further explanation: It is an interesting finding that the difference between the upper and lower stem chamber increases during labelling. While this is probably an effect of phloem transport time at the very beginning (depleted 13C reaching the upper chamber earlier), the difference seems to stabilise after a few days. That would indicate that the dilution with older carbon is occurring progressively along the trunk. However, I do not see why this shows "xylem-transported CO2 to contribute only to a smaller extent" as discussed by the authors (line19). A continuous mixing with xylem CO2 could also enhance the differences. The current experiment does not seem to deliver indications either in favour or against this theory. Therefore, the authors need to better point out their.

Author reply: In accordance with the referees suggestion, we move this topic completely to the discussion section. In addition, we reworded our conclusions on the contribution of xylem-transported CO2 on CO2 efflux as suggested. Please find our improvements in the section 4 Discussion of the revised paper.

Reviewer #2: Minor comments: - The respiratory root flux is very high. I am not very familiar with root flux rates, therefore I suggest comparing this flux with other publica-

tions.

Author reply: Overall, CO2 efflux rates from coarse roots were 10 to 60 times higher than from stems (see Table 3). At the same study site, Kuptz et al. (2011a) reports about a 3 to 10 times higher volume-related respiration rates of coarse roots than of trunks. Coarse root CO2 efflux measured in our study approaches seasonal coarse root respiration rates of 55-year-old aspen trees (Populus tremuloides), ranging between 170 and 430 μmol CO2 m–3 s–1 (Desrochers et al., 2002). The differences in CO2 efflux rates between stems and coarse roots are presumably based on the higher proportions of living, i.e. respiring cells, per unit volume (Marsden et al., 2008).

- Some parts of the description of the results are written in a very condensed form, as many treatments/species/measurements are compared, which is sometime difficult to "digest". - It would help to label axes of figure 2 and 3 with species names and measure type (root/stem). Many journals request plain graphs, but I personally dislike the fact that it leaves the reader to figure out what is plotted in each subplots/symbols etc..

Author reply: Changed accordingly. Please find our improvements for the Figures 2 and 3 in the revised paper.

- Were stem chambers measured in dark or light (thus were transparent chambers used)?

Author reply: Stem CO2 efflux was measured using darkened chambers. Please note the following information given in the section 2.5 Assessment of stem and coarse root CO2 efflux ("Chambers were darkened with aluminized polyester foil to avoid refixation of efflux CO2 by corticular photosynthesis").

- Material and methods section: please explain AOT40 in 2.2. line 4

Author reply: The definition for AOT40 was now added to the section 2.2. Climate conditions and stable carbon isotope labeling in the revised paper.

References

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Kuptz, D., Fleischmann, F., Matyssek, R., Grams, T. E. E.: Seasonal patterns of carbon allocation to respiratory pools in 60–year-old deciduous (Fagus sylvatica) and evergreen (Picea abies) trees assessed via whole-tree stable carbon isotope labeling, New Phytol., 191(1), 160-172, 2011a.

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Nunn A. J., Reiter I. M., Häberle K. H., Langebartels, C., Bahnweg G., Pretzsch, H., Sandermann, H., and Matyssek, R.: Response patterns in adult forest trees to chronic ozone stress: identification of variations and consistencies, Environ. Pollut., 136, 365-369, 2005.

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Warren, C. R., Löw, M., Matyssek, R., and Tausz, M.: Internal conductance to CO2 transfer of adult Fagus sylvatica: Variation between sun and shade leaves and due to free-air ozone fumigation, Environ. Exp. Bot., 59, 130-138, 2007.

Please also note the supplement to this comment:

http://www.biogeosciences-discuss.net/8/C2873/2011/bgd-8-C2873-2011-supplement.pdf

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Interactive comment on Biogeosciences Discuss., 8, 4131, 2011.

Ritter et al. - Fig. 1

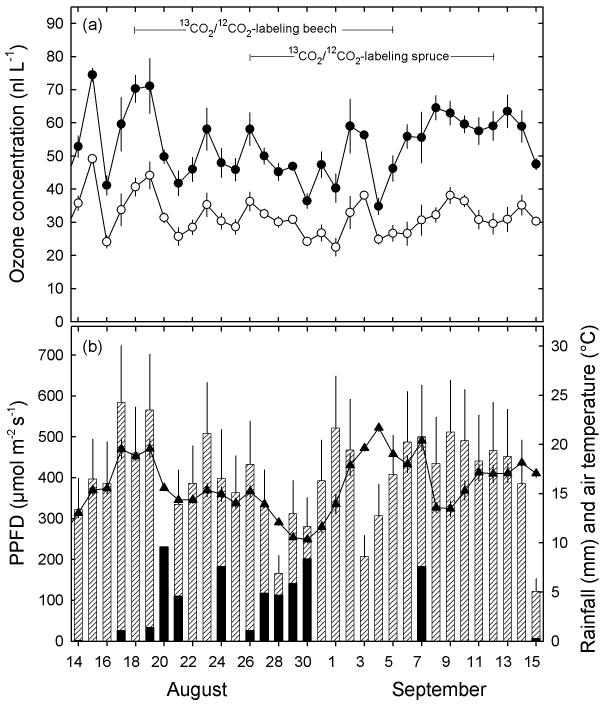

Fig. 1.

Ritter et al. - Fig. 2

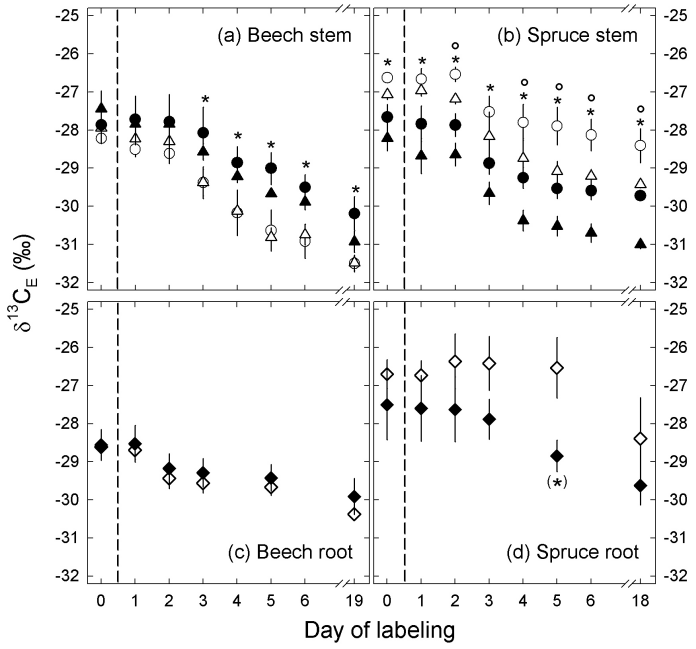

Fig. 2.

Ritter et al. - Fig. 3

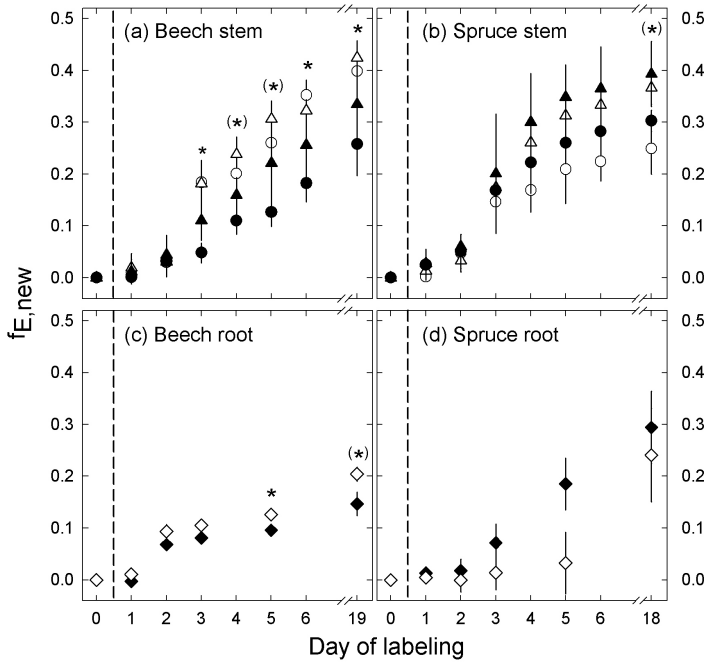

Fig. 3.

Ritter et al. - Fig. 4

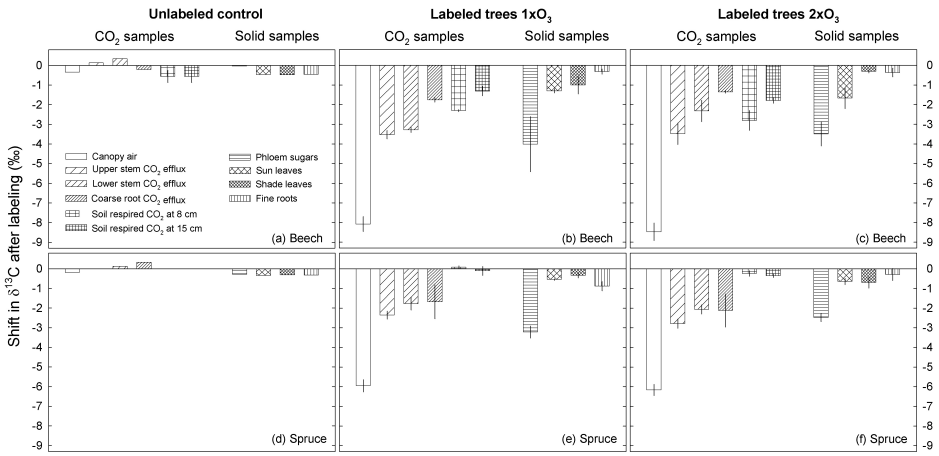

Fig. 4.