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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.

Anonymous Referee #2

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The study explores the respiratory turn-over and translocation of recent photosynthates along the stems, coarse roots and soils of two tree species (Fagus sylvatica and Picea abies) in response to seven-year-long exposure with twice-ambient ozone concentrations. A 13C-labelling experiment was conducted with a sophisticated free-air labelling system, thus avoiding many artefacts which can derive from enclosures. The major advantage of this system is that fully mature trees can be studied in their natural habitat, which is important as carbon allocation and turnover differs markedly between mature and young trees. The trees were subjected to a seven-year-long ozone exposition, avoiding short-term response of trees to abrupt changes in environmental conditions. Therefore, the described experiment was well designed and delivers important new in-

sights on different response in carbon allocation to respiration. Clear differences were found for the two tree species: elevated O3 slightly stimulated the allocation of recently fixed carbon to stem and coarse root respiration in spruce, but induced a significant reduction in C flux in beech. These results are discussed in terms of carbon allocation strategies and ozone effects for both species. The data are well presented and the manuscript is clearly structured and well written. Therefore, the manuscript is of interest for the readership in Biogeoscience. I have a few points which should be considered in a revised version, but given that these are adequately addressed I can fully recommend this paper for publication.

Specific comments: 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 d13C 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.

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.).

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.

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 publications.

- 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..

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

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

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