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Biogeosciences Discussions

Interactive comment on "Short-term natural δ^{13}C variations in pools and fluxes in a beech forest: the transfer of isotopic signal from recent photosynthates to soil respired CO_2" *by* O. Gavrichkova et al.

O. Gavrichkova et al.

olga.gavrichkova@ibaf.cnr.it

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We thank the anonymous referee for the positive evaluation of the manuscript and for important suggestions in data interpretation. Following the comments, we have considerably modified the section dedicated to the 13C dynamic in soil respiration, emphasizing more on the non-biological causes of measured flux and isotopic dynamic like diffusion fractionation and advection. Further, we have done additional analyses and added the data on 18O composition of phloem extracts. This has improved our evaluation of the carbohydrate translocation velocities respect to only 13C data.

Detailed comments Page 2406 it would be nice to have the appropriate citations for this sentence: Diurnal variation of_13C signature in recently fixed organic matter associated with leaf level gas exchange and oscillation in starch content during the day/night cycle has been reported.

The sentence is referred to the previous one and to the papers cited in it. To make it more clear we have stated it in the text.

2406 2407, the authors are describing a temporal disequlibrium due to isotopic sink and source pools, which is valuable, but they ought to cite Bowling et al. (2008) New Phytologist because they cover this concept pretty well.

We thank the referee for the suggested paper. It was overlooked in our literature search. We have cited it throughout the text.

Page 2407, last objective "the speed of C translocation from source organs (essentially leaves) to roots and, in general to the soil and therefore, back to the atmosphere as respiratory CO2." Seems like a big assumption is inferred here, that all carbon going from the phloem into the soil via exudation and root turnover is released to the atmosphere. Maybe its just wording, but did the authors assess a diseqbuilrium belowground?

We have rephrased this part. However, applicability of natural abundance for time lag evaluation and other TSA-based techniques are actually based on this assumption: rhizomicrobial respiration is fuelled mainly by recently assimilated C. But we agree with the comment: some recent papers show as well as our results that it is not completely true. Old C was shown to be considerably involved in fueling respiration processes; 13C changes during carbohydrates transport and other biological and non-biological processes which interact at different steps of C translocation and modify initially imprinted 13C.

Section 2.4, did you sample bark or phloem? This paragraph says you sampled

bark. Can you be more specific about exactly what tissues you sampled, and how representative those samples are of the major NSC-transport elements in the phloem?

We have added to the method section sampling details. Bark pieces were sampled to a depth of wood. It is a standard procedure used almost in all the other cited for PSS data papers. The method was previously confronted with other techniques for sampling of phloem soluble carbohydrates (ex. Gessler et la., 2004), giving reliable results.

Section 2.5, how was a pressure gradient avoided during collection of flask samples from the chambers? 10ml is small relative to the 7 L volume so it may not be a big deal, but could lead to enriched signals.

We have add this issue to the discussion section, given also an approx. calculation on how could this influence our gas samples.

Section 2.6, seems odd that this equation is for CO2 per se, when really its carbohydrate. Since there can be fractionation associated with the various paths for carbohydrate to become CO2 again, perhaps this should be re-stated more exactly.

There is a mistake here. The equation is for calculation of canopy weighted δ13C of LSS. We thank for the notation.

Section 3.3: how did the PSS compare to the canopy weighted (LAI weighted) d13C of leaf carbohydrates (equation 1)?

We decided not to present the graph of the canopy weighted δ13C of LSS because the available data of sugars and starch content cover only one sampling day (so also canopy weighted δ13C). Canopy weighted δ13C patterns are similar to Scartazza et al., 2004, measured at the same site . We have therefore limited to name the comparison with PSS in the text, given also the average canopy weighted δ13C value.

Same section: the authors state "The characteristic 13C peaks observed during the central part of the day (11:00 14:00 LT) for top leaf sugars were also reflected in the phloem extracts, confirming its close relation to the supply of photoassimilates from

the crown." I don't see that this has yet been shown. The relationship at that time of day could also be spurious given what they said in the previous sentences about the weaker relationship between d13C of canopy top LSS and PSS. And given the time lag in transport, how could these be coupled within just three hours anyway? Please clarify?

Correlation of LSS and PSS was significant, this gave us an opportunity to hypothesize that the time lag is 24 h or higher, being an aliquot of 24h. In the last case, the observed significant correlation is due to similar environmental conditions in the adjacent days. It explains also 6h lag correlation found between LSS and CO2. However we agree that diurnal variations in PSS d13C were really weak, more likely as a result of mixing with LSS from other crown layers and with old C. Taking this into account, we have modified the text, trying also not to overestimate the meaning of LSS-PSS correlation. Three hours between PSS and CO2 is not a short lag if you consider the length of the path, the C have to be transported through.

Page 2415, there d18O results are interesting but not mentioned much. Why?

We have considerably changed this part in the new manuscript version. Interpretation of the 18O variation was inaccurate. We have performed additional analyses and have added other data on 18O signature of PSS. Day-night changes were much more pronounced here than in PSS 13C and gave us an opportunity to improve our transfer velocity estimations.

Page 2416 around line 5, rather than cite figure 2 for the relationship between starch breakdown and changing LSS d13C, can you show the relationship for these two parameters, perhaps including regressions for both before and after midnight?

The relationship is quite simple: along with the decrease in starch content during the night, 13C signature of LSS tends to be more enriched. We prefer not to increase the number of figures and limit to name regression parameters in the text. Day-time 13C is more likely driven by photosynthetic fractionation and is not linked to starch cycle.

Line 8, what was the r2? We have added the R2 value

Page 2418, second paragraph could be deleted to save on length of text. This is already well known.

Paragraph was deleted.

Section 4.2, your first couple sentences compare apples to oranges, or your PSS/LSS results to other published PSS/leaf organic matter results. We know there is an offset of LSS to leaf organic matter, so this comparison seems like it should be changed to comparing apples to apples.

We thank for the observation. We have stressed that LSS in our case are composed almost entirely with sugars and that there is an offset between organic matter and LSS.

Can you explain what a ”periodogram” is in the methods?

We have added more details on what Periodogram is to M&M section.

Interactive comment on Biogeosciences Discuss., 8, 2403, 2011.