Biogeosciences Discuss., 8, C334–C337, 2011
www.biogeosciences-discuss.net/8/C334/2011/


Biogeosciences
Discussions

# *Interactive comment on* "Short-term natural $\delta^{13}$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.

**Anonymous Referee #1**

Received and published: 24 March 2011

This paper contains some interesting results that are, for the most part, interpreted comprehensively and carefully. The question of carbon turnover time in forests is a hot topic currently and of interest to the readers of BGD. The concepts and tools are not novel, but there is so little data at this temporal scale of resolution that the results are still of high value. The writing is very good and the number of figures seems fine. I enjoyed reading this manuscript.

The conclusions are sound except for the soil respiration d13C results. The very strong enrichment (-18 per mil) could be due to advection of enriched CO2 from soil pores



or from the atmosphere surrounding the chamber base when negative pressure was created during sample removal from the surface chambers. Insufficient information is provided to allow us to know if this is an issue. Is there an offset due to this problem and does it vary over the 72 hour experimental period? There is a long section of the Discussion devoted to interpretation of the soil respiration d13C data, but at this point its not clear how much we can interpret these results.

I also have some methodological questions described below.

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.

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.

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?

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?

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.

Section 2.6, seems odd that this equation is for CO2 per se, when really its carbohy-

drate. Since there can be fractionation associated with the various paths for carbohydrate to become CO2 again, perhaps this should be re-stated more exactly.

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

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?

3.4: enriched soil respiration is consistent with advection into the chamber during sample collection. Again, how was this technical aspect addressed?

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

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?

Line 8, what was the r2?

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

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.



Line 15, I'd like to see the LAI weighted starch, sugar, and LSS d13C as a function of vertical layer. This would make an interesting figure.

The discussion on interpretation of soil respiration d13C is rather long considering that we don't know how much advection of soil CO2 or CO2 around the base of the chamber caused the observed enrichment of soil respired d13C, and how this artifact may have varied diurnally. I think this section is rather speculative and could be shortened, with more information given on potential method artifacts.

Instead, can more be made of the d18O data to model how gs varied? Can estimates of GPP from eddy covariance be used to estimate assimilation with enough accuracy to help interpret time lags and starch formation?

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

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