Biogeosciences
Discussions

Open Access

Interactive comment on "Carbon transfer, partitioning and residence time in the plant-soil system: a comparison of two $^{13}CO_2$ labelling techniques" *by* M. S. Studer et al.

Anonymous Referee #2

Received and published: 12 December 2013

The study by Studer et al. can be seen as a methodological paper aiming at comparing two 13C labelling methods and providing mathematical tools to analyze the data in terms of transfer time, residence time and partitioning. Several papers have reported a more sophisticated approach based on compartmental modelling that, while also empirical and statistics, distinguishes several (at least two) pools of labelling C in the plant-soil system. In the present paper, more simple models are used because the sampling frequency was not high enough to provide enough points for fitting models with more than two parameters. This is a strong limitation of this manuscript. In the exponential model used for pulse-labelling data analysis, a non-zero asymptote is definitely needed especially because as the plants are actively growing, it is expected that

part of the labelled C is incorporated in the biomass while another part is exported or respired. Similarly, a non-constant a-parameter over time is required to account for growth in the logistic function used for CL. Because this was not considered in the study, the MRT that are calculated are questionable as it mixes information about two pools that behave differently. The way it has been done gave unrealistic MRT in some cases. Not enough samples leads to the use of too simple models which provides unrealistic parameter values that are misinterpreted (or over interpreted).

Specific comments The word "velocity" is misused. Velocity means distance / time. Estimation are transfer time is fine with time lag but would have required much frequent samplings. I am not sure the signal peak is only related to velocity, as it depends on the balance between inflow and outflow. This leads to an unclear definition of transfer time (P16348 L17-19). In addition, the 13C at peak do not affect the total amount of assimilated C. It can be estimated by summing the amount of labelled C in all compartment just after labelling, so after 2h in this study (which is a little bit too late owing to the rapid loss by respiration aboveground. Note also that the transfer time in PL and CL experiments are hard to compare because in CL, transfer time also account for mixing labelled into a pool of unlabeled substrates.

In the models, it seems that only a and k are fitted parameters. How was b determined? Regarding the lack precision on lag due to the sampling frequency, how does it affect the estimation of a and k? b is a fixed parameter which is not transfer time but the observed peak time (which could be quite different from the real peak time because of the sampling frequency). Standard errors of model estimates should be reported.

P16252 L26-28: this is obvious that partitioning cannot be at equilibrium after only two hours based on expected or observed transfer time. So the word "overestimated" is not well chosen. The same comment for "underestimation" P 16253 L22-25. It would make sense to calculate partitioning only at the asymptotic values, which will lead to different meanings for PL and CL (in case of PL, labile pool with not be considered in the partitioning).

P16239-L13: response to climate is not a process P16239-L13-15: explain why P16240-L10-13: FACE are not comparable to labelling experiment. Due to the lon exposure to high CO2 concentration, the biological system is responding and not at steady-state at all which would make difficult any conclusion about allocation in a system where allocation is changing due to the CO2 treatment. P16241-L18-21: would better fit in the result section P16242-L6: chamber volume is not enough (many shapes are possible): please give area and height. P16242-L14-18: please give more details about the design of the belowground part of the system. P16243-L2 At what time according to the light/dark cycle? P16244-L17: time instead of date P16256-L24: It is the same with CL P16256-L26-27: where does this recommendation come from?

Fig 1 seems to be eye fitted and do not correspond to the mathematical description, especially assuming growth instead of steady state.

Interactive comment on Biogeosciences Discuss., 10, 16237, 2013.