

Interactive comment on “Carbon allocation and carbon isotope fluxes in the plant-soil-atmosphere continuum: a review” by N. Brüggemann et al.

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This is a very neat although long review article with an impressive list of contributors. It covers an important and timely topic and I was pleased about the broad range covered in very fine detail - making full use of the co-author's expertise. The MS is well written and has a clear structure, although some repetition could maybe be addressed and sections be combined or moved elsewhere (see my suggestions below). Moreover, I find the authors could pay more attention in the revised version to their generalisation of references (e.g. is it AMF or EcMs a study tested, was it one study only in one area of the globe...? I think it is important to not generalise when we actually do not have the data to support this; better would be to acknowledge the current rudimentary knowledge we have on certain belowground aspects in carbon dynamics and flux

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components).

I have some specific comments, which I hope are helpful to improve the MS.

Abstract: You might want to expand/change that last section: 'This is where new research approaches should be aimed at'; to make clear this thorough review provides a neat summary revealing some knowledge gaps in relation to interpreting SI signals correctly, to be addressed by future research.

Page 3623 Line 13: Better to use 'primary' as also animal detritus etc. is a source of SOM. P3627 L8: Is 'online' the right word or do you mean in situ? L12: better to switch words around: agree well P3636 L6: This (or the following) paragraph might want to consider latest insights into C allocation based on analyses of SR vs GPP. Recent time series analyses of SR and forest C fluxes suggests that there is a root internal C pool, mixing GPP-derived belowground C over time (days to weeks) and then allocating it to root or mycorrhizal fungal activity. The authors might want to consider some related recent literature (e.g. Vargas et al. On the multi-temporal correlation between photosynthesis and soil CO₂ efflux: reconciling lags and observations. *New Phytologist*. DOI: 10.1111/j.1469-8137.2011.03771.x; and another discussion paper: Heinemeyer et al. 2011 Exploring the “overflow tap” theory: linking forest soil CO₂ fluxes and individual mycorrhizosphere components to photosynthesis. *Biogeosciences Discuss.*, 8, 3155–3201, 2011 www.biogeosciences-discuss.net/8/3155/2011/ doi:10.5194/bgd-8-3155-2011). P3637 L4: Some recent data show this in situ and reveal the dynamics in this C allocation over several years at fine temporal scale; Heinemeyer et al. *BGD* 2011. L6: that (plant-derived) C turnover ... L7: Maybe check/make clear if this only refers to AMF studies (i.e. Staddon et al.)! To my knowledge, the other studies quoted here only analysed C incorporation (vandenkoornhuysse) and transport (Godbold ref is missing!) not turnover or do they? Moreover, in ECM forests this linkage seems to vary considerably during seasons and years but there are not many high temporal resolution flux data to generalise this (again, see maybe Heinemeyer et al *BGD* 2011). P3639 L9: This is true and it is interesting that some studies do not find such a clear reduci-

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ton in Ra. However, some of these differences might well be explained by artefacts such as collar insertion for SR measurements, cutting of root C supplies as shown in a recent study (Heinemeyer et al., EJSS, 2011) but one would need to check those references on such issues. L26: It is a bit confusing maybe to quote the hysteresis when before you refer to rather general seasonal differences in the magnitude of Ra (if I understood this right). Surely the hysteresis effect is at hourly/daily times steps? P3640 L12: Or different amounts/contribution of the individual SR component fluxes? P3643 L14: better use 'seems of young age' as it is only based on one references. L20: Sorry, I don't know these 'early spring allocation' studies, but is it allocation of new or mobilisation of old stored root starch reserves? Section 3.5: A general question: Does this short section need to be included with the previous relevant sections (3.1 etc.), or does it justify/need to incorporate some of that material in here? As it is, I feel it is somewhat repetitive and could be either incorporated elsewhere or expanded by cutting other sections. P3662 L15: Therefore, until a robust ... P3663 L1: I don't quite like the term 'meshwork' is there a better (English) word? Is it physical and biochemical interactions or levels...? Or simply 'network' or interlinked processes. Conclusions P4: This is a good summary of the 'open questions' and this is where I think the main text in the actual manuscript should be more critical/pointy, i.e. when stating things 'are like this' based on only one reference, this is maybe misleading (unless it is a review etc.) and should acknowledge that actually this is only based on a very limited number of studies, and quite often on seedlings - thus maybe this warrants further research.

Fig. 4: Add maybe the re-mobilisation aspect to this nice Fig., internal plant (root) C storage pool etc. but I might have overlooked it.

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