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Biogeosciences Discussions

Interactive comment on "Response of δ^{13}C in plant and soil respiration to a water pulse" *by* Y. Salmon et al.

Anonymous Referee #1

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Salmon et al address the effects of a water pulse on the isotope composition of CO2 respired by 4 year old beech saplings grown in mesocosms and by the soil, aiming at better understanding the link between the isotope signature of respiration and environmental drivers of photosynthetic isotope fractionation.

The fact that the plants were maintained in the dark after the water pulse (P500, L1-5) has stopped photosynthesis and therefore any link between the expected change in DELTA_I and delta_13C of respiration. In such conditions, hypothesis 2 but also 1 and 3 cannot be anymore tested because we expect that the response time of stomata to the water pulse was higher than the 15 minutes of photosynthesis that was allowed during the water pulse (P507, L3-10). The comparison of DELTA_I measured by leaf gas exchange of illuminated leaves on the second set of plants and the delta_13C of

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respiration of the first set of darkened plants (P508, L1-7) seems to be nonsense to infer a coupling between both. This is a major drawback.

The discussion starting from P510, L18 to P511, L26 completely hides the fact that the measurements of delta_13C were done in the dark and that no new photoassimilate were produced after pulse labelling that would have been transferred by the phloem and used as substrate for respiration. Same for P512, L2 to P513, L3: no new photoassimilate could have been transferred to the root and used as substrate for root or rhizosphere respiration via exudation.

Owing that, the results are surprising but amazing. The change in delta_13C of soil respiration might have been driven by change in carbon source of soil microbes (but with possible interaction between rewetting and photosynthate starvation after several hours or days in the dark). The change in delta_13C (respiration, phloem or microbial biomass) cannot be ascribed to change in DELTA_I (or stomatal conductance) because photosynthesis doesn't occur in the dark. It can be due to change in carbon sources related to photosynthate starvation. Among the new sources, you may expect the use of soluble organic compounds that were previously use for osmotic adjustement before drought was relieved by the pulse watering (can it explain the drop in delta_13C of leaf biomass?). The manuscript should probably be rewritten to explore these putative explanations (and other), but without any attempt to relate what measured on dark adapted plants and on illuminated leaves. The significant relationships found between gs (orCi/Ca) and delta_13C in respiration, phloem or microbial biomass may be more likely due to some confounding factors.

Additional points P497, L20: The root system of 1m tall beech sapling may extent well above 9 cm of the stem and below 17 cm depth. Can you provide indication about the severity of root disturbance induced by collecting the trees? This is a quite big issue for understanding the response of the tree to imposed drought. One option will be to give the sapling density in the original forest and the rooting depth of the sapling so that the average soil volume available for each sapling in natura can be estimated.

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P514, L19 - P515, L8: this part of the discussion is an interesting review but quite speculative to interpret the data without additional measurements like isotope composition of specific organic compounds.

Interactive comment on Biogeosciences Discuss., 8, 4493, 2011.