Biogeosciences Discussions

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Reviewer comment on bg-2021-35

Anonymous Referee #2

Referee comment on "Temporal dynamics of tree xylem water isotopes: in situ monitoring and modeling" by Stefan Seeger and Markus Weiler, Biogeosciences Discuss., https://doi.org/10.5194/bg-2021-35-RC2, 2021

The paper presents a new, fully automated measurement system for online water isotopic measurements of xylem and soil water with custom-made gas probes, a custom-made control system and an infrared laser absorption analyzer. The main objective was to test the system, and a secondary aim was to collect data to parametrize a root water uptake (RWU) model and to try to establish temporal relationships between RWU and xylem water isotopic signatures. The system was deployed for three months in a beech forest and tested on three trees and in the soil between the trees. For both xylem and soil water measurements, the same type of probes was used. Deuterium-labeled water was used to set an isotopic labeling irrigation pulse, which was followed in the xylem of the trees at three different heights. The outcome was that it was possible to monitor the isotopic signatures of soil and xylem water with an unprecedented time resolution. At the same time it was revealed that a direct inference of RWU from tree xylem water isotopic signatures is not possible due to various processes that lead to a degradation (or better: superimposition) of isotopic signals in the xylem, mainly due to the contribution of different root-xylem vessel path lengths to the xylem signal measured at a certain point, that contribute water of different ages (i.e., different times at which it was taken up by the respective roots).

The paper is very interesting and presents both a novel, fully automated water isotope measurement system and very relevant data regarding the relationship between isotopic signals of RWU and xylem water, falsifying the hypothesis that xylem water isotopic signatures reflects RWU of one point in time (i.e., in the recent past). It presents a rich dataset, which is also made available to the public, including the data processing codes in R. However, some minor points and questions regarding the measurement and modeling methodology need to be addressed before I can recommend final acceptance of the paper. Specific comments and technical corrections can be found in the annotated manuscript.

Please also note the supplement to this comment:
https://bg.copernicus.org/preprints/bg-2021-35/bg-2021-35-RC2-supplement.pdf