Biogeosciences Discussions

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Comment on bg-2022-214

Anonymous Referee #2

Referee comment on "Physical and stoichiometric controls on stream respiration in a headwater stream" by Jancoba Dorley et al., Biogeosciences Discuss., https://doi.org/10.5194/bg-2022-214-RC2, 2022

The paper presents a study of the co-dependences between transient storage, stoichiometry, and microbial respiration in a headwater stream. The analysis is based on experimental data from two rounds of nutrient experiments, each consisting of four sets of nutrient treatments (N, N+C, N+P, and C+N+P) and continuous injections of a conservative tracer (Cl-) and a reactive tracer (resazurin) as a proxy for aerobic respiration. Results show that, in the experiments, microbial respiration remained similar under different discharge conditions and across stoichiometric treatments despite significant differences in the transient storage timescale, which supports the conclusion that residence time alone can be a weak predictor of stream respiration "due to the relevance of local and dynamic variations in stoichiometric conditions".

The work is interesting and provides novel insights into the interactions between nutrient uptake, hydrologic exchange and stoichiometric conditions. However, while I applaud the authors for exploring an important and complex topic, I find some of their conclusions widely speculative and not supported by the data. Specifically, it is not clear how the authors can conclude that "the sequential stochiometric treatments conducted over the two rounds of experiments counterbalanced the controls imposed by hydrologic transport" when the results simply show that microbial respiration (as quantified by Raz transformation) is constant in the same way that the ratio A/As is found to be constant. The authors argue that constant microbial respiration may have resulted from "increased metabolic activity likely prompted by the removal of nutrient limitations from their sequential nutrient additions which counterbalanced the decrease in discharge and surface transient storage", but this would have been easier to believe if the results had shown that respiration was not constant as the discharge varied in the absence of nutrient additions. The data presented in the paper do not provide any evidence that aerobic respiration would have changed under different discharges if no nutrients had been added and therefore it is impossible to conclude that the sequential stoichiometric treatments conducted in the experiments "counterbalanced" the controls imposed by hydrologic transport. In fact, if stream respiration was found to be approximately the same at the beginning of Rounds 1 and 2, we may as well conclude that the nutrient treatments applied by the authors did not affect stream respiration.