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Interactive comment on "Temperature-mediated changes in microbial carbon use efficiency and ^{13}C discrimination" *by* C. A. Lehmeier et al.

Anonymous Referee #2

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General comments:

"Temperature-mediated changes in microbial carbon use efficiency and 13C discrimination" by Lehmeier and co-authors is a well-written manuscript that addresses questions of interest to a wide range of BG readers. The authors used stable isotope tracers and a flow-through chemostat with a single species and single carbon substrate to identify temperature controls on microbial carbon use efficiency as well as the discrimination against 13C during respiration. This study offers unique insights into the role of temperature for microbial carbon cycling and contributions to 13C-CO2 signatures.

In fact, while the authors focus on broader applications for soil and terrestrial C cycling, these results are also extremely relevant for freshwater and marine biogeochemistry and microbial ecology. Perhaps even moreso given the chemostat conditions, which

may be more appropriately applied to aquatic ecosystems. The authors could reach a broader audience by acknowledging this in the language, scope, and citations of the introduction/discussion (sometimes just a matter of deleting “soil”).

The chemostat set-up and equilibrium assumptions are very clearly described. I do believe the authors could be more up-front about the unknowns associated with equal labeling of cellulose and glucose within the labeled cellobiose substrate, and what this might mean for the interpretation of the discrimination results (there are hints of this in EEA methods and results/discussion, but this seems to be an unknown with significant consequences for results).

Are there recommendations for how these results can be applied to non-steady state scenarios in heterogeneous soil or biofilm matrices? This study is novel and useful, but drawing connections from steady-state chemostat measurements to the real world remains a challenge.

Specific comments:

Page 17372, line 15 - Is a 1:1 respiratory quotient appropriate for both cellulose and glucose? I would guess cellulose RQ > 1, while glucose RQ$\sim$ 1.

Figures –

What is the uncertainty of the results presented in Figures 3, 4, 6?

Figure 5 could more clearly identify the knowns/unknowns beyond boxed and unboxed. Perhaps two panels to show the difference in (a) steady-state chemostat versus (b) soil measurements and the unknowns/challenges for moving forward?

Interactive comment on Biogeosciences Discuss., 12, 17367, 2015.