

Interactive comment on “A temperature threshold to identify the driving climate forces of the respiratory process in terrestrial ecosystems” by Zhiyuan Zhang et al.

Anonymous Referee #2

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This study is an ambitious, broad-scale meta-analysis of eddy flux data to test the notion that thresholds in temperature response patterns of ecosystem respiration exist between global temperature zones. Their analyses suggest that such a threshold exists at ca. MAT=11C. Moreover, they found little evidence of other significant environmental controls on respiration below this threshold, but several contributing factors above it. Overall, the study was intriguing and potentially important. However, I have reservations about how the analyses were performed and interpreted, and feel that a stronger conceptual model of underlying mechanisms explaining these patterns is needed.

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Statistical analyses:

I'm not familiar with this sort of quantile piecewise linear regression, so will leave it to others to comment. The distribution of data in Fig. 1 do suggest a potential break in the upper boundary condition for respiration vs. temperature at 11C, but the regression tree suggests one at 3C, which is also visible in Fig. 1.

Given that the relative contributions of other environmental drivers to respiration varied with MAT, I wonder if the variation of these environmental contributions over temperature could be used to provide additional insight to the existence of- and mechanisms underlying the 11C threshold, rather than simply being used to explore the two, separate field of data (above and below 11C).

I believe that the regression tree actually provides more insight to the overall pattern of environmental controls than does the piecewise regression.

Discussion:

The background is too broad brush, providing minimal explanation of likely mechanisms responsible for the CO₂ fluxes and their observations, despite some references to more detailed studies. I think that results of- and arguments made in the syntheses of Prescott 2010, Sinsabaugh et al. 2017, Xu et al, 2017 and Zhang et al. 2009 (below), would strengthen this article by providing more detailed explanations of these mechanisms. Sinsabaugh and Zhang specifically address both plant and microbial dominated processes in global patterns relevant to this manuscript. The others focus more specifically on microbial processes likely driving much of the observed pattern in heterotrophic respiration.

Conclusion:

The results suggest an interesting pattern of varying controls on carbon flux in ecosystems that appears to be partly regulated by temperature. However, the structure of those controls is not convincingly demonstrated nor is a comprehensive explanation

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for the pattern of environmental controls developed. Both of these weaknesses need to be addressed before the work is publishable.

Suggested References:

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Xu X, Schimel JP, Janssens IA, Song X, Song C, Yu G, Sinsabaugh RL, Tang D, Zhang X, Thornton PE. 2017. Global pattern and controls of soil microbial metabolic quotient. *Ecological Monographs*, in press.

Zhang Y, Xu M, Chen H, Adams J. 2009. Global pattern of NPP to GPP ratio derived from MODIS data: effects of ecosystem type, geographical location and climate. *Global Ecology and Biogeography* 18: 280–290.

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