November 11, 2017

Dear Editor:

We are submitting the revision of the manuscript, "A temperature threshold to identify the driving climate forces of the respiratory process in terrestrial ecosystem" by Zhiyuan Zhang, Renduo Zhang, Yang Zhou, Alessandro Cescatti, Georg Wohlfahrt, Minmin Sun, Juan Zhu, Vincenzo Magliulo, Feng Tao, and Guanhong Chen (MS No.: bg-2017-345). We greatly appreciate the referees' comments and suggestions about the manuscript, which indeed assist us to improve the quality of the manuscript significantly. The response to the referee's comments was summarized as follows.

Referee #2:

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=11℃. 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.

Statistical analyses:

I'm not familiar with this sort of quantile piecewise linear regression, so will leave it to other to comment. The distribution of data in Fig. 1 do suggest a potential break in the upper boundary condition for respiration vs. temperature at 11℃, but the regression tree suggests one at 3℃, 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 11℃ threshold, rather than simply being used to explore the two, separate field of data (above and below 11℃).

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

Response (R): The upper boundary respiration rate is represented by the 99th quantile regression, and the break of temperature at 11℃ indicates the turning point of the changing rates (slope) of the maximum realizable R_e rates with temperature. The regression tree was used to evaluate the relationships of the mean realizable R_e rates vs. temperature and other micrometeorological factors, and 3℃ was the threshold temperature to regulate the mean R_e rates. Many studies have demonstrated that temperature is the primary driving force of respiratory process (Brown et al., 2004; Enquist *et al*., 2003; Gillooly *et al*., 2001; Lipson *et al*., 2000; Yvon-Durocher *et al*., 2012). Therefore, it is reasonable to divide the relationships between environmental

factors and R_e rates based on temperature zones.

Discussion:
The background is too broad brush, providing minimal explanation of likely mechanisms responsible for the CO_2 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.
R: In the revision, we will follow the suggestions to give more explanation of likely mechanisms responsible for the CO_2 fluxes and their observations based on references above and others.

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 for the pattern of environmental controls developed. Both of these weaknesses need to be addressed before the work is publishable.
R: In the revision, we will adjust the structure to make the explanation be clearer and more convincing.

Reference

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Thank you very much for your assistance on our manuscript. Best regards.

Sincerely yours,

Renduo Zhang, Ph.D.
Professor

CC: Zhiyuan Zhang, Yang Zhou, Alessandro Cescatti, Georg Wohlfahrt, Minmin Sun, Juan Zhu, Vincenzo Magliulo, Feng Tao, and Guanhong Chen