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Dear Dr. Stoy,

Thank you very much for providing helpful suggestions.

Our manuscript (bg-2014-138) entitled “**Biophysical controls on net ecosystem CO₂ exchange over a semiarid shrubland in northwest China**” has been carefully revised in light of your comments. Point-by-point responses to all of the comments are appended below.

Revisions to the manuscript were highlighted either using the blue font color or using the track change mode. Please do not hesitate to contact me in case any questions arise regarding the manuscript.

Yours sincerely,

Tianshan Zha

Editor's comments: I found the manuscript to be well written and the analyses to be strong. My major concern is the third-order polynomial used to fit the NEE/microclimate relationships. This has little physical meaning. Could a non-rectangular or rectangular hyperbola be fit to the GPP data instead? A stronger focus should be placed on the responses of GEP and RE, rather than NEE, on climatic drivers. For example, on page 9 line 42, is the 'quadratic' relationship between NEE and temperature not due to the increase in respiration at high temperatures? The manuscript needs to be refocused toward an analysis of the processes that make up NEE - namely GEP and RE - rather than NEE itself. (Of course some discussion of environmental controls on NEE is warranted, and can help motivate analyses of GEP and RE).

RE: We used a light response model (Eq. 1), which was modified by Ye (2007) from the rectangular hyperbola, to quantify the NEE-PAR relationship. Model parameters that have eco-physiological meanings were shown in Table 1, Table 2 and Table A1. Equations (2)-(6) show how these eco-physiological parameters were calculated. We chose this modified light response model (Ye, 2007; also see Eq. 1 in our manuscript) because it incorporates photoinhibition at high radiation, as our data (Figs. 2 and 3) showed decline of daytime NEE at high PAR in summer months. Our analyses indicated that neither the traditional rectangular nor non-rectangular hyperbola could well capture the trend of data at high radiation. The modified light response model fit our data pretty well, as shown by Figs. 2 and 3. Therefore, we did not fit the data with a third-order polynomial that might be suggested by reviewer #2 who pointed out a third-order polynomial trend in the NEE_{day}-PAR relationship as shown in Fig. 2. We provided a hypothetical explanation to this trend instead. The authors agree with the editor that changes in daytime NEE with environmental factors could be ascribed to either of its two components, namely GEP or R_e , or both. In order to elucidate the mechanism underlying daytime NEE variations, we conducted additional analyses on GEP responses to abiotic factors. We found that the responses of GEP to PAR resembled those of NEE_{day}. In addition, the effects of VPD, T_a and SWC on the GEP-PAR relationship were similar to those on the NEE_{day}-PAR relationship. Responses of GEP to T_a and VPD were also consistent with those of NEE_{day} (Fig. 4c and d), indicating that environmental controls on NEE_{day} were largely attributable to photosynthetic rather than to

respiratory responses. We made clarifications on this issue in the Results section (line 267-269; line 273-274) and also revised the Discussion part accordingly (line 349-355). In addition, we added GEP- T_a and GEP-VPD relationships to Fig. 4 to illustrate the consistency between the responses of daytime NEE and GEP.

Editor's comment: An additional reference to consider when justifying the importance of dryland ecosystems is Poulter et al. (2014, doi:10.1038/nature13376)

<http://www.nature.com/nature/journal/v509/n7502/abs/nature13376.html>.

RE: We have cited it to justify the importance of dryland ecosystems in the revised manuscript (line 41).

Editor's comment: On page 3 line 3, how rapidly are dryland ecosystems expanding?

RE: We have added an example here to show the expansion rate of desertification area in China (line 37).

Editor's comment: 'organic matter' on page 3 line 19.

RE: Revised (line 55).

Editor's comment: On line 36 (page 3...using continuous line numbers makes it easier to review manuscripts), it is true that this phenomena is widely known, but are there references to help quantify the magnitude of desertification in China?

RE: We have added a reference here to quantitatively show the magnitude of desertification in China (line 72). BTW, we used continuous line numbers in the revised manuscript.

Editor's comment: On line 42, has vegetation been recovering or has it been given the opportunity to recover?

RE: We have changed the sentence to "...the vegetation has been given the opportunity to recover..." (line 79).

Editor's comment: On page 4 line 24, the eddy covariance instruments are plural.

RE: Revised (line 108).

Editor's comment: The hyphen between 10 (and 30) and cm on page 6 and elsewhere is unnecessary.

RE: Revisions made throughout the manuscript.