Dear reviewer Dr. Russell Scott,

We thank you for providing the insightful and constructive comments. We carefully edited the paper according to these comments and suggestions. We hope the revised version of the manuscript is to your satisfaction, and of course, we are more than happy to improve the manuscript if new comments and suggestions might arise.

Reviewer: 1

This paper presents an assessment of the 10 yr carbon budget of wheat/corn crop rotation along with a much more detailed component assessment over the course of one year in China. The authors use both long-term eddy covariance observations along with respiration measurements and a comprehensive array of biophysical ones for their analysis. The main result is a comprehensive carbon budget for this cropping system as well as some estimates of the controlling drivers and a comparison with previously published agroecosystem C budgets.

The paper is well written. The results are clearly presented and the discussion is well framed. There is a great need for these kinds of studies so that the large uncertainty in carbon budgets of agroecosystems can be reduced. I have no major objections to this paper being published. The weakest part of the paper is its consideration of uncertainty. Ideally, it would be great to see confidence intervals given on the detailed crop budgets, but this is difficult to address and not easy to improve. I have just a few stylistic suggestions to improve the paper's presentation.

Response

We appreciate Dr. Scott for the positive evaluation and constructive comments. We have revised the manuscript thoroughly according to all the comments.

1. Throughout the paper, "groundwater table" is used to indicate "depth to groundwater" or "water table depth" or even "groundwater depth". One of these later terms should be used. (e.g., L. 27). Likewise, "cultural" is used to indicate "agricultural". This should be changed to "crop" or "agricultural" cycle.

Response

All these suggestions are adopted and all the texts are updated. We use "groundwater depth" and "agricultural".

2. All throughout the paper, C balance figures are reported down to the 1/10th's of a g C. I'd suggest rounding these off to the nearest whole number which would make it easier to read as well as not convey such high level of confidence in their accuracy (maybe even consider rounding the nearest 10's).

Response:

We appreciate the comment, we round the figures to the nearest whole number.

Figure 1. There are two dots on the map to indicate location of one flux site. Also, would be nice to have a smaller inset map that shows a more zoomed out region to indicate where in China we're zoomed into.

Response:

We updated the figure as pasted below.
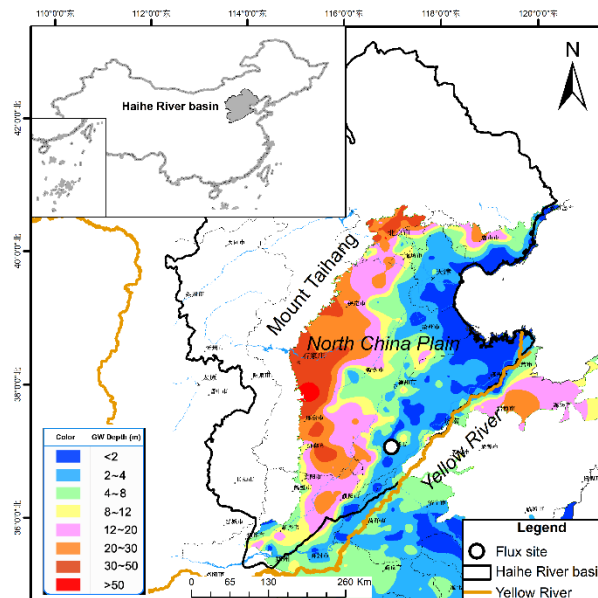
Fig. R1 Location of the experimental site. The background is the shallow groundwater depth in early September of 2011 (modified from http://dxs.hydroinfo.gov.cn/shuiziyuan/)

L151. "gaps less than 2 h" L274. "as previously mentioned" L283. "were" to "are". Also see L288 and elsewhere.

Response:

We appreciate the comment, all the tense problems are all corrected in the revised manuscript.

L323-332. Here and elsewhere, correlation is being used to indicate causation. The text should be changed to correct this.

Response:

We appreciate the comment, the texts are updated to focus on the correlation alone. The updated texts are pasted below for your convenience:

"The NEE, GPP and ER for both wheat and maize were correlated with the three main environmental variables of R_{si}, T_a and WD using the multiple regression (see Appendix B for details). In the wheat season, T_a showed its relatively greater importance to all the three CO_2 fluxes with a higher T_a increasing both GPP and ER, and also enhancing NEE (more negative) (Fig. 8a), but R_{si} showed negligible effect to all the three CO_2 fluxes; higher WD correlated negatively with GPP, thereby reduced net carbon uptake. In the maize season, WD had good correlations with all the three fluxes of GPP, ER, and NEE, but T_a showed negligible effect to all the three CO_2 fluxes; WD showed relatively greater importance to both GPP and ER, and a deeper WD drove higher net carbon uptake (more negative NEE); R_{si} had a good correlation with ER, but a bad correlation with GPP (Fig. 8b), ultimately, higher R_{si} in maize season lowered the net carbon uptake (more positive NEE). Overall, R_{si} and WD showed its relatively greater importance in influencing the inter-annual variation of maize (Fig. 8b)."

L338-339. Wondering if this cold season uptake might be caused by IRGA self-heating as shown previously by Burba et al. Did you consider this?

Response:

We appreciate the reviewer for this comment, we did not consider this. But the winter wheat at our site has green leaves in winter, and our leaf level gas exchange measurement in winter shows that photosynthesis happens in winter. In addition, wheat is also reported to have photosynthesis under low temperature in winter in other studies, e.g., Savitch et al. (1997). So we are inclined to trust the measurements.

L413. "a short period of" L421 considered L422 "are required" L423 "is much closer to the surface because..."

Response:

Revised.

L454-464. Rather than reporting all these values in the text again, I'd suggest just referring to the values in the table.

Response:

We appreciate the comment, the texts are corrected accordingly.

L522. Rather than just reiterating these numerical results I'd suggest trying to write what some of the broader implications of your work are.

Response:

We appreciate the comment, we have thoroughly revised the conclusion, which is pasted below for your convenience:

"Conclusion

Based on the decadal measurements of CO_2 fluxes over an irrigated wheat-maize rotation cropland over the North China Plain, we found the cropland was a strong CO_2 sink if grain export was not considered. When considering the grain export, the cropland was a weak CO_2 source with an NBP of -40 gC m^{-2} yr^{-1} in the full 2010-2011 agricultural cycle. The net CO_2 exchange during the past decade showed a decreasing trend, implying a decreasing carbon sink capacity of this cropland. In the wheat season, air temperature shows the best correlation with the CO_2 fluxes; while in the maize season, both short-wave radiation and groundwater depth show good correlation with the CO_2 fluxes. The comprehensive investigation showed most of the carbon sequestration occurred during the wheat season, while maize was close to being CO_2 neutral. Soil heterotrophic respiration in this cropland contributes substantially to CO_2 loss in both wheat and maize season. This study provides detailed knowledge for carbon cycle research of the North China Plain."

Reference used in this response:

Savitch, L. V., Gray, G. R., and Huner, N. P. A.: Feedback-limited photosynthesis and regulation of sucrose-starch accumulation during cold acclimation and low-temperature stress in a spring and winter wheat, Planta, 201, 18-26, doi: 10.1007/Bf01258676, 1997.