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Interactive comment on “Net global warming potential and greenhouse gas intensity in rice agriculture driven by high yields and nitrogen use efficiency: a 5 year field study” by X. Zhang et al.

X. Zhang et al.

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2015-12-30 Dear Reviewers, Thank you very much for your critical comments and great support! Please see the attached point-by-point answers and the manuscript with tracking system for your further evaluation. Wish you a Happy New Year! Sincerely yours, Zhengqin (on behalf of all authors) Referee #1 GENERAL COMMENTS The authors present an interesting and complete assessment on Global Warming Potential (GWP) and greenhouse gas intensity (GHGI) during three years in a rice-wheat rotation. The number of crop seasons, as well as the complete overview the sustainability of the agro-ecosystem (soil GHG emissions, SOC, CO₂ equivalents from inputs and opera-

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tions, and crop yields) are, from my point of view, the main strengths of the this study, which fits well into the scope of the journal. Conversely, the manuscript requires additional details and explanation before it can be considered for publication. Moreover, I do not understand why the authors did not set some variables (e.g. Zn fertilization -which has been reported to influence crop yields and GHG emissions- plant density, water management. . .). That would have simplified the discussion and maybe would have allowed obtaining some conclusions about management techniques (and not only about the overall scenarios) and the possibilities of combining scenarios. The authors should also improve the Materials and Methods section, explaining much better the GWP calculations and other issues of major interest. The conclusions are adequately presented: since each scenario is a combination of several management techniques, the authors cannot recommend any single practice, only the full scenario. Conversely, ALL the management factors that could have influence the measured variables (yields, GHG fluxes, GWP) should be briefly discussed. A: Thank you very much for your great support and critical comments. Those comments are all valuable and very helpful for revising and improving our paper, as well as further important guidance for our researches. We have made corrections which we hope to meet with approval. Please see the following point-by-point answers. 1. Yes, all of these variables such as Zn fertilization, plant density, and water management affect crop yields and GHG emissions. We are sorry that we did not set them as separate variables and just integrated them to realize our goal for better yield and NUE. According to your comments, we added some information for better understanding in discussion, such as on Page 10, Lines 253-271 for yield, Page 11, Lines 297-298 for GHG emissions. 2. It is really true that we update all possible components for calculating GWP as both of you Referee suggested. So, we put them in a better way on Page 6, Lines 140-161. 3. In conclusion, the ISSM scenarios could be adopted for both food security and environmental protection. We discussed scenarios in detail emphasizing the main components. Revised accordingly Page 14, Lines 376-379 and Page 15, Lines 420-422.

Referee #2 General Comments The authors have attempted to test agro-ecosystem
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dependent variables against a comprehensive set of controls related with the global perspective of GWP, and have tried to relate the study with the food security. The scope of this study is too large to detail all the measurements and their dynamics. Provided this paper is revised, it could be useful for relevant farming community, interesting to the scientific community and potentially important for the climate change studies. This paper should be published after filling up the significant gaps identified and correcting the specific and/or technical problems in the manuscript: There are two major problems which need to be resolved before this research is published: 1. The C contents of the biomass (harvested crop=grains/paddy + straw) have gone un-accounted for in equations, although grain yield has been accounted for in equation 3 for GHGI calculation. However, in either case the crop straw is not mentioned (accounted). Crops grains as well as the wheat and rice straw accumulate a significant amount of C. As well, it is not clear how the total C balance of the agro-ecosystem was calculated. It is unclear how wheat grain and rice paddy and their straws have been accounted for in C balance and GWP calculations. The relative contributions of different GHGs on a global time scale are not even briefly mentioned. The “N” in the abbreviation “NGWP” is redundant. Instead negative GWP (cooling) and positive GWP (warming) could be simpler to be used. 2. As the measurements were made from the same plots over years, therefore, repeated measures ANOVAs should be used, although year could also be taken as a fixed variable at the same time to see differences between years. A: Thank you very much for your patience and your great support. We have tried our best to revise our manuscript according to your valuable comments. Please see the following point-by-point answers. 1. We determined the C balance by calculating the SOC changes in the integrated soil-crop system in this study as adopted by several researches (Shang et al., 2011; Zhang et al., 2014). We may adopt an alternative approach for calculating the C balance as suggested considering the C inputs from all parts including grains, straws, root exudates, manures etc. and outputs such as heterotrophic respiration. We compared these approaches and they agreed well with each other as reported by our previous publication (Zhang et al., 2014). We added some information according to

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your comments. Harvests included crop grains as well as the rice and wheat straws were removed out of the field for all the treatments in this study. Revised accordingly Page 5, Lines 111-113. 2. We deleted the “N” and “net” according to the Referee’s suggestion. Thus, we use GWP for all of our updated terminology. Thank you for your comments. 3. Considering the Referee’s suggestion, we have made correction in Table 3. A repeated-measures multivariate analysis of variance (MANOVA) was used to test cultivation patterns, cropping years and their interaction on GHG emissions and grain yields for the three annual rice-wheat rotations. Thank you very much for your indication. We therefore corrected the corresponding description according to the new MANOVA results. Specific Comments 1. Authors have presented the conclusion in the abstract in a clear, concise and comprehensive manner A: Thank you very much for your comment! 2. 5 years field study for this experiment is appropriate as it provides larger data set for processing to conclude with less uncertainty A: Thank you so much for your support. 3. The terms GWP and Food Security are very important and need to be defined in introduction section A: You are right. This is our major aim. We revised this point accordingly. Page 3, Lines 38-42 and Lines 51-54. 4. Please provide a brief rationale for this research with Food Security A: You are right. Thank you very much! Revised accordingly Page 3, Lines 38-49. 5. The comments by the other referee are tired not be repeated here A: Yes, thank you. 6. It could be very interesting if the GWPs be related to the annual (or seasonal) temperature and precipitation. A: Thank you for your comment. The annual temperature and precipitation were similar over three years in this study. Further observations are essential to find out their relationship. 7. Fig. 1 may not be needed in this paper as the climate is not discussed in results section or related with other variables A: Daily mean air temperature and precipitation were provided accordingly as Supplementary resource 1. In the title, “Net” is redundant A: Thank you for your comment. We have deleted the “Net” in the title and the corresponding texts. Page 18885 Line 6: add “equivalent” before “emissions” Line 7, 8: putting the abbreviations in brackets could be more meaningful Line 13: “, i.e., N1, N2, N3 and N4,” is redundant as these are already defined earlier Line 24: why is the word

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“cost” here? Page 18886 Line 4, 5, 6: Conclusion cannot be made on the basis of hypothesis, therefore, please remove this conclusion. Page 18887 Basal fertilizers- what was rate? Page 18888 Line 7: space or “.” Is required after mL Line 13: why different size brackets are used when same sized could be used? Table 2. The 2ND column CH4 values could be rounded off to no decimal point while the SD could be rounded off to a single decimal point. A: We are sorry for the inconvenience. Revised accordingly Page 2, Lines 19-21, Line 25, Page 3, Line 48, Page 4, Line 76 and Table 2. The basal fertilizers rate was presented in Table 1 and lines 108-110.

Thank you once again for your critical comments and great support! Wish you a Happy New Year! Sincerely yours, Zhengqin (on behalf of all authors)
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Please also note the supplement to this comment:  
<http://www.biogeosciences-discuss.net/12/C8764/2015/bgd-12-C8764-2015-supplement.pdf>

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