Dear Prof. Richard Conant and Reviewers,

On behalf of my co-authors, thank you very much for your positive and constructive comments on our manuscript. We have carefully studied the comments and have made corrections which we hope to meet with approval. Please see the attached point-by-point responses and the tracked change version of manuscript for your further evaluation. All revised positions mentioned in the responses can be readily found in the attached clear version of manuscript.

Response to Reviewer's comments:

Reviewer 1:

1. The section on the details of the long-term experiment (lines 145-153) is not necessary.

Response: Thanks very much for your suggestion. According to your suggestion, we have deleted the details of the long-term experiment (**please see Line 158-167**).

2. It was a bit confusing because the rates of residue incorporation used in this study (Table 1) were different from those in the long-term experiment (line 146).

Response: Thanks for your comment and sorry for our unclear expression. Yes, the rates of residue incorporation used in this study were different from those in the long-term experiment, but we think it is appropriate to use the equation to calculate the SOCSR in this study. We have noticed the uncertainty induced by the SOCSR calculation method and discussed it in the results and discussion part of '**CH_4, N_2O emissions and SOSCR'.** Moreover, we also presented the reasons why we hold the opinion that the SOCSR calculation method in this study is appropriate, and the uncertainty incurred by this method unlikely affects the main conclusions of this study (**please see Line 306-324**).

3. The relationship between CH_4 emission and the amount of organic matter input was not the major focus of the paper. The discussion should be simplified rather than being extended with possible explanations, some of which are speculative.

Response: Thanks for your good suggestion. According to your suggestion, we have simplified the relevant discussion (**please see Line 274-285**).

4. At a few other places in the discussion section e.g. lines 278-285 the authors presented their results, and compared the results with others', which was fine but the manuscript would be more informative if the implications of the findings could be explored.

Response: Thanks for your good suggestion. According to your suggestion, we have explored the implications of the SOC sequestration of this study (**please see Line 325-335**). We also revised somewhere else, such as **Line 301-303** and **Line 387-389**, to illustrate the implications of our findings.

5. Minor comments:

Line 76: delete "And"

Response: Agreed and revised (**please see Line 84**).

Line 112: The scientific name of rice was provided but not for winter wheat

Response: Sorry for our carelessness. We have added the scientific name of wheat in the text (**please see Line 121**).

Lines 252-253: What does it mean by "the applied OM rates among different treatments are statistically different"? A statistical test on the independent variables (OM

application rates)?

Response: Sorry for our unclear expression. We have deleted this sentence.

Line 311: “was not” instead of “wasn’t”

Response: Agreed and revised (**please see Line 363**).

Lines 344-346: incomplete sentence

Response: Sorry for our unclear expression. We have revised this sentence (**please see Line 398-403**).

Once again, thank you very much for your constructive comments and suggestions.

Reviewer 2: Specific comments

1. 1. Abstract: Authors employed the meta-analysis to calculate the various Nr losses. As an important part of this study, the results of the meta-analysis should be simply presented in the abstract. Moreover, it would be better if the abstract is concisely shortened, since some findings in the current version were insignificant, e.g., L34 ‘while methane emission …..wheat rates increased’.

Response: Thanks very much for your comment and suggestion. According to your suggestion, we have presented the main findings of the meta-analysis in the abstract. We have also concisely shortened the abstract (**please see Line 24-54**).

2. L71-72, specify the current water and straw application methods.

Response: Thanks for your comment and sorry for our unclear expression. We have specified the water and straw application methods (**please see Line 79-80**).

3. L140 Using the relationship of straw input rate and SOCSR of previous study to calculate the SOC changes is fine, since both of the studies have similar climatic conditions, cropping history and agricultural practices. But the uncertainty should be noticed and can be discussed in the result and discussion part.

Response: Thanks for your good suggestion. According to your suggestion, we have noticed the uncertainty induced by the SOCSR calculation method and discussed it in the results and discussion part of '**CH_4, N_2O emissions and SOSCR'.** Moreover, we also presented the reasons why we hold the opinion that the SOCSR calculation method in this study is appropriate, and the uncertainty incurred by this method unlikely affects the main conclusions of this study (**please see Line 306-324**).

4. L193-205. The environmental cost evaluation is interesting. But, why treated N_2O as a GHG when conduced this evaluation, since it is both a GHG and Nr species?

Response: Thanks for your comment. N_2O is both a GHG and Nr species, but its environmental cost was calculated as a GHG here. This is because the cost of N_2O emission as Nr species is mainly to damage human health (Gu et al., 2012). But the effects of Nr losses on the direct damage costs of human health were not included in this study, which are very difficult to quantify. The environmental costs included in this study mainly refer to the global warming incurred by GHG emissions, soil acidification incurred by NH_3 and NO_X emissions, and aquatic eutrophication caused by NH_3 emissions, N leaching and runoff (Xia and Yan, 2012). We have added such reasons in the methodology to make it clearer (**please see Line 208-210**).

References:

Gu, B., Ge, Y., Ren, Y., Xu, B., Luo, W., Jiang, H., Gu, B., Chang, J.: Atmospheric reactive nitrogen in China: Sources, recent trends, and damage costs, Environ. Sci. Technol., 46, 9420-9427, 2012.

Xia, Y., Yan, X.: Ecologically optimal nitrogen application rates for rice cropping in the Taihu Lake region of China, Sustain. Sci., 7, 33-44, 2012.

5. L275-280. This discussion needs to be concise, since the effect of N fertilizer on CH_4 emission is beyond the focus of this study.

Response: Thanks for your suggestion. According to your suggestion, we have simplified the relevant discussion **(please see Line 292-294)**.

6. L289-290. The calculation of the N_2O emission factor needs to be specified in the methodology.

Response: Thanks for your correction. According to your suggestion, we have specified the calculation of the N_2O emission factor in the methodology **(please see Line 218-223)**.

7. L345. Does the straw application affect the Nr losses (e.g., N_2O and NH_3 emission) and the subsequent calculation of Nr intensity?

Response: Thanks for your comment. Previous studies have proven that direct incorporation of crop straw had insignificant effects on various Nr releases (Xia et al., 2014). Because the majority of N contented in the crop straw is not easily degraded by microorganisms in a short-term period, and can be stabilized in soil in a long-term period, rather than being released as various Nr (Huang et al., 2004; Xia et al., 2014). For instance, a meta-analysis, integrating 112 scientific assessments of the crop residue incorporation on the N_2O emissions, has reported that the practice exerted no statistically significant effect on the N_2O releases (Shan and Yan, 2013)**.** Therefore, the effects of wheat straw incorporation on various Nr

losses were considered as negligible in this study. Moreover, previous studies have also proven that straw incorporation exerted little impacts on grain yield. For instance, a meta-analysis conducted by Singh et al. (2005) have found that incorporation of crop straw produced no significant trend in improving crop yield in rice-based cropping systems. Moreover, based on a long-term straw incorporation experiment established since 1990 in the TLR, Xia et al. (2014) have reported that long-term incorporation of wheat straw only increased the rice yield by 1%.

Therefore, in the present study, the effects of straw incorporation on NrI were considered as inappreciable. We have presented such reasons in the results and discussion part to make it clearer **(please see Line 256-263 and Line 397-406)**.

References:

Huang, Y., Zou, J., Zheng, X., Wang, Y., Xu, X.: Nitrous oxide emissions as influenced by amendment of plant residues with different C: N ratios, Soil Biol. Biochem., 36, 973-981, 2004.

Shan, J., Yan, X.Y.: Effects of crop residue returning on nitrous oxide emissions in agricultural soils, Atmos. Environ., 71, 170-175, 2013.

Singh, Y., Singh, B., Timsina, J.: Crop residue management for nutrient cycling and improving soil productivity in rice-based cropping systems in the tropics, Adv. Agron., 85, 269-407, 2005.

Xia, L., Wang, S., Yan, X.: Effects of long-term straw incorporation on the net global warming potential and the net economic benefit in a rice-wheat cropping system in China, Agric. Ecosyst. Environ., 197, 118-127, 2014.

8. L377-378. I don’t think the GHGI and Nr have to have some specific relationship, although the N production and fertilization can both affect them.

Response: Thanks for your comment and sorry for our unclear expression. We have deleted such sentence. What we wanted to present is that extra attention should be paid to the interrelationship between the NrI and GHGI, which could provide hints for the mitigation purpose. For instance, N fertilizer production and application is an intermediate link between the NrI and GHGI (Chen et al., 2014). For the NrI, N fertilization promotes various Nr releases, exponentially or linearly (Fig.4), while N production and application made a secondary contribution to the GHGI (Table 4). Such interrelationships ought to be taken into account fully for any mitigation options pursued, in order to reduce the GHG emissions and Nr discharges from rice production simultaneously (Cui et al., 2013b; Cui et al., 2014) **(please see Line 409-416)**.

References:

Chen, X., Cui, Z., Fan, M., Vitousek, P., Zhao, M., Ma, W., Wang, Z., Zhang, W., Yan, X., Yang, J.: Producing more grain with lower environmental costs, Nature, 514, 486-489, 2014.

Cui, Z., Yue, S., Wang, G., Zhang, F., Chen, X.: In-season root-zone N management for mitigating greenhouse gas emission and reactive N losses in intensive wheat production, Environ. Sci. Technol., 47, 6015-6022, 2013b.

Cui, Z., Wang, G., Yue, S., Wu, L., Zhang, W., Zhang, F., Chen, X.: Closing the N-use efficiency gap to achieve food and environmental security, Environ. Sci. Technol., 48, 5780-5787, 2014.

9. L428. The ‘ecological compensation mechanism’ is a good idea to encourage famers to adopt knowledge-based agricultural managements. To make it clearer, authors need to provide more details about that rather than just giving a mention.

Response: Thanks for your good suggestion. According to your suggestion, we have added more details to make the ‘ecological compensation mechanism’ clearer **(please see Line 459-468)**.

Reviewer 2: Some further remarks

1. L 72, delete ‘the’

Response: Thanks for your correction. We have revised it according to your correction (**please see Line 81**).

2. L 98-101, long sentence, needs to be split.

Response: Thanks for your correction. We have revised it according to your correction (**please see Line 106-109**).

3. L102, N_2O should be ‘nitrous oxide (N_2O)

Response: Thanks for your correction. We have revised it according to your correction (**please see Line 111**).

4. L116, delete ‘an’

Response: Thanks for your correction. We have revised it according to your correction (**please see Line 125**).

5. L196, ‘was’ should be ‘were’

Response: Thanks for your correction. We have revised it according to your correction (**please see Line 202**).

6. L230, replace ‘to a reasonable rate’ with ‘reasonably’

Response: Thanks for your correction. We have revised it according to your correction (**please see Line 242**).

7. L233, delete ‘without threatening food…study’

Response: Thanks for your correction. We have revised it according to your correction (**please see Line 245-246**).

8. L252, replace ‘produced’ with ‘showed’

Response: Thanks for your correction. We have revised it according to your correction (**please see Line 265**).

9. L335, ‘manufacture’ should be ‘production’

Response: Thanks for your correction. We have revised it according to your correction (**please see Line 361**).

10. L348, delete the sentence

Response: Thanks for your correction. We have revised it according to your correction (**please see Line 376**).

11. L427, ‘has’ should be ‘have’

Response: Thanks for your correction. We have revised it according to your correction (**please see Line 460**).

12. L443, delete ‘as well’

Response: Thanks for your correction. We have revised it according to your correction (**please see Line 479**).

13. Table 1-6, the abbreviations in the table titles should be self-explained.

Response: Thanks for your correction. We have revised it according to your correction (**please see the tables**).

Once again, thank you very much for your constructive comments and suggestions.

In addition, we also polished the English expressions in the whole manuscript and redrew Figure 5. All changes in the manuscript will not influence the main conclusions of the paper. And here we did not list the changes but marked in red in the attached tracked change version of manuscript. We appreciate Editor/Reviewers' warm work earnestly, and hope that the correction will meet with approval.

Yours sincerely,

XiaoyuanYan on behalf of all authors