Responses to the reviewer

We would like to thank the reviewer for his/her thoughtful comments. We have addressed all these comments in our revised manuscript. The point-by-point responses to the review comments are provided below.

Some general comments:

- **Question 1**: The paper is a valuable, relevant and interesting contribution to the literature, however it presently merely reports the regional findings rather than discussing them in the context of existing knowledge or investigating the underlying causes of changes observed. Therefore to me it fails to clearly identify whether anything new was learned.

- **Answer**: Thank you for the comment. The objective of this study is to identify the high risk areas for crop production under climate change in China and to support adaptation to climate change at regional scale. Although the gridded outputs were provided by the ISI-MIP project 1, the decision makers are usually not well informed from the scientific results. Our results could show the risk assessments at the administrative zones and thus provide a starting point for regional studies on vulnerability and adaptation strategies to climate change. It bridges the gap between the modelers and policy-makers. We have clarified the objective and scientific significance of this study in the introduction section. Furthermore, we have enhanced the discussion on the underlying causes of the risk in the revision.

- **Question 2**: The paper would benefit from discussing the main climatic causes of the changes observed by comparing patterns in the changes in temperature, precipitation and CO_2 to the patterns observed in crop yields. I realize that it would go beyond the scope of this paper to do an in-depth analysis here, but it is not satisfying to not receive any information about how climate changes in different GCM projections. Do the crops that increase growth mainly benefit from CO_2 fertilization? Do the crops that show a decline of yields mainly suffer from increased water stress?

- **Answer**: As the reviewer kindly mentioned, an in-depth analysis of the causes is beyond the scope of the paper. We have added some additional analyses in order to better understand the causes of the changes of relative yields. More specifically, we have investigated the role of CO_2 fertilization in the risk assessments.

- **Question 3**: I think it would be valuable to receive information from your analysis about leading reason for the grey areas of inter-model uncertainty behind the temporal plots of median crops yields. Are they mainly due to differences between the crop models, mainly due to differences between the GCMs, or a mix of both, and if so, in

what relation?

- **Answer**: In the revision, the model spread was analyzed to understand the uncertainty of the assessment. The standard deviation from all the available GCM-GGCM pairs was used to quantify the model agreement. The model spread caused by GGCMs and GCMs was separately evaluated. The standard deviation of the estimates from the GGCMs was firstly calculated for each GCM. The averaged GGCM standard deviations of the GCMs was then used to assess the model spread caused by GGCMs. Using the same calculation procedure, the model spread caused by GCMs was estimated and compared with the model spread caused by GGCMs.

- **Question 4**: You announce at the end of the introduction that you intend to compare your results to those obtained from AR4-based studies but as far as I can detect, do not do so subsequently. More generally: the strength of your study is that it is multi-model, multi-GCM using AR5 scenarios. The important question left open by your paper is: what do we learn from such a multi-GCM, multi-GGCM AR5 analysis? Do the results simply confirm previous knowledge (if so, in what way is that significant? Were there doubts about earlier studies?) or add to it? I suggest that you more systematically discuss your results (a) with respect to the present state of knowledge about climate impacts on crops in China, identifying the advances made (even if it is an important confirmation of existing knowledge), (b) with respect to AR4 in particular (if that is important – you mention it in the introduction), (c) with respect to single model studies. In summary: what is the advance in knowledge you provide?

- **Answer**: Thanks for the suggestions. We have provided more systematically discussions in the discussion section. As the previous AR4 studies are under different climatic scenarios, we compared the differences between AR4 and AR5 assessments qualitatively. We have modified the statements in the introduction accordingly.

- **Question 5**: You discuss the median behavior a lot, and the disagreement between model pairs. However, would not the "worst case" be of particular importance, too? If the best case happens, no problem. The median case is of interest. But the worst case could potentially really be a problem. It could be the real case. Maybe those models are right. So it is not just uncertainty, it is also a case where "the worst case cannot be excluded scientifically and is therefore a non-zero likelihood, i.e. a risk". So I suggest you also discuss the worst cases as such.

- **Answer**: We agree the worse case is meaningful for risk assessment. We have shown a figure of the worse case and have added a brief discussion regarding the risk of the 'worse case'.

Some other, more minor comments:

- **Question 6**: I suggest to not use the abbreviation GGCM (global gridded crop model) because it is so similar to GCM. It can cause mistakes and confusion.

- **Answer**: We have replaced "GGCM (global gridded crop model)" with "GGCropM (global gridded crop model)" throughout the manuscript.

- **Question 7**: The crop models used are established models described elsewhere, but the paper should very briefly describe what they do and what not.

- **Answer**: We have added a very briefly description about the crop models in the revision.

- **Question 8**: Figures 6 and 7 are never mentioned in the text. You discuss Figs. 4 and 5, but not 6 and 7.

- **Answer**: It was corrected in the revision.

- **Question 9**: How do results compare to discussions in the IPCC's AR5 WG2 report?

- **Answer**: Although our results are generally in line with the large pattern shown in the IPCC's AR5 WG2, our results have provided the risk assessment in details for different administrative zones. We have added a brief discussion in the revision.

- **Question 10**: The English is ok; however, there are quite a number of small but important language mistakes that are typical for non-native speakers. Often it is about the word "the", so let me explain once more, since it occurs many times: you use "the" before a noun when you mean a specific thing or group of things, one that you identify: you are talking about those things (for example: the coast of China, the GGCMs used). You do not use "the" if you are talking about a type of thing generally without a specific thing referred to (for example: "GGCMs simulate climate"). There are too many small language problems for me to list, so let me just do it for the abstract so you get an idea: (i) "a couple of" usually means: two. You mean: "a number of" (since there are 4). By the way: why not just say "four GGCMs"; (ii) "may benefit food production IN (not over)"; (iii) "where are outside"; you mean "which (or that) are outside"; (iv) "such as North China Plain" should be "such as the North China Plain"; (v) "new agronomic strategy"; better "nee agronomic strategies" or "a new agronomic strategy".

- **Answer**: Thanks for the comments. We have read through the manuscript and polished the language.