Reply to Referee Report 2:

We feel delighted to see the referee's appreciation of the modeling approach implemented in this research involving the IMPACT model and his generally positive assessment on the MS. We are also grateful to receive his critiques and thus glad to make the following responses.

First of all, the referee emphasized the need of a more explicit presentation of international trade into the discussion of climate change-food security business in China, given the existing volume of grain trade between the world's second largest economy and the rest of the world. The authors fully agree with the referee on this point and will revise the MS in such a way that the following points stand out from the discussions:

(1) International trade should be regarded as an effective climate change adaptation option to ensure China's food security in 2050; and

(2) Changes are needed in the Chinese climate change thinking so that open trade is considered an option in the highest level of food security policy making.

Second, our modeling results showed that "climate change does not seriously affect China's national food security" and we therefore called for more attention to be paid on regional disparities when the impact of climate change on food security is concerned. However, the referee suggested that the results should be interpreted the other way around. We are conservative about this suggestion, because:

(1) The results from the same socioeconomic model of IMPACT also show more negative impacts in other parts of the world (Nelson et al. 2010), compared to relatively optimistic results in China; and

(2) Even with intrinsically biophysical models, "moderately positive" effects of climate change on yields and thus food self-sufficiency in China were also reported (Ye et al. 2013).

Third, we are sorry to be ambiguous on the following points and therefore commit to make explicit revisions; here, we are glad to clarify that:

(1) Water balance was explicitly simulated for each of the 15 river basins in China using the IMPACT model's Water Simulation Module, as clearly shown in Fig. 25 at p30 and Nelson et al. (2010);

(2) In order to reduce the uncertainty of the simulated impact of climate change on yield, 4 GCMs, cross-driven by A1B and B1 emissions scenarios, were used to

represent future climates. Moreover, we used the CO2 level of 369 ppm in crop modeling to largely exclude the CO2 fertilization effect as a measure to control uncertainty on yield change under climate change. We did recognize that, theoretically, C3 crops use CO2 less efficiently than C4 crops, so in other words, C3 crops (e.g., rice and wheat) are more sensitive to higher CO2 concentrations than C4 crops (e.g., maize). But no scientific consensus has been reached to date concerning the quantitative magnitude of this CO2 fertilization effect in open field;

(3) We re-examined the settings of the GDP growth rates, and glad to confirm that these numbers reflected our understanding of future GDP trend. We adopted the average GDP growth rate of 8.09% for 1990-2000 from the World Bank's World Development Indicators. This number was indeed lower than the two-digit growth rate number reported elsewhere, but the latter was nominal. It is generally accepted that two-digit GDP growth rates in China can not be sustained. The growth rate for 2013 was already forecasted to be 8% by the Chinese Academy of Social Sciences (Xinhua, 2013). An average growth rate of 6.24% for 2010-2050 does not look odd at all from this perspective.

Fourth, we are glad to see that the referee came across with one of our previous reports on the same subject that was submitted to the World Bank. The authors are happy to declare that this report was internal and has never been publicly released in any form. Moreover, the MS incorporated additional analyses and contributions from more Chinese authors, making the current paper genuine even to the previous internal report.

Finally, we will certainly accept the referee's recommendation to substantially shorten the paper by selecting maps, condensing introductory texts, leaving out irrelevant policy options, and so on.

References:

Nelson et al. 2010. *Food Security, Farming, and Climate Change to 2050*. IFPRI, Washington D.C.

Xinhua 2013. *China's GDP to grow 8 pct: think tank*. China Daily, http://www.chinadaily.com.cn/china/2013-04/27/content_16454481.htm.

Ye et al. 2013. Climate change impact on China food security in 2050. *Agron. Sustain. Dev.* **33**: 363-374.

The Authors, May 2013