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Hydrology and Earth System Sciences Discussions

Interactive comment on "Food consumption patterns and their effect on water requirement inChina" *by* J. Liu and H. H. G. Savenije

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The authors wish to thank the reviewer for his comments. The sequence of our response follows the points made in the review comments:

1. More details of the method to quantify VWC: The methods to calculate VWC of a crop or an animal will be added to the main text. VWC of a crop is generally calculated by dividing consumptive water use (or the sum of crop transpiration and soil evaporation during crop growing period in m3/ha) with crop yield (in kg/ha) (Liu et al., 2007b). VWC of an animal at the end of its life span is generally calculated as the total volume of water that was used to grow and process its feed, to provide its drinking water, and to clean its housing and the like (Chapagain and Hoekstra, 2004). Since VWC values are all derived from literature, we will not introduce detailed process of calculating VWC in this paper. The audience can refer to Liu et al. (2007b) and Chapagain and Hoekstra

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(2004) for details.

The reviewer may have misunderstood us in several aspects. First, in the paper, consumptive water use (soil evaporation + plant transpiration) instead of total irrigation abstraction is used to calculate VWC of crops. Using consumptive water use is a common way to calculate VWC. Second, we did not use any hydrological information to calculated VWC, CWRF and TWRF. The actual evaporation was not calculated in this paper; instead, VWC was obtained from literature. Third, in the current version, we have clearly stated that the VWC values used in this study are based on the estimations for the years around 2000 (instead of 2003 according to the reviewer). Since annual VWC values of various food items in China are rarely available, we only presented results with constant VWC for a certain food item for historical analysis of CWRF. We have argued in the current version that this treatment should not influence the presented analysis, as its main objective is to demonstrate the effect of consumption patterns alone on CWRF, while holding all other variables constant.

2. Section 3.6: This section will be expanded in the revised version. Major changes will include the follows:

a) The growth trend of food consumption will be calculated for each food item;

b) Effects of technological changes on VWC of each food item will be analyzed based on the changes in crop yield.

In addition to the above changes, we will discuss the limitations of the simplified scenarios in the conclusion section.

In the formulation of the future scenarios, we will not consider the consumption trend in the recent past in more developed economies in Asia. However, it will be useful to compare the CWRF in 2030 in the medium modernization scenario (S2) with the current CWRF in Japan and South Korea. The comparison will be provided in the revised version.

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3. Water scarcity in China: we will provide the water resources in the major food production area in China, or the North China Plain, in the revised manuscript. The uneven spatial distribution of water resources and its implication will be discussed in the conclusion section. Impacts of climate change will not be discussed because little information is available regarding the possible impacts on VWC, not to say TWRF.

Specific comments:

1. Page 31, line 23-25: It may be argued that, while wheat is a staple food in the Northern part of China, rice is a more consumed food in the Southern part. Nevertheless, the energy water productivity of wheat is almost identical to that of rice (Table 1). Hence, the basic CWRF calculated with only wheat consumption is justified here. We will add the above explanation in the revised manuscript.

2. Page 35, line 7: The title will be changed to "Historical CWRF"

3. Page 37, line 12: The title will be changed to "Historical cultural CWRF and energy intake"

4. Page 37, line 6: As stated earlier, the reviewer may have misunderstood us. VWC is calculated by dividing consumptive water use (or the sum of crop transpiration and soil evaporation) by crop yield. While annual crop yield is often reported, consumptive water use of individual crops is not reported over time in statistics.

5. Scenario analysis: The reviewer is correct. We need to assume the changes in per capita food consumption for the scenario analysis. Major changes in the revised version will include the follows:

a) The growth trend of food consumption will be calculated for each food item;

b) Effects of technological changes on VWC of each food item will be analyzed based on the changes in crop yield.

6. Page 42, line 4-6: the two options provided by the review will be mentioned in the

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revised manuscript.

7. Page 42, line 7: The sentence will be changed into "Both options need further study to provide realistic estimates of their potential contribution to mitigating China's water scarcity"

8. Page 46, Table 1: the data sources will be added.

Interactive comment on Hydrol. Earth Syst. Sci. Discuss., 5, 27, 2008.