

Interactive comment on “Food consumption patterns and their effect on water requirement in China” by J. Liu and H. H. G. Savenije

Anonymous Referee #2

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General Comments:

This paper addresses relevant scientific questions and fits in the "Hydrology and Social Sciences" subject area of HESS. Overall it is a nice paper and addresses an issue that becomes increasingly important for China and the rest of the world - water for food. However, I do have a few comments:

First, I would like to suggest presenting more details of the method used to quantify crop water use/consumption and VWC in this paper. These can be added to the main text or in an appendix. It will help readers better understand how the results are derived. For example, the paper indicates that VWC includes crop water consumption from both effective precipitation and irrigation water, however, it is not that clear whether

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VWC calculations take into account only consumptive water use or total irrigation water abstraction, for irrigated crops. It looks only irrigation water consumption is accounted but it will be good to clarify this in the paper. Moreover, for estimating VWC, CWRF and TWRF of China for year 2003, what hydrologic information was used? How the actual evapotranspiration on crop land is estimated? What is the uncertainty in the estimation of VWC and other indicators with only 2003 data, given the effects of annual climate variability on water supply for and water requirement of crops?

Second, it would be good if Sub-section 3.6 can be expanded because policy-makers and researchers are interested in knowing how much water is required to meet future food demand, and how water scarcity may limit food production, such that proactive policies can be formulated. Change rates for CWRF and VWC in the three scenarios need to be justified with facts and data. For example, for CWRF, would it be useful to consider consumption trend from recent past in more developed economies in Asia whose diet habits are close to China? Projections into the future usually need modeling that integrates both the demand and supply sides. The projections in this paper are based on direct assumptions for CWRF and VWC changes over time, without (explicit) consideration of the interactions of food demand and supply systems. The limitations of the simplification here need to be mentioned.

Third, the paper didn't give any numbers regarding water available for agricultural uses in China. Without such water availability information, "constraint of water scarcity on food production" (as mentioned in Introduction) is not a self-explaining fact. In addition, the uneven spatial distribution of water resources in China should also be mentioned. Further, it would be good if the paper could briefly discuss the implications of climate change on VWC and TWRF of China in the next couple of decades since it is an emerging issue with significant importance. However, I am not recommending adding any analysis of climate change impacts on water availability and food production since it is out of the scope of the paper.

Specific Comments:

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1) Pg.31, Line 23-25: "met only by the consumption of wheat": In Southern China the main staple food is rice not wheat. Wheat is popular in Northern China. Since VWC of rice is significantly higher than wheat, CWRf can be underestimated if only wheat consumption is considered in calculating CWRf. Is that possible to use a mix of typical crops, including roots and tuber, which are more often consumed by rural population with lower income? Otherwise, if there is sufficient evidence that justifies the use of wheat as the single crop in calculating basic TWRF, they need to be given in the paper.

2) Pg. 35, Line 7: Suggest changing the sub-section title to "Historical per capita water requirement for food". This section only discusses historical CWRf, so the title can be more descriptive by adding the word "historical".

3) Pg. 37, Line 12: Similarly, I would suggest changing the title of sub-section 3.4 to "Historical Cultural CWRf and energy intake" to make it clearer and more descriptive.

4) Pg. 37, Line 6: The paper says "annual VMC values of various food items in China are rarely available". However, with governmental statistical year book, which reports area, yield and production, and agricultural water consumption and abstraction data annually published by water agencies, such VMC data of multiple years can be figured out. Such multiple-year VMC data can reduce the uncertainty of VMC estimate caused by climate variability.

5) Pg. 39, the three scenarios: For example, for S1, it is assumed that CWRf for animal product will increase by 1.6% per year, and VWC will decrease by 1.2% per year. It seems CWRf is calculated based on VWC, so how could change rate of CWRf be assumed? Perhaps it is assumed that per capita food consumption, or calorie intake, will increase by 1.6% per year, rather than CWRf?

6) Pg. 42, Line 4-6: "two seems feasible to meet the additional water required for food consumption". Besides improved rainfall management technologies and increased virtual water import, other important ways of improving crop water productivity could include crop yield improvement through agricultural research and formulation of appro-

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priate agricultural policy. These two options are particular important and need to be considered given China's continued significant investment in agricultural technology research in the past decades, the food self-sufficiency policy, and the greater attention being paid to reducing the development gap between rural and urban areas, which leads to agricultural policy reform.

7) Pg. 42, Line 7: "contribution to China's water supply": Importing food from world market or effective rainfall management does not increase water supply but can mitigate emerging water scarcity in China. So, this sentence is unclear and need to be modified. Some rainfall management technologies, such as rainfall harvesting, do increase water supply, but that needs to be specified if that is what the authors meant.

8) Pg. 46, Table 1: What are sources of data with which these VWC and calorie water productivity results are calculated? Need to add a note listing the sources of data used.

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