

***Interactive comment on* “Determination of virtual water content of rice and spatial characteristics analysis in China” by L. J. Zhang et al.**

Anonymous Referee #1

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This manuscript gives an accounting of virtual water content (VWC) of rice and its spatial characteristics analysis. The subject considered was an important one and the paper was well organized. However, there are still two main concerns. Firstly, the authors should highlight their innovation and specific achievements in this study more clearly. Secondly, the results should be discussed more adequately. This manuscript would be accepted after a minor revision.

In addition the following are some comments.

1. The authors used their framework to analyze the VWC of rice in China and compared it with the other three frameworks. However, its innovation was not clarified enough. This work would be of sufficient general interest if it clarified its major difficul-

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ties and challenges, and the original achievements to overcome them in a clearer way in abstract and introduction.

2. Page 3, lines 23-25. Most of the background data on water use in China cited by the authors was after 2006, except the per capita water use (in 1997). The data would be more unified if the per capita water use was updated.

3. The introduction would be stronger if the authors explained the reason of choosing rice as the object of the study. Although rice production took a large part in the agricultural production, the productions of wheat and corn were also large. Moreover, cash crops like cotton are also important and were considered in many previous studies. Thus, the authors should justify for their choice.

4. In Section 2, the authors introduced 5 kinds of VWCs. However, the readers might be confused with the relationships between these VWCs. More details should be furnished. This section would be of sufficient general interest if it included the detailed introduction of direct and indirect VWC. Did the indirect VWC include green, blue and grey water like the direct VWC?

5. Since the indirect water in the total VWC of rice is very little, the authors should explain why the assessing on indirect water is necessary. Moreover, the introduction on the methodology for indirect water seems a little longer since the indirect water is not that important. This methodology part (section 2.1.1) could be condensed.

6. In the section 2.1.1, the meanings of “direct consumption matrix”, “direct consumption coefficient”, “complete consumption coefficient matrix” and “complete consumption coefficient” should be explained since they might be confusing for readers. Their units should also be marked.

7. The colored lines and circles in the Figures 1 to 5 might be confusing. Do they mean a kind of isometric lines? The authors should clarify the meaning of the lines and circles.

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8. Page 12, lines 13-14. The authors noted: “The VWCtotal values show a three-tiered distribution, decreasing gradually from southeast to northwest of China.” However, it did not show a strict “three-tiered” distribution but a staggered distribution in Fig. 5.

9. In the Section 4.2.2, the authors described geographical distribution of the VWC of rice in China. But the root reasons of the distribution were not explained detailedly. This section would be stronger if the reasons of the distribution were discussed by some instances, e.g., why Beijing has the highest VWCindirect while Ningxia has the lowest one.

10. In the discussion section, the authors did not give guidance for water management basing on their results. Some opponents of virtual water claimed: it does not provide any indication of whether water resources are being used within sustainable extraction limits; therefore the use of virtual water estimates offer no guidance for policy makers (For instance, please see Frontier Economics. 2008. The concept of ‘virtual water’ - a critical review [<http://www.frontier-economics.com/australia/au/publications/217/>]; Australian National Water Commission. 2008. eNewsletter of Australian National Water Commission, Edition 30 [http://www.nwc.gov.au/__data/assets/pdf_file/0005/11885/DistilledJuly2008.pdf]). It would be better to explain how this virtual water study could help China to solve its water problems.

11. As the authors cited, “The concept of virtual water was defined as the water embodied in the traded products” (page 2, line 23-24). Therefore, the authors should discuss more information on the trade of rice; otherwise the “virtual water” would seem not to be different with “water use”.

12. Since the authors made many assumptions and simplification in their computing, the uncertainty of the results might be discussed.

13. In the conclusions section, the authors may list too many results. This section would be clearer if these results were condensed.

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