

Interactive comment on “Analysis of Trade-offs between Food Security and Water-Land Savings through Food Trade and Structural Changes of Virtual Water Trade in the Arab World” by Sang-Hyun Lee et al.

Anonymous Referee #1

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The aim of the manuscript is to “analyze the quantitative and structural characteristics of virtual water trade in the Arab World in order to understand the effects on water savings and land tenure from importing crops and identify the temporal changes of VWT”. The authors develop an exhaustive study of virtual water trade of the Arab world, giving figures of water footprints, main exporters, main importers, VWT, water savings and “land savings” for each country. I must say I was very interested in the beginning particularly because of the water scarcity encountered in the Arab world. Although the results are interesting and may be used by stake holders and authorities, the method-

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ology is not properly described, and the quality of the figures and introduction hampers the understanding and reproducibility of the paper.

I have a feeling that “water savings” and VWT is the same. Please confirm. If so, why do you have two different equations.

The analysis on land savings has so limited information that it basically needs to be inferred from what is available.

Inconsistencies found in the introduction, methods and visualization of results are mentioned below. The manuscript still needs considerable polishing. There is a very poor explanation on the main equations used (Eq. 3 and 4) and understanding the methods section of centrality is almost impossible. Figure explanations are very limited, with captions of one line.

Detailed review:

L. 22-24 First sentence is convoluted. Please divide in two parts so that it is clearer.

L. 32-33 Redundant. Water trade will contribute. . . in the event of an increase in global food trade. Sentence needs improvement.

L. 41 with the “real” water you mean blue water, green water or both combined?

L. 42-43 A citation for this sentence?

L. 45 “were” saved

L. 47-48 Strange, how can crop trade save virtual water. Isn’t virtual water embedded in crop trade? Or do you mean in the importing country? Is this sustainable?

L. 50 25-75 km³ “per year”?

L. 51 What do you mean with “blue water saving from international trade”

L. 51 Again, where is the blue water being saved by the food trade? Be more specific. In total, in the exporting country or in the importing country, or in both?

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L. 65 Are you sure of this? You, say later that rain will decrease.

L. 71-72 I think this sentence is repeated from the beginning.

L. 77 Main objective. You have not said what are these structural characteristics of virtual water.

L.. 83 It is not possible to understand this sentence. "increasing 1 % self-sufficiency of study crops in comparison to average self-sufficiency from 2000 to 2012 in terms of trade-off between water saving and food self-sufficiency."

L. 87 What do you mean with "vulnerable expansion" and "robust expansion"?

L. 99 "VWT denotes the VWT..." ??

L. 99 ", ne,"??

L. 111 "The import of crops could affect the water and land savings in the importing country". This is contradictory. So, finally, is virtual trade causing or preventing water and land shortages?

Equation 3 What does "import" mean in Equations 3 and 4? It is not clear. Why isn't the water saving just the VWT? And blue only, or blue and green combined? And what if the crops imported use green water? Or there is an error with this important equation because water times a volume of import cannot give water again, unless I understand incorrectly.

L. 119 I cannot see the "w" in the equations. And what does the variable "Lands" and "land savings" mean?

Section 2.3 was impossible to understand and the level of English has dropped considerably. Please rewrite this section. An explanatory figure of degree centrality would help considerably in understanding this section. Example: "The in-degree centrality based on the number and volume of links in VWT network, which expressed to non-scaled in-degree centrality (NSInDC) which is based on the number of links, and scaled

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in-degree centrality (SInDC) which is based on the volume of links."???

L 181 Is this the total volume of water per year or the total volume in the period 2002-2012?

L. 186 Reference needed for "Rice is a blue-water-intensive crop"

Figure 6- What are the small numbers in the figures. Any units? Why is the shape of the flows changing direction? Is that important?

Table 4- How can the water saving be larger than the available water resources, for instance, for Egypt or Saudi Arabia? Is then water saving=virtual water flow?

L256-262 But why is this figure important. You describe it in detail but do not say what this finding represent in real words.

Improve the caption of Figure 4. It needs more explanation.

Improve the caption of Figure 5. It needs more explanation. What do red numbers mean?

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