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Discussions

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.

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The world population is expected to reach 9.6 billion by 2050, according to a report published by the United Nations(UN). Moreover, despite the progress made over the last two decades by some of the international organizations such as the Food and Agriculture Organization (FAO) of the UN, around 815 million people still suffer from chronic hunger. On top of this, climate change driven by greenhouse gas emissions from human activity and livestock redistributes rainfall patterns, drought, and flooding to threaten our ability to achieve global food security, eradicate poverty, and achieve

sustainable development. These issues have alarmed many nations to address the water issues from the perspective of climate change and food security. Therefore, to address the water issues, specifically in water scarce regions, the concept of virtual water trade (VWT, i.e., importing water in virtual form), is actively researched to fuse the concept in water policy formulation.

In this manuscript, using the concept of VWT, the authors analyze the impacts of food trade on food security and water-land savings in the Arab World. Based on this review, the following points are highlighted:

1) The abstract of the manuscript does not state the problem statement. The abstract starts with the aim of the study.

2) In Table 4, how did you compute the national blue water saving. As per the footnote, the values for the national blue water saving are estimated by you. As per your Table 3, if I consider Saudi Arabia, the total blue water imported is (324.3+68.9+70.8+696) * 106 m3/year =1160*106 m3/year=1.160*109 m3/year. However, as per your Table 4, the national blue water saving in Saudi Arabia is 8.14*109 m3/year. You need to provide a sample calculation to support your values. You may also want to see LN 183.

3) As per the authors, the largest amount of blue water was imported annually by Saudi Arabia, followed by the UAE [see LN 183]. This statement contradicts with the values presented in Table 4. As per Table 4, Egypt and IRAQ have saved 13.05*109 m3 and 12.17*109 m3, respectively.

4) The magnitudes/values of virtual water import per capita need to be supported with the population data for the countries. As per the figure, though Egypt and Saudi Arabia import a very large volume of virtual water, UAE has a very high value of virtual water import per capita. What does this lead to conclude? I think, to make a concrete statement, considering the land and water saving, you need to work with the population data distributed by the World Bank's Development Data Group that provides population and other demographic estimates and projections from 1960 to 2050

(https://data.worldbank.org/data-catalog/population-projection-tables). See LN 57-59.

5) In Table 3, what is meant by green water import? Is this the amount of rainfed water [see LN 105-106] in the exporting country? Is this the amount of rainfed water in the importing country? Do we assume that the green water in the importing country is equal to the green water in the exporting country? Does this make sense without considering the climatology/hydrology and other crucial factors in the importing country? I think, few lines (may be from Mekonnen and Hoekstra, 2010) are required from the authors for the readers to understand. As per your equation (1), you are using WEP[ne,c].

6) The equation (3) and equation (4) need to be re-written. Some of the variables are undefined. Moreover, the equations do not have the variable "w".

7) Does the Arab World strongly depend on water resources from exporting countries [see LN 310-311]? I think, based on your Table 4, only some of the countries rely on water resources from exporting countries. In fact, based on the values presented in Table 4, I am unsure the reason for some of the countries (e.g., Algeria) to rely on the exporting countries when they have the capacity. Probably, you need to bring the water price and the local conditions to realize the reason for the import in those countries.

8) The equation that is used to compute the self-sufficiency is not understood. As per the authors, crop import could result in low food self-sufficiency in the Arab World [LN 222]. However, as per the authors, the self-sufficiency is defined as the ratio of imported crops to total consumption [LN 236-237]. Based on this equation, the authors mention in the manuscript that the average self-sufficiency of Wheat in Egypt from 2000 to 2012 was 47.64%. Furthermore, the authors state that 278.77 million m3 irrigation water would be required to increase the self-sufficiency by 1% to reach 48.64% [LN 238-240]. Going by the definition of self-sufficiency, the 1% increase in the self-sufficiency has caused the country (i.e., Egypt) to import an additional 1% from the exporting countries. Does this lead to self-sufficiency?

Minor comments»> see the attached file

Please also note the supplement to this comment:
https://www.hydrol-earth-syst-sci-discuss.net/hess-2018-4/hess-2018-4-SC1-supplement.pdf

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