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Hydrology and Earth System Sciences
Discussions

Interactive comment on "Recent evolution of China's virtual water trade: analysis of selected crops and considerations for policy" *by* J. Shi et al.

J. Shi et al.

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The introduction is long and provides a somewhat disorganized review of previous research on virtual water trade.I suggest that the authors re-write or re-organized the introduction in a way that it sets the stage for the research questions that will be addressed in this paper. They should first provide the background that leads to those questions, and, then, clearly state the objectives of their study.

We thank the reviewer to point out the problem and agree that the introduction is overly long and provides some information which is not closely linked to our research ques-

tions. Therefore, we have deleted the unnecessary parts and re-organized this section.

Methods: section 2.4 is overly long; it uses many acronyms and equations that are probably not necessary. The reader would easily get lost. It is much easier to say that each traded crop has its own country-specific and crop specific virtual water "content" (VWC). Trade between two countries is calculated by multiplying the VWC by the traded amounts and adding the values obtained for all the traded crops. It is obvious what virtual water imports and exports are and there is no need to define them. You can just define the net import and the difference between VW imports and VW exports. My impression is that the reader would easily get lost in subscripts, sums, and all those acronyms. For example is VWI the same as VWB?

We agree with the reviewer that there are too many acronyms and equations in section 2.4, which might be confusing. In fact, we realized this problem early and have already reduced acronyms and equations in the first draft significantly. Here we take the reviewer's suggestion and rewrite section 2.4. We have further reduced the acronyms as many as possible and used descriptive language instead of equations.

Results: I think the results on network topology, strength vs degree relations, etc. are not well integrated with the other results, do not contribute to explaining/interpreting China's trade, and are not novel [see Carr et al. (2012, here mistakenly cited as 2013b, in press) and Dalin et al., (2012)]. I would eliminate all these results from the paper and concentrate on the spatiotemporal patterns of China's VW trade. For instance, section3.3 (lines 15-23) provides information on network properties and their scaling laws that are very well established and have already been reported in the literature.

We agree with the reviewer that there are literature exploring the global virtual water network. But a virtual water trade network centered at China has never been solely analyzed. Since the share of virtual water trade linked with China is high, it's of importance to have the perspective from the standpoint of this country (and also more countries with heavy share in the global virtual water trade network). Indeed, we have

several unique findings from this country-level analysis, including dominance of grain crops, the correlation between geographic location and net virtual water import/export, the reemerging of scale-free property in the China-centered network (comparing to the scale-free property in the whole global virtual water network), the high heterogeneity of China's network etc. We believe a country-specific network analysis on big players in the virtual water trade is equally important with the analysis at a global scale. Also, country-specific analysis is of special importance to assist national policy-making process. We appreciate the efforts of introducing innovative approaches like complex network analysis to provide new insights into virtual water research and we hope to contribute to this exploration and spur more and deeper researches and discussions along the direction.

Discussion: I would eliminate the section 4.3. I don't see the point of ending the manuscript with a discussion on what has not been included in the manuscript "due to data and time limitations".

We agree with the review and have eliminated section 4.3.

Minor points:

a) P. 11614, line 2: please, delete "unconsciously". We have deleted "unconsciously".

b) P. 11615 line 19: Please, delete "was the first to use". Carr et al (GRL, 2012) was published at the same time. Please, correct this reference in the reference list (publication year: 2012). We thank the review to point out this mistake and have made the correction.

c) P. 11618, Line 25: I would refer to climate fluctuations instead of "fluctuation in weather regime". We have changed "fluctuation in weather conditions" into "climate fluctuations".

d) P. 11619: line 3: I am not convinced that "Virtual Water Content" is a good way to call the VW cost of a commodity. "Content" could give the impression that VW is physically

contained in the commodity. However, if this is the way it is commonly called in the literature, I am fine with this expression. Yes, "Virtual Water Content" is commonly used in the literature for now. For convenience and consistence with relevant literature, we will keep this expression.

e) P. 11619 lines 15-17: this sentence states something obvious and could be deleted We have deleted this sentence.

f) P. 11621. Line25-26: this last sentence could be deleted because it is not very informative. We have deleted this sentence.

g) P. 11622: top paragraph: the text here could be shortened. Lines 7-11 could be rewritten as "Grain crops account for 97% of all VW imports". Lines 16-18 could be deleted. The difference between total and average should be clarified. We have revised this part and clarified the difference between total and average.

h) Line 21: "source" could be replaced by "trade partner" We have changed "trade partner" into "source".

i) Line 25: I would replace ", even if less significantly" with "and smaller in volume" We have changed the ", even if less significantly" into "and smaller in volume".

j) Line 27: ". . .been important trade partners for China's exports". We have made the correction.

k) Line 28: "has become" We have made the correction.

l) P. 11623: Lines 4-13: here you could be more concise: you keep repeating thatChina imports from a small number of countries and exports to a much greater number of countries. We have revised this part and made it more concise.

m) Lines 14-22: I would remove this analysis and discussion of scaling properties in network structure. We agree that the scale-free property is under discussed and we have added more texts in the manuscript. We believe this analysis is relevant

and present the k-s relationship to explore the intrinsic characteristics of China's virtual water trade network. We have added the following sentences in the revised manuscript: "Scale-free property shows the existence of trade partners with a degree that greatly exceeds the average ("hubs"). This confirms the high heterogeneity of the network, in line with other network analyses and implies the robustness and weakness of the network, i.e., if failures occur at random and the vast majority of nodes are those with small degree, the likelihood that a hub would be affected is almost negligible;even if a hub-failure occurs, the network will generally not lose its connectedness. However, on the other hand, if the very few trade partners with heavy degree are removed, then the pattern of the network would be significantly changed, which is not at the favor of a steady food supply chain." Also, the identification of the network property is helpful to contribute to building models for projecting the future evolvement of the network.

n) Line 28 What is the "absolute" deviation? The absolute deviation of an element of a data set is the absolute difference between that element and the mean value of the data set. We have clarified this in the revised manuscript.

o) P.11625. Lines 19-28 could also be deleted. We have revised this part.

p) P. 11626: Lines 25-29: this part needs to be explained better. There is the need for a reference to support the statement about the low production cost of soybean. The idea of water savings also needs to be clarified. The water saved in China goes back to the USA or Brazil. We agree with the reviewer. We have deleted the statement of "low production cost of soybean" for lack of literature at hand. And we have added "it would consume more water if China produced those soybeans domestically" in the manuscript. Water scarcity means a high intensive competition in water use among different sectors. By importing virtual water from other countries, China can save water because water use for domestic production is lower. Such water saved can be used by sectors within China.

q) P. 11627: line 14. The authors mention here "pollution". Pollution should not have

any direct effect on water quantity. We realized this is beyond the scope of this research and have removed relevant part.

r) Section 4.3: I would eliminate the section. We agree with the reviewer and have removed this section.

Please also note the supplement to this comment:
http://www.hydrol-earth-syst-sci-discuss.net/10/C6736/2013/hessd-10-C6736-2013-supplement.pdf

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