Hydrol. Earth Syst. Sci. Discuss., 10, C1138–C1142, 2013
www.hydrol-earth-syst-sci-discuss.net/10/C1138/2013/

Hydrology and Earth System Sciences Discussions

Interactive comment on "Water footprints of cities – indicators for sustainable consumption and production" *by* H. Hoff et al.

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Received and published: 25 April 2013

This paper is a very interesting contribution to the topic of water footprinting. It provides a very good overview of current issues and enhances the analysis by applying a high spatial resolution trade model, that allows analysis of virtual water trade beyond country resolution.

A major shortcoming is the lack of providing detailed results in a format that allows reproducing the results and using them for further research. This concerns mainly the trade model, which is very vaguely described as well as the data in figures 1a-c. The figures are appropriate for illustrating the results but insufficient for further research. The main request is therefore to publish (as supplement) the grid cell results of the

trade for the evaluated crops (individually if possible) as well as the trade balances that have been derived from COMTRADE. This is the minimal requirement for transparency in my point of view. Furthermore providing detail results is essential for enhancing further research in this direction.

Another general comment is that uncertainties of the results are completely neglected. Quantitative assessment might be a major issue and beyond the scope of this study but still it should be addressed qualitatively. Since supplementary files are necessary, this might also be examined outside the main paper and just summarized.

Generally, the paper might be condensed a bit in the discussion and conclusion part where some redundancy occurs.

Detailed comments: Page 2605 lines 20ff: The selected crops cover a large share of global production. However, other major crops such as sugar cane and cotton are neglected. In some countries, the selected crops will be much less than the mentioned 71%. Maybe discuss this issue shortly. Also pasture is neglected which is relevant for meat consumption in the case of green water.

Page 2606 lines 4ff: The assumptions of equal consumption is definitely rather rough (as you discuss below). While urban population might have higher food demand in terms of quality, rural population might have higher consumption since they might feed animals with left overs. I think this is fair for a first approach but might be discussed in further detail for other cases than Berlin For imports I think there might be a relevant difference between rural and urban population due to purchase power and logistics. This might be considered in further detail.

Page 2606 lines 25ff: this is a very complex topic and no detail is provided on how it is exactly done. Here the principal procedure needs to be presented (in the supplement) and also the resulting trade flows. Otherwise the results are not transparent enough.

Page 2607 lines 2ff: here it is indicated what has been done for German Coffee but

not explained in detail (comment above). The question of processing and losses in reexports has not been discussed (I think discussing it is enough)

Page 2608 lines 13ff: It would be interesting to also consider the balance of individual crops since some cells are importer and exporter at the same time (through different crops). As suggested above, this can be provided as raster files as supplement.

Page 2609 lines 11. I think it is important to mention that also pastures, cotton, sugar cane and palmoil are not considered. Based on Pfister et al 2011 (in the references) cotton contributes around 4% of total blue water consumption in crop production (number 5 crop out of 160) and is especially important for imports. Based on the same reference, Sugarcane is number 5 crop in total water consumption and number 6 in blue water consumption. Palm oil is number 11 for total water consumption. I think this could be mentioned here (especially cotton). In addition to table 1 it would also be interesting to have a table with country / crop virtual water imports for each city (like provided in aggregate form in figure 3).

Page 2609 lines 15-17. For the distances of blue water it is the opposite picture for the comparison of Lagos and Berlin.

Page 2609 lines 21ff. This factor 10 has also been shown in the results of the study by Pfister et al 2011 (same range of values for maize in table 2) and therefore seems robust. In order to better understand the factor for different water productivity i think adding the related yield in Table 2 would help to directly understand this.

Page 2610 lines 17ff. Since Berlin has only blue water footprint of 15m3 per capita and year cotton might be dominating the result, since global average blue water footprint of cotton production per capita and year is also around 15m3/year and capita based on Pfister et al. 2011 and therefore is probably higher in Berlin (as cotton consumption is supposedly higher in Europe than on world average).The comparison with 115L/d personal water use is interesting. However, i think this is domestic water use and not drinking water as noted in the paper (e.g. incl. toilet flushing).

Page 2610 lines 24. This is due to the selection of crops. Tea, which is in consumed India, has on the global level total water consumption which his 25% of the one from coffee and therefore Delhi might have a relevant water footprint from tea consumption.

Page 2613 lines 6ff. The rainfed share might be overestimated. Based on results in Pfister et al. 2011 blue water is more than 2% and might be around 10% of total water consumption in Brazil soy production. I suggest to check some literature estimates here.

Page 2613 lines 19ff. Cocoa is partially irrigated in these countries although the majority not

Page 2615 lines 25ff This is why Ridoutt and Pfister 2010 (ref in paper) suggested using the change in green water consumption only in water footprinting.

Page 2617 lines 20ff This is also an economic issue.

Page 2619 lines 27ff Monea also contributes to improved water productivity (management).

Page 2621 lines 6ff. This is not completely true. Feng et al. 2011 (http://dx.doi.org/10.1080/09535314.2011.638276) compared bilateral trade and MRIO based water footprint analysis. I think this has to be added but agree that more work is required.

Page 2621 lines 17ff. Similar to Galli et al. (from a ecological footprint perspective) the issue has also been addressed from a carbon footprint / LCA perspective (Ridoutt and Pfister 2013, DOI: 10.1111/jiec.12026) also suggesting a celar structure of footprints without overlaps (especially also from a product labeling perspective).

Figures 4a and 4b Quality of this figures needs improvement. Since it allows comparing modeled and reported data, the reported data area should be clearly drawn into the maps on the left side of the figures.