

Interactive comment on “Assessing water footprint of wheat production in China using a crop-model-coupled-statistics approach” by X. C. Cao et al.

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1. We sincerely appreciate and accept the comments 4 and 6 to 19. The quality of our manuscript would be promoted significantly if revised according to these comments.
2. (Reply to the 1st paragraph and comment 1) Previous water footprint for farm crops is quantified by calculating the field crop water requirement (CWR or called potential ET) due to the lacking of data. The result is not in conformity with the actual situation in most cases, such as Perry (2014) queried that:

For irrigated crops, the assumption that crop ET from whatever source is equal to

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potential crop ET is incorrect for any crop that yields significantly less than potential. When plants are stressed, transpiration slows, so that actual ET is less than potential ET.

Potential ET calculation is climatologic and hydrological analysis rather than water resources utilization evaluation. We are also aware of this issue. Potential ET is the basis of making irrigation regime, but not the representation of actual water use. Authors of this study spent a long time to collect data, especially data in irrigated land, in order to make the result close to the actual situation as far as possible, by using the CROPWAT-coupled-statistics approach. We think that collecting the irrigation data nationwide is a 'new thing' of this manuscript.

3. (Reply to the 1st paragraph and comment 1 to 3) It is expounded in 'The Water Footprint Assessment Manual – Setting the Global Standard (P46)' that the water footprint of a product is defined as the total volume of fresh water that is used (directly or indirectly) to produce the product (Hoekstra et al. 2011). 'WF is the field ET' is the current research actuality but not the meaning of the water footprint. We deem that it make sense to include the conveyance water loss in the WF estimation. Arguments put forward for this view are: 1) irrigation water for filed crop evapotranspiration could not be satisfied if some more water withdrawal for 'loss' has not been supplied by the reservoir or the headwork of irrigation district, 2) the part of water conveyance loss can neither be reused by crops during their growth stages, nor sever departments of social economy in general, 3) it has the feature of commodity and farmers are requested to pay for it in most cases, 4) the amount of this portion of water resources is sizeable and should not be ignored, and 5) the conveyance water loss in crop growth period is also taken into part of water use for crop production in traditional agricultural water management evaluation, and two important water productivity (WP) indices are defined as (Kijne et al., 2003; Playan and Mateos, 2006; Jensen, 2007; Cao et al., 2012):

$WP = \text{crop yield} / \text{gross irrigation water}$

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$WP = \text{crop yield} / (\text{gross irrigation water} + \text{effective precipitation})$

We believe that the 'water footprint' is comprehensive and useful index (even it is questioned by scholar) for measuring the relationship between water resources utilization and agricultural production process, and it provides a new approach for assessing water resource utilization in agriculture. Water footprint assessment should not be divorced from or fall behind the mainstream agricultural water utilization research. So, we argue that far from 'taking the conveyance loss into account in the WF estimate is wrong', it is an interesting and meaningful exploration, also a 'new thing', for crop water footprint assessment.

4. (Reply to comment 5) We admit that the discussion about the estimate is not deep enough and systematic enough.

The study period in Mekonnen and Hoekstra (2010) is 1996-2005, while our study year is 2010. Their values (67 and 64) are incomparable since the study period is different.

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