Interactive comment on “Marginal cost curves for water footprint reduction in irrigated agriculture: guiding a cost-effective reduction of crop water consumption to a benchmark or permit level” by Abebe D. Chukalla et al.

Reply to Anonymous Referee #3

We thank Referee #3 for the comments; below we give the reply to the comments.

Comment

The authors discuss an important topic about a modelling approach rather than expert based approach to deriving marginal cost curves for irrigated agriculture. Their paper has a lot of data and detailed analysis and the method they offer seems to be relevant and to work. It involves a lot of data and assumptions and would seem to be laborious in any actual application, although one could envision a software package that would make the computations easier, assuming the data could be obtained.
The authors published a paper on the same general topic in this journal, and this work would seem to be an extension of it. I have no detailed comments on the methodology, which seems to be straightforward and mainly to use a software package to simulate a lot of scenarios and then plot the resulting cost curves. I judge the work to be of publication quality.
I think the article merits publication. My suggestion is to add some text to explain how this work can be used. Who will use it and for which decisions? Is it simply a model exercise meant for the research literature or can the work be translated into action programs?

Reply: the current study indeed extends our previous work on green and blue WF reduction of irrigated crops (Chukalla et al., 2015). The modelling approach in deriving marginal cost curves relates to the yield response to field management, water stress and local conditions. The consideration of a large number of combined management options led us to use modelling to assess effects of field scale measures and their interaction, as field experiments are limited in covering such combinations; here we draw from Chukalla et al (2015). The calculation of marginal costs of WF reductions is methodologically straightforward. The derivation of plausible WF reduction pathways requires insight in the agronomic plausibility of successive implementation of field scale measures. Next, the derivation of the marginal cost curve for WF reduction again is in itself straightforward but still uncommon in the WF literature.
The previous paper estimated the WF reduction of different measures and combinations of measures. The current paper, through the MCC, shows the cost-effectiveness of measures and combinations of measures. Therefore, the current paper gives important information for decision making on WF reductions by farmers, using both the cost and physical effect to rank measures. As the referee suggests, it is important to show how the work can be used, who can use it, and for which decisions it can be used; this is explained in the paper in section 3.4: the application of the marginal cost curve.
In reaction to a similar comment of referee #2 we will address in the revised paper the relevance of the work for farmers, companies in the food and beverage sector and water managers. The MCCs presented in the paper are of interest to farmers who are seeking to or incentified to reduce crop water footprints in their production practice. They are of interest of companies in the food and beverage sector that increasing formulate water efficiency targets for their supply chain and that are seeking to stimulate

farmers to reduce their WF. Finally, the MCCs are of interest to water managers responsible for water allocation and supply to irrigation farming, providing them with information on the costs to farmers if they reduce WF permits to farmers.

References:

Chukalla, A. D., Krol, M. S., and Hoekstra, A. Y.: Green and blue water footprint reduction in irrigated agriculture: effect of irrigation techniques, irrigation strategies and mulching, Hydrol. Earth Syst. Sci., 19, 4877-4891, 10.5194/hess-19-4877-2015, 2015.