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Interactive comment on "A site-specific agricultural water requirement and footprint estimator (SPARE:WATER 1.0) for irrigation agriculture" *by* S. Multsch et al.

Anonymous Referee #1

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The paper describes the model SPARE:WATER 1.0 which was developed to calculate water footprints of crops in irrigated agriculture. The manuscript is well written and the content fits well to the scope of the journal. However, some aspects require improvement or clarification before the manuscript may be considered for publication:

1.) The model presented here is computing blue, green and gray water requirements of crops in relatively high detail. In contrast, crop yields are not computed by the model but need to be provided as input data (Table 1). The authors should discuss which consequences this setup may have on the computed water footprints. In irrigated regions crop yields often show a strong response to the performance of the water

supply system. Any shortage in water supply would be reflected in crop yields (since yields are taken from the statistics) but it would not affect crop water requirements because these requirements are computed by the model without considering water availability.

2.) In the introduction and the discussion section authors describe other models used for similar purposes and explain or discuss differences to the model presented here. Such a comparison is required and highly appreciated. However, I miss a reference to FAO AQUACROP in this comparison because FAO AQUACROP is likely the model which is most similar to the model presented by the authors. In addition, it seems that the authors confuse model extent and model resolution when comparing their model to global models. The global models mentioned by the authors (H08, GCWM, WFPN) simulate crop yields and crop water requirements at a spatial resolution of 5 arc minutes at global scale. It's therefore a matter of the presentation of results whether crop specific water requirements are made available for each single country and territory but it's certainly not an issue of missing spatial detail as suggested by the authors (e.g. on pages 663 and 664). It is also very obvious that the water footprint computed for Saudi Arabia will differ a lot from global averages, mainly because of different climate and different crop management. Therefore I don't see a value in comparisons like the one presented in Figure 7.

3.) The authors apply their model for Saudi Arabia to demonstrate the capabilities and to compare the model output to results obtained from other models. I miss a discussion on how a successful application of the model in Saudi Arabia can suggest that the model can be used for other countries as well. In many aspects Saudi Arabia is a very specific case. Agriculture is completely relying on irrigation, climate is extremely arid and irrigation water is mainly withdrawn from fossil aquifers. I would highly appreciate some guidelines on how to adapt the model and the required input data when applying the model in other regions where irrigation is used supplementary, salinization is caused by high groundwater tables and water logging instead of saline irrigation water

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or regions where winter rains wash out the salt accumulated in the soil by irrigation in the summer season (e.g. the Mediterranean region).

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