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Discussions

Interactive comment on "Green and blue water footprint reduction in irrigated agriculture: effect of irrigation techniques, irrigation strategies and mulching" *by* A. D. Chukalla et al.

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This paper presents the results of an interesting and comprehensive simulation study using AquaCrop of the impacts of environment and management practices on crop water consumption and yield, with the results presented as water footprint (WF) of blue and green water. The methods were adequately described, with a couple exceptions (below). The results are well-presented and understandable. In general, the results are as would be expected from past work and general understanding of the physics. I compliment the authors on posing the problem in terms of water consumption rather than irrigation water applied.

As the authors point out, the effects simulated are essentially the result of differences in simulated surface evaporation. Thus, the ability of Aquacrop to correctly simulate surface evaporation is critical. Although AquaCrop has been extensively validated, it is not clear that the surface evaporation component of the model has been sufficiently validated. The authors should provide references or other evidence that the surface evaporation component is accurate under at least some of the conditions simulated.

The study assumes 80% surface wetting with furrow irrigation. The most common furrow configuration in the U.S. would be alternate furrow irrigation, which results in about 50% surface wetting for most irrigations.

The irrigation strategies need better rationalization and description. The fully irrigation strategy of irrigating at relatively small depletions (20 – 36% of RAW) would result in very high irrigation frequencies which would be impractical with furrow irrigation. Since RAW is, by definition, the depletion level for minimal stress, why were smaller depletion levels used? The deficit irrigation strategy is not defined. Was it based on a depletion level or reduction in ET? The results indicate very little reduction in ET or Y with deficit irrigation, indicating very minor deficits. Supplemental irrigation is defined as limited applications, although the stated replacement of full depletions to FC whenever the depletion reaches RAW would be a common practice for full irrigation. Figure 6 indicates that, for this condition, only 21.5 mm of supplemental irrigation was used, and the deficit treatment reduced irrigation by only 14.4 mm. These are extremely small changes.

Provide information on the percent covered by mulch in the simulations. It appears that 100% ground cover was used? This is not a feasible practice for furrow or sprinkler irrigation (or rainfall), and is not the normal practice for synthetic mulches.

For me, presentation of results in terms of WF clouds my evaluation of the simulations. The simulation of yield and surface evaporation are relatively separate processes. Thus, when small differences in WF are reported, it is difficult to know if it results from changes in yield or evaporation.

It is difficult to understand the first sentence on P 6960.

Figs 2 and 3: These figures appear to present yields at some moisture content of the yield. Since potato and tomato are mostly water, the graphs indicate very high yield and low WF, and maize with low yield hand high WF. Are moisture contents normalized to a standard value (for example, maize yield is often normalized to 15.5% moisture in the U.S.). Only if the yield is represented in terms of dry matter can the crops be compared. This would also allow graph scales that can be read.

I am concerned that these results show yield with less than 200 mm of ET. I do not believe you can produce a consistent yield for these crops in an arid or semi-arid climate with less than 200 mm of ET. In my semi-arid environment with drip irrigation, maize requires about 200 mm of well-timed transpiration to produce the first unit of yield. I recognize that these results represent a wide range of climates, but I do not expect yield production at very low ET values, and thus question the validity of AquaCrop in this range.

Figs 4 and 5: Define the meaning of the colored lines.

Fig 7. Define which figure (b, c) is for which treatment (deficit, full). Was synthetic mulching simulated only for drip and SDI irrigation? I don't understand your explanation for the lower impact of SDI than drip under full, no mulch conditions. This indicates to me a problem in the simulation.

Interactive comment on Hydrol. Earth Syst. Sci. Discuss., 12, 6945, 2015.