Hydrology and
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Discussions

# *Interactive comment on* "Water savings potentials of irrigation systems: dynamic global simulation" *by* J. Jägermeyr et al.

**Anonymous Referee #2**

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Dear Editor and Authors,

In this paper, the authors developed a global map of irrigation system for the first time. The irrigation system was categorized into three, namely surface, sprinkler, and drip irrigation. Then, they modeled the irrigation application of each system and incorporated it into the LPJmL global hydrological model. These works enabled the authors to simulate detailed hydrological simulation in irrigated cropland, which provided new insights into irrigation efficiency of the world.

I believe this study is well designed and presents novel data and results on global hydrology. Although the draft is basically well prepared, I observed some parts are unclear and need revision. See below for detailed comments. I recommend this paper

be published after moderate revision.

Detailed comments

Page 3594 line 5 "due to climate and other biophysical dependencies": The statement is a bit unclear because these terms cover quite broad range of aspects, particularly the latter part. Specify (narrow down) what were explicitly taken into account in this modeling. I observe this study mainly dealt with irrigation water partition into transpiration, evaporation, interception, and return flow.

Page 3594 line 8 "dynamic representation of three major irrigation systems": I have read this draft three times, and I am still confused what "dynamic representation" stands for. The term "dynamic" gives me an impression that something grows/varies by time, but as far as I understand that the irrigation system was fixed during simulations except three sensitivity studies (i.e. All-surface, All-sprinkler only, and All-drip). Do you mean "explicit representation. . ." or "modeled and parameterized three major irrigation systems" here?

Page 3594 line 11 "dynamically retrieved": Similar to above, I couldn't clearly understand what does "dynamically retrieved" indicate.

Page 3596 line 27 "a dynamic simulation of irrigation systems": Again and again, what is dynamic simulation? What is "static" simulation?

Page 3597 line 15 "To our knowledge, besides LPJmL, PCR-GLOBWB is the only global model that calculates daily evapotranspiration and percolation losses per unit crop area based on surface and soil water balance": It is not very clear what this mean. Without surface/soil water balance calculation, actual evapotranspiration couldn't be estimated. For example, the H08 global model (Hanasaki et al., 2008, HESS) solves surface water and energy balance of irrigated cropland (expressed as a sub-grid cell) explicitly.

Page 3600 line 3 "defined as beneficial consumption (Wbc)": What are the differences

between Wbc and T (transpiration)? Clarify the relationship between these two.

Page 3603 line 25 Equation 9: I am curious about the physical meaning of "Wsat-Wfc-Wpwp". Actually, I expected "Wsat-Wfc" here.

Page 3605 line 17 "Development of new input dataset for grid-level irrigation system distribution": This part is one of the most important points in this work, but it seems validation is completely missing. I understand it is difficult to obtain ground-truth data globally, but at least qualitative discussion could be presented for some parts of the world. For example, does the authors' map explain the general pattern of actual irrigation system distribution of Europe?

Page 3607 line 1 "we ran three synthetic scenarios...": Table 2 indicates that some combinations of CFT and irrigation system are unavailable (e.g. rice and sprinkler irrigation). Does Table 2 hold true in the "All-Drip" simulation? If "All-Drip" simulation really assume even rice paddy can be irrigated by drip irrigation, add discussion on the feasibility of implementation.

Page 3611 line 24 "With correlation analyses . . . in spite of multitude of confounding processes": It is not clear what are analyzed here. Apparently the items the authors discussed here are strongly dependent each other (e.g. precipitation and return flow). The items should be "confounding" with no surprise. In the present form, I hardly found Figure 9 informative. Elaborate the intention and results of Figure 9 in detail.

Page 3612 line 8 "for the first time spatially and temporary explicit": What does "temporary" mean here? Possibly, the authors meant that simulations were conducted at daily time interval, but the present expression gives me an impression that the map of irrigation system varies by time, which is not the case.

Technical comments

Page 3602 line 25: "(Rost et al., 2008)" reads "Rost et al. (2008)".

Page 3609 line 18: remove "very".

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