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Hydrology and Earth System Sciences
Discussions

Interactive comment on "Rain concentration and sheltering effect of solar panels on cultivated plots" *by* Yassin Elamri et al.

Anonymous Referee #2

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Review: Rain concentration and sheltering effect of solar panels on cultivated plots

Solar PV installations are rapidly increasing globally due to technological advances and policy changes. Colocating solar infrastructure and crops would provide several benefits and should be explored during the planning and construction of large solar installations. In particular, agrivoltaics, if implemented properly, can maximize the efficiency water and land use. For colocating crops in solar installation we need to understand the impact of large installations on local soil-hydrological processes. However, studies investigating these processes (both field and modeling) are limited. Hence this study is significant and timely.

Here the authors developed a model to describe rain interception and redistribution by solar panels to identify sheltered zones and the zones where effective rainfall exceeds

the natural rain amounts. The angle of rainfall was found to be a key factor determining the spatial patterns of heterogeneity of rain water reaching the soil surface. I am not familiar with type of models used in the manuscript, however they sound reasonable and appropriate for the research question. This study is novel and will help in the implementation of best management strategies for optimum water availability for crop plants under solar. he writing could be improved. Some sections are not clear (For example Lines 93-95) and there are some grammatical errors. I found some sections (e.g. results) and some figures (Figure 6) hard to follow. The quality of figures could be improved.

I have some comments:

1. It will be interesting to see how the heterogeneities develop with random positioning of solar panels during rain events. I would imagine leaving the panels in random positions during rain storms should decrease the spatial heterogeneity of water distribution. If the panels stop moving when the rain starts, they will be at different positions during different rainfall events. This is something worth considering (and more energy efficient).

2. Is there energy expenditure/cost for the avoidance strategies described in the manuscript? It will be great if the authors could discuss about this. Are there any other cheaper water redistribution strategies? I feel like retrofitting the panels with some sort of water harvesting structures to redistribute rain might be a cheaper than installing tracking pv panels. Most of the existing solar installations are fixed ones.

3. How does the avoidance strategies affect the dust management /or cleaning of PV panels. The dust accumulation on solar panels is an key factor affecting power output and often the periodic rains are very effective in keeping the panels clean. This is something to consider along with managing the rain-water intercepted by panels.

4. Discuss other factors like shading by panels, that may be more important for crop production than spatial heterogeneity of water distribution in crop fields. Shading can-

not be controlled as the panel need to face the sun, while water availability could be managed easily by providing additional irrigation. It would be great if the authors could discuss more on the relative role of these two factors. In arid and semi-arid regions, the redistribution of water could be an important factor compared to shading by panels. In fact, in extremely arid regions the crops might benefit from shading.

5. Do the avoidance strategies or controlling the panels to optimize water distribution impact evapotranspiration from the cropped area?

6. Is there a degree of error that is caused by the diameter of the tipping bucket? I feel that 30 cm width for one point of measurement might cause too big of a mesh when trying to characterize the rainfall distribution of a panel that is 1 to several meters wide at most.

7. For Table 3 and Figure 11, it might be helpful to include the porosity of the soil so that the volumetric water content can be viewed in context of relative saturation of the soil.

8. The word "weak" is used too often where the words "low" or "small" may be more appropriate.

9. It will be great if the authors could discuss the applicability of this study to other locations, in particular in dryland regions where most of the large solar installations are sited. Further, most of the existing solar installations are fixed ones.

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