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

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We appreciated the careful reading of the manuscript and the constructive comments. We answer the comments below, and we will include the corresponding corrections in the revised version.

R1: Specific comments: Line 118: What do you mean with "agricultural engines"? "agricultural machinery" and/or "agricultural equipment"?

This will be replaced by "agricultural machinery"

R1: Line 129 and Fig. 1: For a better evaluation of distribution uniformity under the solar panels it would be better to use a grid of collectors or replicate the series of 21 collectors more times along the PV row. The results here reported should be consid-

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ered partial. See also the comment below on the use of coefficient Cv.

We used a second series of rain collectors indeed for event #12. The results we very close to each others in the two series of collectors (see below).

See as attached document: Figure 1 : rain depths (mm) collected in the two lines of collectors ("Ligne 1, Ligne 2) See as attached document: Figure 2 : correlation between rain depths collected in the two lines

Due to the time necessary to collect all the samples, we could not increase the sampling, so we agree to indicate them as partial. The results could be used nonetheless to check the validity of the model AVrain, where no calibration was necessary to fit on the data (for any of the 12 rain events described in the manuscript).

R1: Line 159: You affirm that the tested rainfall intensities are representative of the local data; it would be interesting to know the return periods of them.

We agree about the relevance of this information, which was missing. The following return periods (based on Montpellier airport station statistics) were obtained: 20mm/h :1 year 35mm/h :3 years 60mm/h :16 years 70mm/h :32 years This information will be added in the manuscript.

R1: Line 179: Appendix?

Sorry, the appendix was present in a previous version. We will remove it in the final version.

R1: Lines 194 – 225: Please specify the units of measurement of each parameter.

The units will be added in the final version.

R1: Lines 259-268: I think that the coefficient of variation Cv here cited by the authors is the manufacturer's coefficient of variation or a measure of discharge of a random sample of emitters useful for microirrigation system design. It doesn't describe the uniformity of water distribution by the irrigation system. In this case it is more appropriate the use of the low-quarter distribution uniformity DU also reported in Burt et al. (1997). But in this case it would be better to have data collected in a grid of collectors. The authors are invited to better explain and justify their choice.

There are indeed different manners to estimate the uniformity of application. Notably Christiansen's uniformity coefficient defined as: UC=100%(1-(average deviation from the averagedepth)/(overall average depth of application)) is a widely used method of uniformity evaluation for sprinkler systems (Burt et al. 1997). Our coefficient of variation is merely related to UC: Cv=1-UC The advantage of using UC (or Cv, which is equivalent) is that the uniformity of rain application due to panels can be compared to the one caused by usual spray irrigation systems. It is however interesting to use other uniformity indicators as suggested by the reviewer, such as DU. DU will use the average of the lower quartile, so the rain depths obtained under the solar panels. Obviously, DU and UC (or Cv) are correlated, as also reported in Burt et al. (1997). This can be observed in the attached figure (figure 3). Therefore, both methods will give similar conclusions. The final version will include a remark about that.

R1: Table 1: As regards the Cv see also the comment above. The values here reported are not supported by a proper data analysis.

We agree that these values are not reported in a unique document. The article of Burt et al. (1997) indicates the value of 80% for fair uniformity. It also indicates the linear behavior between DU and CV (equations 14, 15): DU≈1-K Cv with K≈1. Therefore we selected the threshold of Cv= 0.2 for fair distribution. This is supported by other studies using Christiansen coefficient: “Catch can measurements are used to determine the uniformity of a sprinkler irrigation system. Christiansen (1942) developed a numerical index representing the system uniformity of overlapping sprinklers. This uniformity coefficient (UC) is a percentage on a scale of 0 to 100 (absolute uniformity). A uniformity coefficient of 80 is considered by many to be the minimum acceptable performance. Higher uniformity coefficients are usually needed with intensively maintained ornamentals. Catch can measurements are also used to illustrate water distribution or patterns." (http://horticulture.oregonstate.edu/system/files/onn110110.pdf)

The values indicated in the manuscript were taken from ASAE standards (see http://edis.ifas.ufl.edu/ae094 - see table in Figure 4).

Actually, the most interesting information is the threshold to characterize an acceptable uniformity. A value of Cv =0.2 for this threshold is consistent for all papers cited in the manuscript.

R1: Line 349: Figure 5 (Please change. It is not Figure 1) is not clear. Is it related to a calibrwas ation phase? If it describes the results of the application of the avoidance strategy, why the measured and simulated values in F3 are so high?

The figure number has been changed. The data refer to both measurements and simulations, which are consistent. For this event, the wind intensity was very high so the rain orientation (N-S direction) made it impossible to achieve the rain avoidance strategy since the panels can only rotate along the N-S axis. This causes the heterogeneity to remain high whatever the panel orientation strategy.

R1: Results: See the comment on Cv. The authors should revise the parts in which the Cv is cited according to their revision/choice.

The part related to Cv will be changed as suggested by reviewer.

R1: Lines 694-695: The authors must add also the effects of repeated impacts, especially in bare soils, on the soil aggregates with an increase on soil compaction and soil crust formation

These impacts may appear indeed. This will be added as suggested.

R1: Specific corrections: Line 134: "in abutment"; maybe it is better "inclined, oblique, : : :"

This will be changed to "inclined"

R1: Line 219: Please substitute with “0.01 s m-1/3 after Chow (1959)”

This will be corrected as suggested

R1: Fig. 4: Please substitute “granulometric” with “drop-size”

This will be corrected as suggested

R1: Lines 251-253: Not clear. Please check the sentence. Line 254: “present experimental”. Please check the sentence.

These two sentences will be rewritten as follows: “These have shown that the combination of low tilting angles (i.e. primary slopes ïĄąPV<5°) and low rain intensities lead to lateral homogeneities on the edge of the panels. In these cases, this leads to concentrate water fluxes on the lower corner of the panel. However, the impact on the water balance (and its heterogeneity) is limited due to the low magnitude of the corresponding rainfall amounts. is discussed in section 4.1.”

R1: Table 3: Please add the units of measurement to Ïť.

The unit (m3/m3] will be added

R1: Lines 321: A or _?

A will be removed

R1: Lines 355-358: Not clear. Check the sentence.

This sentence will be clarified as follows: “The influence of variable-tilting angle solar panels on rain redistribution was measured thanks to a wide series of rain events covering a full year. For each event, we put a focus on the spatial heterogeneity, which is assumed to be a crucial issue for the hydrological balance of solar panels on crops. This heterogeneity is characterized with the coefficient of variation Cv of rain depths.”

R1: Table 4: -50 à -30_. Please check.

This will be corrected

R1: Line 417: Figure 7 not 2.

This will be corrected

R1: Line 437: Figure 8 not 3.

This will be corrected

R1: Line 471: Figure 9 not 4.

This will be corrected

R1: Line 489: Figure 10 not 5.

This will be corrected

R1: Line 507: Maybe "variation was observed".

This will be corrected

R1: Line 533: Figure 11 not 6.

This will be corrected

R1: Line 602: Figure 13 not 7.

This will be corrected

R1: Line 789: The reference must be moved according alphabetic order.

This will be corrected

R1: Line 861:The correct citation is "Chow V.T."

This will be corrected

Interactive comment on Hydrol. Earth Syst. Sci. Discuss., https://doi.org/10.5194/hess-2017-418, 2017.

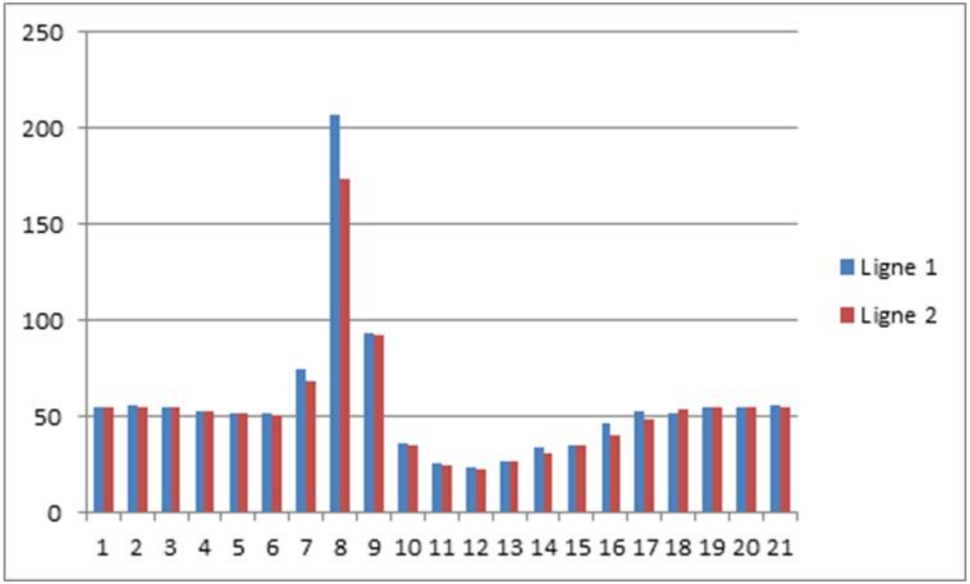

Fig. 1. rain depths (mm) collected in the two lines of collectors (“Ligne 1, Ligne 2)

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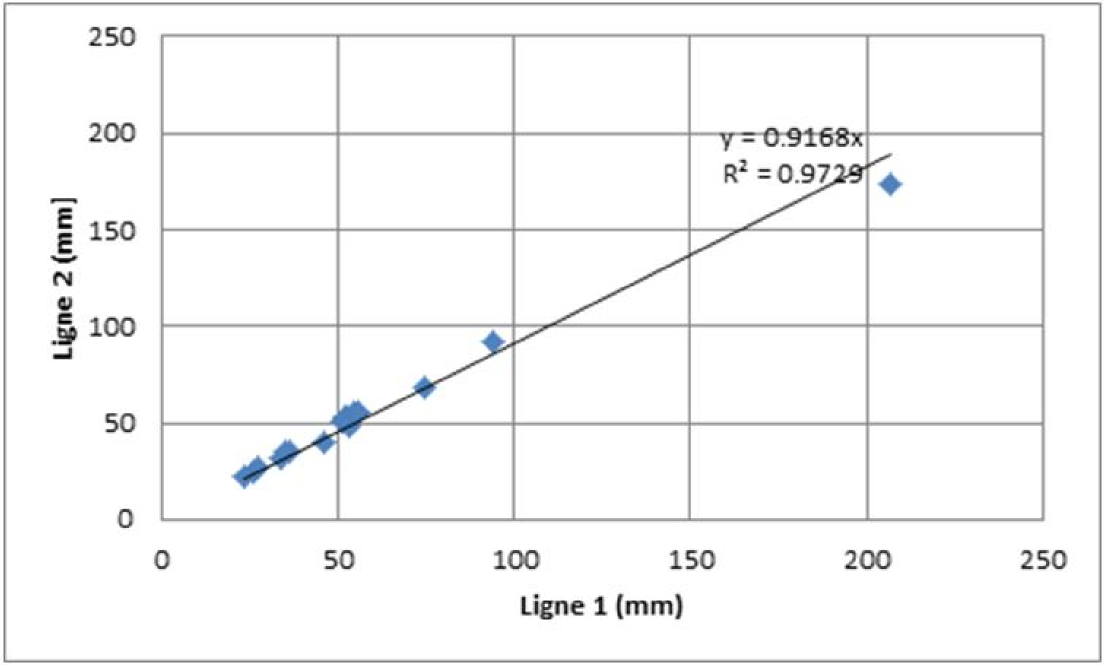

Fig. 2. correlation between rain depths collected in the two lines

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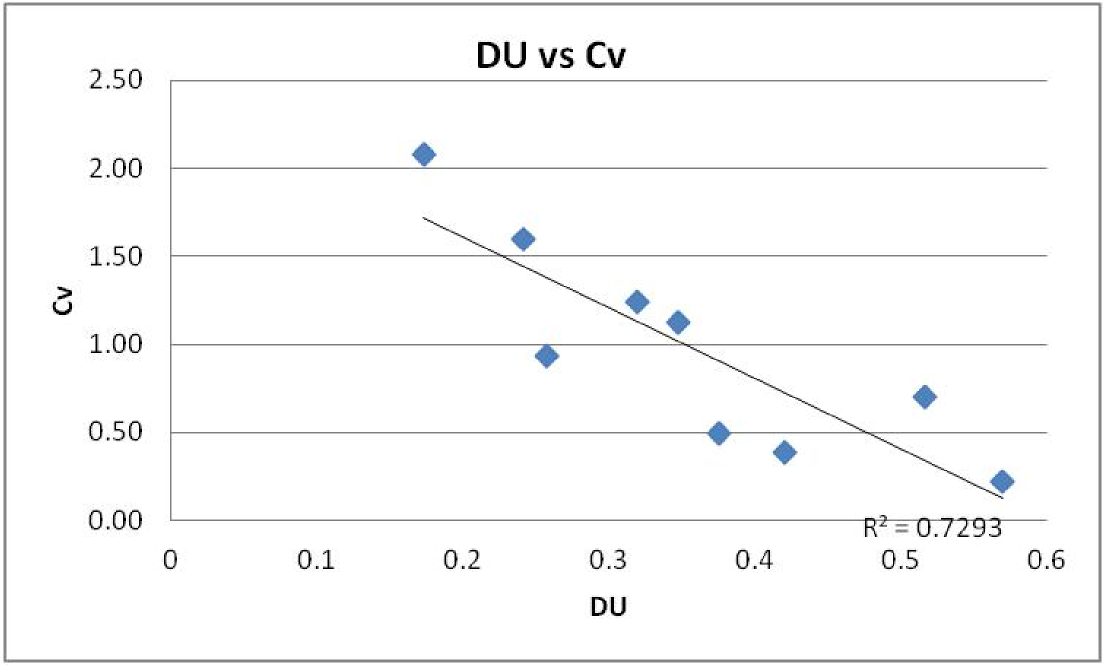

Fig. 3. Correlation between DU and Cv

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Table 1. Microirrigation system uniformity classifications based on emitter discharge rates[1].

Classification	Uniformity, U_s (%)
Excellent	above 90%
Good	90%–80%
Fair	80%–70%
Poor	70%–60%
Unacceptable	below 60%

[1]Adopted from ASAE (1996a).

Fig. 4. Table from ASAE standards (reference values for uniformity)

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