Comments on the manuscript HESS-2018-372

The manuscript is dedicated to the estimation of the influences of a cover crop treatment on some physical properties of the soil in a 10-year field experiment. The research subject is very interesting to assess the convenience of a soil and water conservation practice in a semiarid area.

Overall quality

Nevertheless, the manuscript contains some problems that require a thorough revision. The authors, instead of exploring their field data, apparently prefer to extract some information of the soil water retention curve and of the saturated hydraulic conductivity through inverse methods fitting a hydrological model coupled to those data.
I think that the quality of the raw data is always greater than the use of the output of any model, in particular if the this model systematically predicts a lower ground cover or greater biomass than the corresponding observed values, as Figure 2 indicates.
There are other problems with the interpretation of soil physical parameters as indicated below.

Specific comments

The results shown in Figure 2 can give an 'acceptable' fit, (line, L, 12, page, P, 5), but the data points of the figure are either below, case of ground cover, or above, case of biomass in the two fist plots of the figure. This trend could affect the results.
The time variation of the optimized values of the soil physical parameters shown in Figure 3, can be related to some environmental conditions. As indicated in a previous review this was the case of the van Genuchten soil water retention equation parameter α, in the surface layer, 0-20 cm, for the barley plots. This parameter normalizes the matric component of soil water potential, ψ, in brief matric potential. Using the information of figures 3 and 4, I have plotted in figure 1, below, the optimized value of the parameter α against the annual rainfall, P. The decreasing trend is evident. Why the parameter α can change with the annual rainfall? In principle the parameters of the soil water retention equation do not depend on the rainfall, but the observed relationship of the α parameter with the annual rainfall is more evident than its relationship with the time. The explanation of the manuscript, 'large particle transport (clay transport)' within the soil (L 25-26, P10) is doubtful. Could it be an artifact of the optimization method?

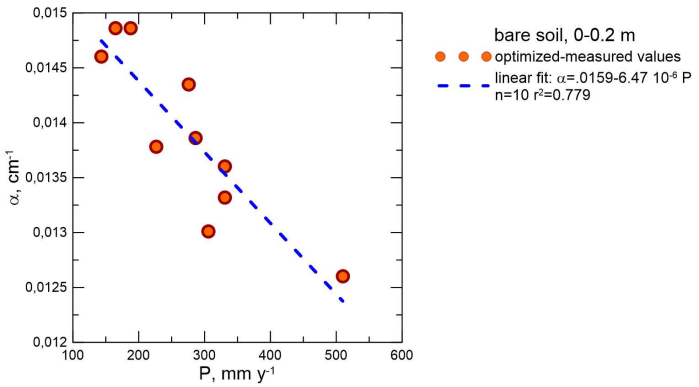

Fig. 1. Relationship between the measured annual rainfall and the optimized value of the van Genuchten parameter α of the soil water retention curve, for the top layer of the barley treatment.

The α parameter is linked to the other parameters m and n, in the original equation of van Genuchten (1980), relating the saturation degree of water in the soil, S, for any water content, θ, with the residual,

and saturated water content, θ_r, and θ_s, respectively,

$$S = \frac{\theta - \theta_r}{\theta_s - \theta_r} \tag{1}$$

with the matric potential ψ

$$S = [1 + (\alpha\psi)^n]^{-m} \tag{2}$$

Van Genuchten (1980) suggested a relation between the m and n parameters to get a closed form equation in the relation between the hydraulic conductivity of the soil and the degree of saturation

$$m = 1 - \frac{1}{n} \tag{3}$$

Kosugi[1] found a further relationship between the parameters α, m and n for the inflection point of the water retention curve, which, with the help of equation 3, characterizes the value of the matric potential at this point, ψ_{IP}, as

$$\psi_{IP} = \frac{1}{\alpha} m^{1-m} \equiv \frac{1}{\alpha}\left(1 - \frac{1}{n}\right)^{1/n} \tag{4}$$

The equation 4 can explain the observation of L 29-32 P 10 of the manuscript.

Why the water balance analysis of the section 3.3 has not been based on the raw data, as, for instance, Palese et al (2014) did? The results of the Figure 4 induce several questions not answered in the text.

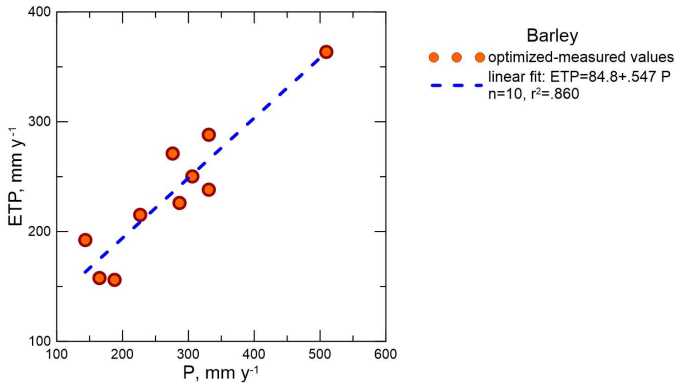

Fig. 2. Relationship between the measured annual rainfall and the optimized value of the evapotranspiration of the barley treatment.

The evolution of the simulated drainage volume of both treatments is roughly parallel, with greater volumes lost from the bare soil treatment than from the barley one. However, during the year 2009-2010, a great difference of drained volume, more than 150 mm, between both treatments was observed: the barley treatment lost less water by drainage than the bare soil treatement. Why? Examining the simulated evapotranspiration plot, one could think that the not drained water was evapotranspirated by the barley crop. If this hypothesis correct?

The manuscript does not inform on the slope of the ground. Was any runoff observed in the plots? Another aspect that deserves some attention is the proportionality between the measured annual rainfall and the simulated evapotranspiration from the barley treatment, very patent in a simple visual inspection of the plots, and more clearly shown in the Figure 2 above. Is there any reason for the apparent proportionality between the annual values of precipitation and simulated evapotranspiration?

With respect to the method of estimation of the evaporation from bare soil, the manuscript indicates that it was computed by the 'multiplication of the reference evapotranspiration by 1' (L18 P5). If I am interpreting this indication correctly it implies that the soil was losing water to the atmosphere without any internal restriction, the stage I of soil water evaporation[2]. Is this interpretation correct? In the affirmative case, why?

Technical comments

Certain terms in the manuscript are imprecise, as 'water availability' written in L23 P1 and in L2 P11, and not defined until L 8 P11.

The field capacity was estimated following Assouline and Or (2014) suggestions in L13 P3, but this estimation seems forgotten in L8 P11, when the value 33 kPa is adopted without any further explanation. Why?

What was the purpose of the measurement of saturated hydraulic conductivity in the laboratory of indicated in L9 P4?

What air entry values were found by the authors (L 30-31 P10)?

The manuscript needs a revision to repair some formal defects. For instance, the sentence in L9 P10 is repeated in L10 P10. Some sentences reiterate certain terms like 'parameters' in L 29-35 P2. The sentence in L 22-23 P 6 is obvious.

Additional references

[1] Kosugi, K. 1994. Three-parameter lognormal distribution model for soil water retention. *Water Resour. Res.* 30:891-901.

[2] Or, D., Lehmann, P., Shahraeeni, E., Shokri, N. 2013. Advances in soil evaporation physics. A review. *Vadose Zone J.* doi:10.2136/vzj2012.0163.