In the following, comments by Referee#2 are indicated with [R#2] and replies by the author are indicated by [K].

[R#2] *This paper applies the maximum entropy production (or maximum power) principle to a relative simple model of the unsaturated zone. It determines the power in each grid cell of which the spatiotemporal mean is taken. This is done for different values of Ksat and it appears that two maxima in power exist. Subsequently, a conceptual model is described and from the spatiotemporal mean of the fluxes and of power an effective conductance is calculated. Interestingly, the two optimum values of Ksat collapse into a single value of the effective conductance. Both analyses are done for a case of homogeneous Ksat and a heterogeneous Ksat field. This is an interesting paper and eventually worth publishing. However, some more clarification and rewriting are needed before that.*

[K] I would like to thank the reviewer for the constructive comments, questions and suggestions, which help to improve the manuscript.

[R#2] *For example, I was especially confused by the conceptual model (Fig. 5). This model is presented as being the same model as in Kleidon and Schymanski (2008) and Westhoff et al. (2014). However, in their models there is competition between runoff and evaporation which is missing in Fig. 5. But I was even more confused, because Kleidon and Schymanski (2008) and Westhoff et al. (2014) optimized their conductance within the framework of their model, where for each value of the conductance the power is calculated. In this paper, the maximum power principle is used to come to a macroscopic head difference and a macroscopic conductance that can replace the microscopic heads and the microscopic K(theta). This is a completely different methodology to get the macroscopic parameters. I suggest to better communicate this in the revised version.*

[K] In my opinion, the conceptual model is the same as in Kleidon and Schymanski (2008) and Westhoff et al. (2014). In the presented study, there is competition between the net flux (between the recharge and discharge zone) and evaporation, equivalent to the competition between runoff and evaporation in e.g. Westhoff et al. (2014). Note, neither the net flux nor evaporation are prescribed in the simulations; both are a function of the non-linear hydrodynamics of variably saturated flow, and the reciprocal, nonlinear dependence of evaporation on the moisture state of the shallow subsurface and the atmospheric forcing. This has been discussed in the reply to Referee#1 and will be repeated below for completeness.

The conceptual model is perhaps better reflected in the figure A below with a connected, dual bucket model, which may replace figure 5 in the revised manuscript. Here, the recharge and discharge zones are represented with buckets having a high and low hydraulic head Hh and Hl, which are connected through an interface with a conductance λeff.

I agree that the proposed methodology is completely different, because no fluxes, etc. are prescribed in the microscopic simulations, which lead to maximization of power purely from the non-linear competition between variably saturated subsurface flow and evaporation driven by an atmospheric time series.

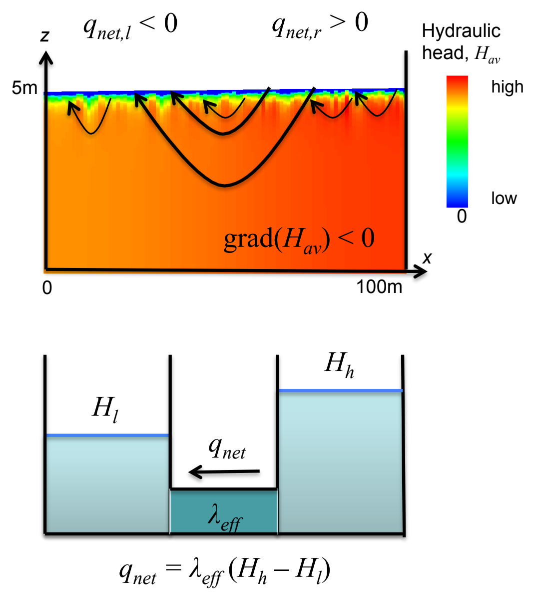

Figure A. Conceptual approximation of the "microscopic" hillslope model with a connected, dual bucket model.

[R#2] *Besides this I also miss a verification of the macroscopic model: Once the optimum macroscopic parameters have been defined, run the macroscopic model with the same climatic forcing as the microscopic model and compare the resulting fluxes with the microscopic model. This may also shed more light on the fact that two optima of Ksat collapse into one optima in lambda (why this happens is still unclear to me).*

[K] The macroscopic model is macroscopic in space and time at dynamic equilibrium. Non-linear variability can not be resolved. Thus, it can not be applied to the hourly climate forcing and simply be validated with the microscopic model. At this point the goal was to suggest a methodology to arrive at a macroscopic model including a macroscopic force, which is otherwise unseizebale. However, at this point, it is not clear how to validate this macroscopic force or effective conductance coefficient, because both are not measurable quantities. The results shown in figure 7 suggest that the mean hydraulic head at the bottom of the flow domain, which can be measured in the field, may be a good indicator of the effective state of conductance. Similar indicators are required for the effective force in order to ultimately validated the macroscopic model and make the model useful for predictions in future.

The collapse of the Ksat into one optima in lamda is due to the fact that the effective exchange coefficient does not increase monotonously with Ksat (figure 6b). The conductance of the macroscopic system decreases as soon as the groundwater reservoir falls dry (grey area in figure 6a). This is to the nonlinear dependence of the relative permeability on the degree of saturation, which is described by the van Genuchten relationship in the model.

[R#2] *P5127, L25: add a graph with time series of the forcing*

[K] The atmospheric time series consists of 8 forcing variables (long-/shortwave radiation, precipitation, air temperature, 2 wind speed components, specific humidity, barometric pressure). The plot will be provided in the revised manuscript containing exemplarily time series of precipitation and air temperature.

[R#2] *P5131, Eq. 10 and 11: Power cannot be summed. Instead the mean should be taken, so it should be divided by NT and NK.*

[K] This will be reconciled in the revised manuscript.

[R#2] *P5132, L7-13: To make this point clearer, I suggest adding a similar figure as Fig.1 but than for a dry and a wet period in time.*

[K] This will be included in the revised manuscript.

[R#2] *P5133, L1: The zone of net inflow is not necessary a net exporter of power. Rephrase to 'incoming water produces more power than outgoing water' or 'incoming fluxes are driven by larger gradients than outgoing fluxes P5133, L3: Are the different zones related to the part they cover at the pf-curves (e.g. convex or concave parts of the curve)?*

[K] This will be rephrased.

[R#2] *P5133, L22-23: If the cross-section is taken a little bit to the right or left, the P values will be much larger in the groundwater reservoir.*

[K] This is correct, but the general shape will be very similar or the same.

[R#2] *P5133, L27: Why does the spatiotemporal mean darcy flux change with changing Ksat? The input (rainfall) and output (evaporation) of water is fixed, so the total mean flux should remain constant.*

[K] Because the mean Darcy flux is function of the Ksat at dynamic equilibrium.

[R#2] *P5135, L20- P5136, L3: I suggest to move this part to the introduction, since it explains the objective of the paper much better than currently.*

[K] This is a good suggestion and will be revised.

[R#2] *P5137, L11-14: I don't understand this explanation*

[K] Lambda does not increase monotonically with Ksat. When the groundwater reservoir falls dry lambda decreases with increasing Ksat.

[R#2] *P5138, L1-7: I don't understand this part. Please be more specific: e.g. to which* *subfigures are you referring? Do you mean that the slope of lambda in increasing monotonously?*

[K] Here I was trying to explain which effective parameter is responsible for the maximum in the power. The explanation will be revised with clear references to the different subfigures.

[R#2] *P5140, L4: Power can indeed not be measured directly, but suction heads and K(theta) can. With this, power can be calculated (although I recognize that these observations are point measurements, while in real hillslopes macropores are also present)*

[K] This is correct, but I validation with point measurements will be very difficult.

[R#2] *Fig. 3: Indicate in Fig. 2 which cross-section is taken for this figure.*

[K] This will be done in the revised manuscript.

[R#2] *P5126, L18: Two maxima in power were found, but for different conductance values (and unique climatic forcing)*

[K] Will be corrected in the revised manuscript.

[R#2] *P5127, L20: If PF.CLM provides evaporation, than net radiation, sensible heat and ground heat fluxes are not needed for this exercise.*

[K] CLM calculates iteratively evaporation based on closing the energy balance Rnet = LH + H + G. Therefore the energy fluxes are needed.

[R#2] *P5128, L6: remove the percentage sign?*

[K] Will be reconciled in the revised manuscript.

[R#2] *P5128, L12: 'and of . . . at the top': rephrase*

[K] Will be rephrased in the revised manuscript.

[R#2] *P5129, L12: PCP: keep to the conventions of HESS: Variables consist of one letter/ symbol and the rest in sub- or superscript (applies also to other variables)*

[K] Will be corrected in the revised manuscript.

[R#2] *P5129, Eq. 4: add the overflow terms*

[K] Correct, they will be added in the revised manuscript.

[R#2] *P5133, L8-9: The stair-step like representation can also be seen as a numerical artefact.*

[K] It is a numerical artifact in the sense that it is a result of the finite difference approximation in the realm of discrete mathematics.

[R#2] *P5134, L26: What is meant by 'correct location'?*

[K] More data points are needed with respect to different Ksat to resolve the discontinuity more accurately.

[R#2] *P5136, L24: the maximum at log(Ksat) = -3 is difficult to see in Fig. 6a. It rather seems to have a maximum at the edge of the parameter space.*

[K] I checked the values again and the maximum is located at log(Ksat) = -3.

[R#2] *P5138, L9-10: please rephrase. There exist a maximum in power in the MATHEMATICAL model of the hillslope.*

[K] Will be rephrased in the revised manuscript.

[R#2] *Fig 1: Indicate that blue is relatively dry and red is wet (or use a logarithmic scale).*

[K] This will be revised.

References

Schymanski, S. J., Kleidon, A., Stieglitz, M., and Narula, J.: Maximum entropy production allows 10 a simple representation of heterogeneity in semiarid ecosystems, Philos. T. R. Soc. B, 365, 1449–1455, doi:10.1098/Rstb.2009.0309, 2010.