Hydrology and
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Discussions

Interactive comment on "Leaf-scale experiments reveal important omission in the Penman-Monteith equation" *by* Stanislaus J. Schymanski and Dani Or

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Review Schymanski and Or Hess

A wonderful paper which definitely is worth to publish in HESS. It is great that the lab of Schymanski and Or have the possibility to do fundamental research: it is amazing to see how artificial made leaves with known conductance are tested in wind tunnels to finally address if one of the most used equations in hydrology is correct or not. I definitely support to publish this paper. In general, I think that the authors could show more results and make some extra interpretation on that in the discussion. This might overlap with the planned technical note, but it would strengthen this paper.

i) Abstract: L9: you report two errors in the PM, without telling which ones (leaf exchanges of sensible heat and longwave radiation). Please add them, a reader would like to know what is missing.

ii) Also in the abstract I would like to see a statement that the error can be enormous. For instance, in Fig 7,8 the authors report differences in modelled vs observed ET and H of up to 100 W/m2

iii) Minor point: Figure 1, you write the Eq Rs=El+Hl+Rll, while in the text you write Rs=Rll+Hl+El

iv) There are some inconsistencies in reporting units in the main text. I mean all units are correct but are not reported. I would be in favour that all variables if introduced for the first time should have a unit. For instance, no unit is given for Rs, while El (L71) does have a unit.

v) L. 80-84, This part is introduced to fast. I do not understand this sentence... you introduce hc here (convective transport coefficient) What do you mean with leaf boundary conductance (the leaf boundary layer conductance to sensible heat is gsw (ant not hc)

vi) I think it would be good to end chapter 2 with a new section (2.5) on the comparison of the different models (Rlin, MuC,PM, MU) and that you finally want to compare numerical solutions with PM and your new derived analytical solution (Rlin). This means that the part from the results L258-264, which are actually methods, should be incorporated in this new section (2.5). It will help the reader what he/she can expect.

vii) Make new section 4.1: I think that the results should be divided in two parts. First 4.1 in which the data are compared to numerical solutions. In that sense I also would like to incorporate the data wind speed against H and ET measurements and numerical solutions. In this section it would be good to link back to Figure 1, were they show that H, ET are dependent on wind speed and Rs and Rll not

viii) Make new section 4.2: In section 4.2 you then can compare the different models. If possible I would like to see 4 graphs (35 pores/mm2 against wind speed, 7 pores/mm2 against wind speed, 35 pores/mm2 against VPD, 7 pores/mm2 against VPD). If they are not measured then only the 35 and 7 against VPD and 35 against wind speed. In this section I hope that the authors can tell a little bit more on the general behaviour of the models and why there is a clear order of over/under estimation depending on the models used. The authors could do that by also showing the resulted Rll ((Eq2) versus Eq. (23) and as a result also the difference in Tl for the different models. Then I hope it becomes more clear why the PM, MUc,MU over and/or underestimate.

ix) Minor point: Results (L257). Here we only report two experiments under varying vapour pressure. This is true for Figure 6, but not for Figure 7 as here you also report an effect of different wind speeds. Please add that.

x) Minor point: I am not in favour of saying that most of the results will be presented in a technical note

xi) L 288, again two errors without clearly telling which ones.

xii) L 292: The discussion directly continues in observations which are not shown, while I think that the authors could discuss the observations which are presented. Especially why some models over/under estimate the results is important to address and important for the readers of HESS

Appendix: It is a real pleasure that, as far I can see, all equations and units are correct. One minor detail, the alphabetic order of variables in table A2 is not completed, for instance Reynolds numbers and Prandl number. Therefore difficult to find.