

Interactive comment on “Generalized combination equations for canopy evaporation under dry and wet conditions” by J. P. Lhomme and C. Montes

Anonymous Referee #1

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General: This paper describes theoretical developments in Penman-Monteith evaporation in canopies; specifically a formulation based on aggregation of discrete canopy elements. Application of the formulation requires simplifying assumptions, which are evaluated for their ramifications in the context of some idealized conditions. I reviewed from the perspective of a hydrologist rather than physicist, and as such some steps in the derivations were difficult to follow in all detail (some specific comments below). The manuscript would benefit from improved organization to highlight the specific theoretical explorations of this work as compared to several similar previous publications from the same group: it is at times difficult to discern which are the new developments and motivations (some specific suggestions below). The significance of the paper is the development of hypothetical behavior of aggregated canopy elements, and in doing so

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it presents several interesting sub-hypotheses that deserve exploration in both further theoretical work and in the field.

Specific comments: 1. The abstract should provide conclusions about the behavior of the formulation rather than simply indicate that simulations are carried out. I suggest the most important are P10958L14 and P10958L19.

2. (P10947L13) The definition of A_i would benefit from clarification. This is the available energy at element i within the canopy, correct? Table A1 uses the words "energy of" but I think it is better to say energy "at" to indicate incoming (external energy)

3. (P10950L16) Theta is a critical concept and could be made more clear. First, if I understand it correctly, it seems it would be more appropriate to write it as $\theta(i)$ to indicate it is a smooth function evaluated at element i . As written now it implies there is a θ for every i . Second, it would be valuable to describe what you envision to be the likely structure of θ . For example is it simple $\theta = \exp(kx)$ as in Beer's law? How can we estimate θ in the real world, which is to say, how can we ever measure something to test whether this assumption is correct? I suspect θ is not a simple function and probably requires a stochastic formulation.

4. (P10956L22) Multiple-layer formulations have already been published. I would like to see how this new element-based discretization can perform outside the layer concept. I do not immediately see how to do that, but perhaps some comments about the possibility are appropriate.

5. I suggest leading the Results (4.2) with the statement P10958L12-13. However, I also think it is worded too strongly. Neither the theoretical basis of Eq 7 nor Fig 2 itself are tested with field data, so it is better to refer to differences among predictions as hypotheses.

6. Another caveat for interpretation (P10959L6-10) is that the evaluation was done without addressing sensitivity to assumed canopy conditions. I also think by collapsing

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the canopy element concept to layers, the simulations are in a restricted theoretical space: that could be discussed in more detail.

Technical: Many places: “supposed” should be replaced with “assumed” to avoid confusion that the assumed conditions are somehow obligatory; P10945L13 I suggest a paragraph break here; P10946L17 I suggest a paragraph break here; P10956L25 The way this is worded it implies Shuttleworth (1978) assumed D was homogeneous throughout the canopy. Suggest rewording "In our model, ..."; P10947L15 suggest citing derivation Lhomme et al. 2012; P10947L22 non-hypostomous; P10949L15 or these resistances are subsumed/lumped; P10950L17 delete “The”; P10951L16 I do not follow how the substitution in the numerator is possible; P10952 Eqs. 20 and 21 are written in reverse order of (9) and (12) and it would be clearer to either change the order of 20/21 or say "similar to Eqs. (12) and (9)"; P10957L25-P10958L7 text duplicates caption and can be removed; P10958L14-18 text duplicates caption text and can be deleted. Suggest new paragraph L18; P10958L7 it is confusing to refer to Fig 2b before 2a; suggest reordering panels in Fig 2; Figs 2-4 would be improved with more descriptive names for the equations

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