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Hydrology and Earth System Sciences Discussions

Interactive comment on "Simple physics-based models of compensatory plant water uptake: concepts and eco-hydrological consequences" *by* N. J. Jarvis

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I would like to thank the author for pointing out to me that I confused "potential transpiration" and "potential evaporation" in the manuscript and I am very happy that my concern about a violation of the mass balance is probably not valid. Doing a search for "potential" in the document, I found out that it is mentioned in the abstract that potential transpiration depends on the leaf area index and the definition is actually given in Equation 23 as $E_{p(t)} = E_{eq}(1 - e^{-0.5LAI})$ where $E_{eq} = 0.3$ cm day^{-1}. However, on the same page (P. 6803, line 13), the author refers to $E_{p(s)}$ as "potential evaporation",

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whereas this variable was defined in Equation 22 as a function of the equilibrium evaporation rate and the leaf area index. “Potential evaporation" is also mentioned in Table 2 and defined as “1.3 times the Priestley-Taylor equilibrium evaporation". On page 6806, lines 9 and 15 and on page 6811, line 5, the author also mentions “potential evapotranspiration", referring to the Priestley-Taylor equation on one occasion and to Table 2, which only mentions “potential evaporation". I hope the author understands where my confusion comes from and can avoid such confusion by a more consistent use of the different terms in the revised manuscript. The author should also clarify for which of the calculations E_{eq} was fixed as stated below Eq. 23, and where it was calculated from the climate data (and how!) to derive $E_{p(t)}$. I assume that E_{eq} was not held constant for the study across an aridity gradient, otherwise I would have trouble interpreting the results.

A constant ratio of actual to potential transpiration across an aridity gradient, as mentioned in the last paragraph of the discussion thus implies that the leaf area index has to vary across aridity in a fairly predictive way, as $\frac{E_a}{E_{tp}} = \frac{E_a}{E_{eq}} \frac{1}{1-e^{-0.5LAI}}$, whereas $\frac{E_a}{E_{eq}}$ varies with aridity according to the Budyko curve. The author may want to point this out to the reader in order to encourage further research.

I look forward to reading the revised version of the manuscript in order to understand better the physical basis of the equations used and what exactly is meant by compensatory uptake.

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