

## ***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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The manuscript by Jarvis deals with the issue of conceptualization of root water uptake under moisture stressed and unstressed conditions. This is a relevant issue given the large uncertainties that still exist in the simulation of soil moisture, root water uptake, and evapotranspiration. The paper is well-written and presents some interesting and illustrative examples of the impact of different root water uptake concepts under different climate and groundwater conditions. It could make an important contribution to the scientific literature by showing how different concepts are linked and impact the

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simulation of land surface hydrology. I would support publication of the current version in HESS if not for two issues.

The first issue relates to the use of the term “physically based” and the (unsupported) claim that physically based concepts should work better. Fact is, most, if not all, successful concepts in hydrology originate from empirical studies on the behavior of fluxes, not on the physical properties. These include the “physical” Darcy’s law—but also the Jarvis (1989) concept of root water uptake. The claim that “mechanistic approaches should be more trustworthy” is, in my view and given the strong adaptive and dynamic nature of natural vegetation and root water uptake—purely hypothetical. In fact, following the author’s arguments, the Feddes model would also classify as a physically based model, since it is based on measurable properties of the root system (i.e., its distribution) and the straightforward assumption that more roots take up more water.

To my opinion, the author should avoid the discussion on “physically-based” models completely, and also not use it in the title. I would suggest to present the Jarvis (1989) and the de Jong van Lier (2008) concepts more neutral as examples of empirical (i.e., based on observed behavior) and theoretical (i.e., purely based on theory and assumptions—not on observation) in addition to the simpler Feddes concept. This would also avoid inconsistencies such as the claim on page 6796, line 3 that the Jarvis (1989) concept showed “excellent” agreement with observations, while the Jarvis concept clearly performs (very) different to the de Jong van Lier concept (Figure 4). How can we trust a physically based model in making blind predictions when it performs very different from a model that already shows excellent agreement with observations? Also, if the Jarvis (1989) model is a dimensionless form of the de Jong van Lier model (page 6797, line 25), how can it be less physically based?

The second issue relates to the presentation of the concepts. In my view, the manuscript is of interest mainly to hydrologists for which root water uptake is not their main research topic. It has the potential to provide an overview of different approaches

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and their (dis)advantages. However, the current version mainly present the mathematical concepts without explaining or illustrating how and when the concepts are different. This could be done in a schematic. I also suggest to present the three different concepts in separate (sub)sections of section 2, and refer to them in the rest of the manuscript with a name (i.e., “empirical”, “simple”, “theoretical”, or something similar) rather than just the equation number.

Given the remarks above, I suggest to accept to manuscript after revisions have been made to it relating to the presentation and terminology. Since these do not require additional simulations, these can be considered minor.

Small remarks:

Page 6794, Line 19: dimensionless (macroscopic) stress index

Page 6796, Line 10: For the average reader it might not be clear here if (6) applies to a layer or the whole soil profile. Please clarify.

Page 6800, Line 21: It is correct to speak of different degrees of compensation when evapotranspiration is potential?

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