

Interactive comment on “When does vapor pressure deficit drive or reduce evapotranspiration?” by Adam Massmann et al.

Adam Massmann et al.

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Thank you for a very thoughtful review. This third review adds further to our feeling that we are extremely lucky to have received such quality reviews.

We agree with your comments and will respond with some general views to open the door for further discussion in this discussion phase. We look forward to reconciling all reviews with a formal response in the final response phase. Also of relevance to this review is our response to RC1, which we will refer to as needed to avoid repeating content.

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1 Soil moisture, uWUE and g_1

Environmental conditions, particularly soil moisture, will effect both uWUE and g_1 as you point out. Not accounting for this variability by using a PFT-focused analysis is problematic. We discuss this in our response to RC1, specifically Sections 2 and 3, and think a strong argument could be made that we should have framed our analysis in terms of more general uWUE and g_1 variability instead of focusing primarily on PFT variability. If we let uWUE and g_1 vary in space and time, then we include a measure of soil moisture through its effect on uWUE and g_1 . In this case, interpretation of our results relies on a less restrictive approximation that soil moisture conditions remain relatively fixed with respect to the VPD perturbation, which is consistent with the general interpretation of our results (e.g. we evaluate the ET response to VPD with other environmental conditions held fixed).

There are also issues with only including uncertainty in uWUE. We discuss reasons for this approach in our response to RC1 (specifically the final paragraph), and we think there may be some tractable approaches to representing uncertainty and variability in both uWUE and g_1 for the final manuscript.

2 Methods/Introduction

A more thorough discussion in the introduction about what is known about the transpiration response to VPD is definitely needed. This is also discussed peripherally in our response to RC2. The clarifications you suggest for the methods section will also improve the manuscript.

3 Results

Regarding the presentation of the results, we agree that in its current form the manuscript can be disorienting. Just discussing the sign of the derivative, and then discussing the magnitude (while including what the current manuscript refers to as the “sign term”) seems to be a much cleaner approach, possibly also differentiating between environmental controls versus plant/canopy controls.

In our response to RC1 we discussed a few revision approaches regarding the results, some of them including significant changes, which should help both with acknowledging g_1 and $uWUE$ variability and streamlining the results. One example (“Option 2”) is to remove the PFT focus from the first portion of the results (Section 3.1-3.2; this could also go in Methods as you suggest), and instead focus generally on how changes in the environment (e.g. wind speed, temperature) and land surface terms (e.g. g_1 , $uWUE$, canopy height) influence the ET response. By using a more sophisticated representation of uncertainty we could then present the distribution of observation-informed ET responses as a function of the model terms (g_a , $uWUE$, g_1 , etc.), and finally tie all this to either PFTs or specific sites with maps of statistics from the distribution of model parameters and ET response. While this could add a lot of analysis and content to the paper, we think in the end it could streamline the results and their interpretation. Basically we would start with the idealized ET response as a function of parameters (no uncertainty), to the observed ET response as a function of parameters (with uncertainty), to how both the parameters and ET response (with uncertainty) map to specific sites, years and/or PFTs. Thoughts on this are welcome.

We also acknowledge that we need to be more precise about some of our language (e.g. “leading order behavior”, “bit more variability”), and thank you for the other minor comments as well; fixing these will improve the manuscript.

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