

Reviewer(s)' Comments to Author:

The manuscript entitled “Dominant controls of transpiration along a hillslope transect inferred from ecohydrological measurements and thermodynamic limits” consist of an experimental study that investigates what controls summer transpiration rates in a deciduous forest located along a set of mild hillslope transects in a European temperate climate (energy-limited during the winter season). In addition to a set of measured ecohydrological variables (namely sapflow and soil moisture), transpiration estimates were compared versus potential evaporation using a parsimonious model based on thermodynamic principles.

Overall, I really liked the set-up of this study: very clear and structured. The methodology is also sound. Therefore, I have no big comments on the general approach, although several smaller remarks remain. Some of the references are a bit old and some recent publications were suggested. Despite this, I recommend this manuscript to be accepted pending a minor revision. I am confident the authors can address these issues stated in the following review.

ABSTRACT

The abstract would improve if you make it in 3 paragraphs (introduction, hypothesis/model, results/take home messages). The way you write the latter paragraph is very important. If I understood correctly, the dominant temporal controls of transpiration (E_t) are T_a and R_n (hypothesis that is supported by your results) whereas spatial controls mainly consist of soil moisture availability (was this a priori hypothesis too? Are you sure there are no previous studies that investigate the spatial controls of E_t ?). If so, then you can say that diel patterns in E_t are primarily governed by local climatic conditions but spatial heterogeneities may arise from landscape factors (tree density, topography gradients). Or, from a modeling perspective you could say that T_a and R_n are sufficient for point/plot

scale Et estimation but as your spatial scale goes up → hillslope/catchment, landscape and vegetation factors become important for Et assessment.

Line 9: Finding from recent studies (See Tim McVicar and Mike Roderick seminal papers on multi-decadal pan-evaporation decline) suggest that wind speed is a key parameter controlling long term AED so I would make a brief mention in the abstract (perhaps saying that although the thermodynamic approach works fine using T and Rn, other parameters such as wind speed are important, especially for long-term scales) and in the manuscript too (adding one paragraph should be enough).

1. Introduction

P2L4: Recent evidence has shown that ecosystems can be sustained by water stored in rock layers (see [Schwinning, 2010](#); [Oshun et al., 2016](#)) so it would be worth to mention that Et can no longer be solely attributed to water stored in the soil matrix. Also, do not forget that groundwater can be the foremost Et source in arid catchments (see [Miller et al., 2010](#))

P2L5 and L6: Please cite one or two papers about the effects of Et on the energy and water balance. What is the range of Et losses on the water balance? Can you provide a range of estimates?

P2L8: Since your work explores the role of Ta and Rn on Et, perhaps you could add that climatic processes (in addition to biogeophysical controls) also influence the temporal variation of Et.

P2L10: Something is missing in your first sentence. Your manuscript is intended to be published in a hydrology journal so say something related to it. Maybe that it is important to investigate the dominant controls of Et in complex terrain as pretty

much of Europe's forests are located over complex terrain areas. Also, add a reference.

P2L11: "that the first order controls". Do you mean controls of land use change?

P2L12: "Hillslope angle" -> "hillslope" should be written in small caps.

P2L13: Your references date back from the 60's! It would be nice to include something more recent and within an ecohydrological perspective. Perhaps [Ivanov et al., 2009](#)?

P2L13: "alter lateral distribution of water" → alter the lateral distribution of water

P2L16: "of supply and demand" → of (water and energy) supply and demand.

P2L16: In addition to Holst et al. work, I suggest you read and cite [Link et al.](#) paper.

P2L30: "Contrary to the classic notion of Dalton evaporation" → Contrary to the classic formulation of Dalton (add citation).

P3L1: "applied for long-term annual means" → applied for long-term annual estimates of E.

P3L9: "how the response to atmospheric demand changes" → how much they respond to atmospheric demand changes.

P3: Somewhere in the last paragraph of your introduction, you should clearly state the aims/objectives of your manuscript.

2. Methods

P3L30 Question: If you have meteorological observations in each site, why are you using only one dataset for model forcing? I assume it is because the datasets in each site look quite similar, if so, you should say that no significant differences were found between the 6 datasets.

P4L2: Your aim should be moved earlier at the end of the introduction section. Also, what do you mean by “potential evaporation of a surface at saturation from first principles”? Perhaps using the term “potential evaporation” is more clear to your readership.

P4L5: “grid-scale global predictions” → grid-based global scale predictions

P4L13: There is an issue after the description of the heat flux partitioning. It reads as if the latent heat flux is equal to the sum of the heat fluxes.

P5L4: “namely the temperature gradient $T_s - T_a$ responds” → namely the temperature gradient which responds.

P5L11: “this limits (subscript opt)” → this limit.

P8L3: “35 and 42 yrs” → yrs old.

P8L5: “suspect data was filtered” → data were filtered.

P8L9: “A arithmetic mean” → An arithmetic.

P8L12: “The circumference at breast height of all trees with circumference larger or equal 4 cm” → with a circumference larger or equal to 4 cm.

P8L15: “LICOR LAI-2200” → LICOR LAI-2200 Plant Canopy Analyzer

P8L23: “Following the manufacturer manual we assigned for each sensor depth an representative” → Following the user’s manual we assigned for each sensor depth a representative.

P9L7: The acronym of diameter at breast height (DBH) should be defined here, and not until line 9.

P10L22: It was not clear at which effective depth was the root water uptake considered. Do you have independent observations of the depth reached by tree roots?