

The study titled “**Assessing the seasonal compartmentalization of water fluxes in the soil-plant-atmosphere continuum of a high-elevation mountain grassland**” is interesting and investigated seasonal partitioning of water sources supporting plant transpiration and deep drainage using isotopic data and HYDRUS-1D modeling. While the topic is of relevance, the manuscript requires substantial improvements. Below, please find the main and the specific comments regarding the manuscript:

Main Comments

Abstract

The abstract clearly motivates the topic and outlines the modelling framework and objectives, but it reads more like an extended introduction and does not provide enough quantitative evidence to support its main claims. In particular, statements that the framework “accurately” simulates VWC/AET/isotope dynamics should be accompanied by performance metrics, and the key ecohydrological-separation findings should be reported quantitatively (e.g., representative SOI ranges or an effect size) rather than described only in qualitative terms such as a “higher degree of separation” or a “greater proportion of winter water” in 2022.

Introduction

The Introduction section is well written; however, it needs the following improvements:

1. It consists of paragraphs that do not have a concluding sentence at the end of each paragraph. Therefore, some of the paragraphs need to be revised as mentioned in the specific comments.
2. The introduction lacks a proper objective paragraph. The introduction section needs an objective paragraph in which the authors should mention the following points (in one single concise paragraph as the last paragraph of the introduction section):
 - 1) A sentence summarizing the research need
 - 2) Stating the main objective of the research
 - 3) Stating the specific objectives of the research
 - 4) A sentence regarding the value of the study

Therefore, the last two paragraphs of the introduction section should be revised.

Methodology

The methodology section is clearly written in detail, however, a performance evaluation section with corresponding metrics to evaluate the modelling is missing and needs to be added. Moreover, the authors should use past tense and passive sentences throughout the manuscript which needs revision. Further minor comments are available in specific comments.

Results & Discussion

The Results & Discussion section is informative; however, it needs addressing the following points:

1. The authors calibrated the model using one set of variables and validated it using a different set of variables, but both steps were conducted over the same time period. This raises two concerns: (a) the calibration and validation periods are not independent, so the exercise does not represent out-of-sample validation in the usual sense; and (b) because the validation targets differ from the calibration targets, it is unclear whether the model continues to reproduce the calibrated variables correctly during the validation window, or whether good agreement for the validation variables is achieved through compensating errors/equifinality. Please justify the rationale for this approach!
2. Report on model performance consistently for all evaluated variables in one or more standalone tables. See specific comments.
3. Enhance visualization. See specific comments.
4. Make tables and figures standalone. See specific comments.

Conclusion

The conclusion is concise and can be improved with the following revisions:

1. Add sentences on limitations and uncertainty and how these may influence inference on seasonal partitioning.
2. End with a brief statement on implications under changing snow regimes and one concrete recommendation for future work (or improvements).

Specific comments

L39: “in the subsurface” is vague and generic, use more specific term.

L46: “available to roots”

L70 – 84 & 85 – 96: These paragraphs are presenting previous studies, individually. However, the paragraphs need to have a concluding sentence at the end. Please revise the paragraphs.

L97: Use the accurate word for evapotranspiration. The use of evapotranspiration can be misleading for the readers without specifying the type. The authors abbreviated evapotranspiration as AET which can be considered actual evapotranspiration by the readers. If this is true, revise the text as follows: “actual evapotranspiration (AET)”.

L105 – 131: revise these two paragraphs and make an objective paragraph based on what is proposed in the main comments. Also, these two paragraphs include sentences that belong to methodology and need to be removed from the introduction.

L144: define hydrological year in the body of the manuscript instead of figure 1 caption.

L156: AET is already defined in the introduction section. No need to redefine it.

L168: refer to the corresponding figure.

Table 1: Soil sand, silt, and clay content (%) Is not 100% in aggregate!

L185: mention the accuracy of soil moisture and matric potential sensors.

L210 – 215: Use passive sentences.

Table 2: tables should be standalone, I suggest revising the table and defining each parameter within the table. Also, clearly mention that they are optimized or not in the caption.

L295: the authors defined ET_0 as potential evapotranspiration while they defined it as ET_p in figure 3d. Please revise the text to ET_p or PET.

L320-321: move to methodology.

L358-362: move to methodology.

L374: use passive sentences.

L429: 3. Ensure consistent terminology for correlation metrics throughout the manuscript (e.g., avoid mixing Spearman’s rank correlation with Pearson notation).

Table 3: Add the 95% confidence intervals since the results are achieved through inverse solution approach. Also, I suggest defining parameters in the caption or table to have a standalone table.

Figure 5: showing a fitted VG model based on measurements without any performance metric does not have any value. So, either add performance metric(s) in the figure 5 or table 3. Also, define θ and h in the figure axes or caption.

Figure 7: I suggest using “Sim” than “Mod” since it is widely used in the literature. Also, define the abbreviations in the caption. Moreover, the measurement lines interfere with the simulated lines and they are too congested, please try to use contrasting colors, and size adjustments in order to distinctly visualize the simulation and observation. I suggest using the full words for “Sim” and “Meas” as there is enough space in the graphs.

L428-431 & 466-469: It is better to report the simulation performance in table(s) rather than within the body of the manuscript which makes it harder to find for the readers.