

General Response We sincerely thank the Editor and the Reviewers for their careful and constructive comments. All comments were addressed thoroughly and led to substantial improvements in the manuscript. Below, we respond point-by-point to each comment. Line numbers refer to the revised manuscript.

A. Uncertainties and Limitations

Reviewer/Editor comment: Concerns regarding the limited consideration of uncertainty sources and model limitations (e.g., weather variability, macropore flow).

Response: We fully agree. We have substantially expanded the discussion of uncertainties and limitations, explicitly acknowledging their implications for the interpretation of the results. Specifically, we addressed:

1. **Weather Variability:** The use of a representative median climatic year and its implications for variability and extremes (LL208-214, LL535-538, and Appendix A).
2. **Temporal Resolution:** Limitations imposed by the daily temporal resolution (LL226-232).
3. **Parameter Uncertainty:** Uncertainties associated with PTF-derived hydraulic parameters, particularly (LL470-474; LL540-585).
4. **Preferential Flow:** The lack of explicit macropore flow representation and its consequences on water-balance estimation (LL241-243).
5. **Spatial Scale:** The profile-scale nature of the analysis and the absence of spatial upscaling (L520-524). These aspects are now explicitly discussed in Sect. 2.3 and Sect. 4, and the manuscript language has been softened to reflect these boundaries.

B. Generalization and Soil-Profile Controls

Reviewer/Editor comment: The analysis relies too strongly on regional averages, masking soil-profile variability and limiting generalizable insights.

Response: We thank the Reviewer for this important observation. In the revised manuscript, we restructured the Results and Discussion to emphasize soil- and profile-level controls rather than regional averages alone. Individual soil-profile characteristics (depth, texture, layering) are now directly linked to simulated water-balance behavior. This allows for a clearer process-based interpretation (e.g., comparing shallow soils across different regions) and improves the general relevance of the findings beyond the specific study areas (Sect. 3.2–3.4; Figures 4–5).

C. Model Description and Parameterization

Reviewer/Editor comment: Insufficient detail on model parameterization, boundary conditions, and key assumptions (e.g., ponding depth, drainage).

Response: We agree and have expanded Sect. 2.2–2.3 to explicitly document the model configuration. We have also added two detailed Appendices. This documentation includes: soil-profile discretization, vegetation parameterization, treatment of drainage and groundwater recharge, and the justification for ponding depth and runoff generation rules. Information previously provided only in the public discussion is now fully integrated into the manuscript.

D. Context, Target Audience, and Tone

Reviewer/Editor comment: The contribution relative to existing work and the target audience are not clear; the tone towards previous studies is too critical.

Response: We have revised the Introduction and Discussion to better position the study within the existing literature. We have clarified that our primary target audience includes soil scientists engaged in soil health and ecosystem services assessment who may benefit from a more hydrological, process-based approach. The tone towards previous work has been revised to be more balanced and constructive, framing our study as an advancement to the state-of-the-art (Sect. 1 and 4).

List of Relevant Changes in the Manuscript

- **Expanded Section 2.3:** Included a thorough catalog of model limitations (weather, PTF uncertainty, macropores).
- **Restructured Results (Sect. 3.2–3.4):** Shifted from regional summaries to profile-specific analysis to highlight how individual soil characteristics (explanatory variables) drive hydrological outcomes.
- **New Appendices:** Added Appendix A and B to provide full transparency on model parameterization and climatic data selection.
- **Revised Figures 4 & 5:** Updated to display profile-level hotspots and specific soil behavior rather than lumping data by region.
- **Refined Introduction:** Softened the critical tone and clearly stated the "step forward" offered by the process-based approach for the soil health community.
- **Softened Language:** Replaced definitive claims with appropriate caveats throughout the text to reflect the acknowledged uncertainties.